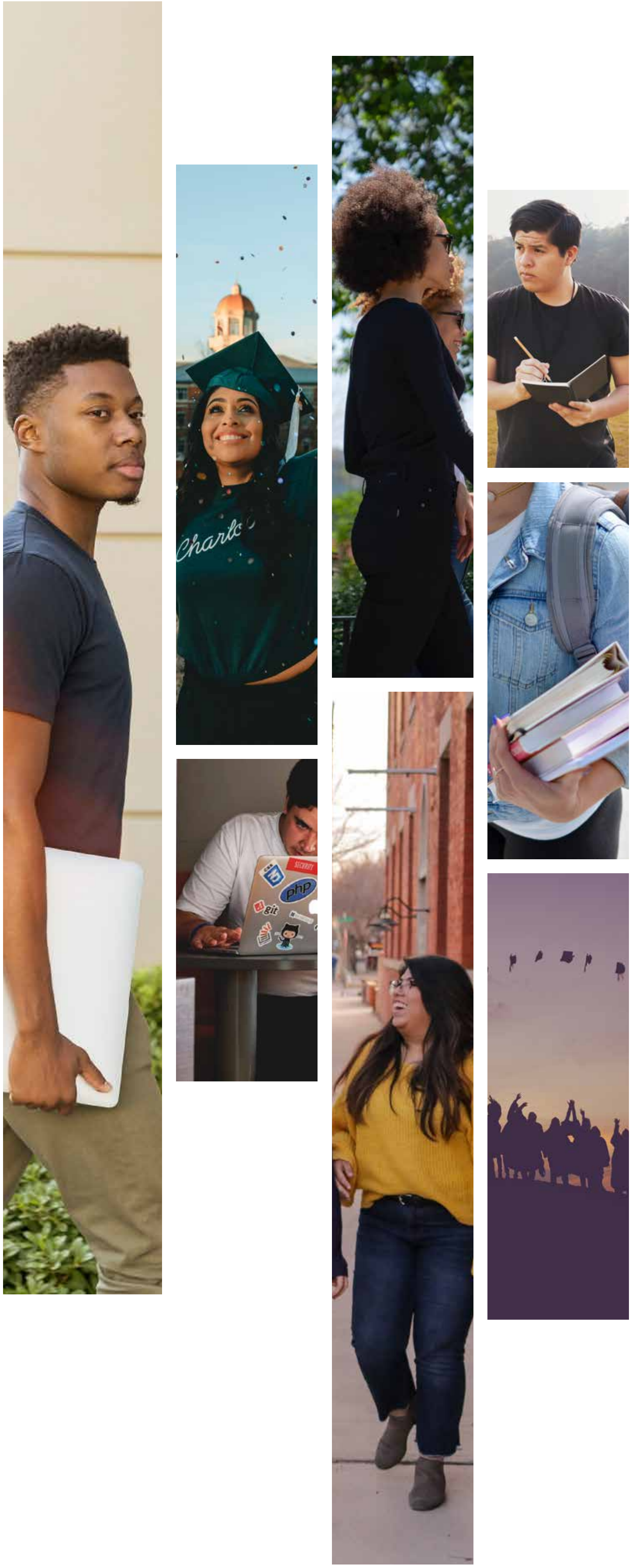


UNC WESTERN CAMPUSES
HAZARD MITIGATION PLAN

FINAL - August 2021

ESP

U. S. Department of Homeland Security
Region IV
3005 Chamblee Tucker Road
Atlanta, GA 30341

FEMA

September 2, 2021

Mr. Steve McGugan
State Hazard Mitigation Officer
Assistant Director / Mitigation Section Chief
Division of Emergency Management
NC Department of Public Safety
200 Park Offices Drive
Durham, NC 27713

Reference: University of North Carolina – Western Campuses

Dear Mr. McGugan:

We are pleased to inform you that the University of North Carolina – Western Campuses Hazard Mitigation Plan Update complies with the Federal hazard mitigation planning requirements resulting from the Disaster Mitigation Act of 2000, as contained in 44 CFR 201.6. The plan is approved for a period of five (5) years effective September 2, 2021 to September 1, 2026.

This plan approval extends to the following participating jurisdiction that provided a copy of their resolution adopting the plan:

- University of North Carolina – Western Campuses

The approved participating jurisdiction is hereby an eligible applicant through the State for the following mitigation grant programs administered by the Federal Emergency Management Agency (FEMA):

- Hazard Mitigation Grant Program (HMGP)
- Flood Mitigation Assistance (FMA)
- Building Resilient Infrastructure and Communities (BRIC)

National Flood Insurance Program (NFIP) participation is required for some programs.

We commend the participants in the University of North Carolina – Western Campuses Hazard Mitigation Plan for development of a solid, workable plan that will guide hazard mitigation activities over the coming years. Please note, all requests for funding will be evaluated individually according to the specific eligibility and other requirements of the particular program under which the application is submitted. For example, a specific mitigation activity or project identified in the plan may not meet the eligibility requirements for FEMA funding, and even eligible mitigation activities are not automatically approved for FEMA funding under any of the aforementioned programs.

We strongly encourage each community to perform an annual review and assessment of the effectiveness of their hazard mitigation plan; however, a formal plan update is required at least every five (5) years. We also encourage each community to conduct a plan update process within one (1) year of being included within a Presidential Disaster Declaration or of the adoption of major modifications to their local Comprehensive Land Use Plan or other plans that affect hazard mitigation or land use and development. When you prepare a comprehensive plan update, it must be resubmitted through the State as a "plan update" and is subject to a formal review and approval process by our office. If the plan is not updated prior to the required five (5) year update, please ensure that the Draft update is submitted at least six (6) months prior to expiration of this plan approval.

The State and the participants in the University of North Carolina – Western Campuses Hazard Mitigation Plan should be commended for their close coordination and communications with our office in the review and subsequent approval of the plan. If you or the participants in the University of North Carolina – Western Campuses Hazard Mitigation Plan have any questions or need any additional information, please do not hesitate to contact Celicia Davis, of the Hazard Mitigation Assistance Branch, at (202) 997-7490, Hailey Peterson, of the Hazard Mitigation Assistance Branch, at (202) 655-8757, or Edwardine S. Marrone, of my staff, at (404) 433-3968.

Sincerely,

Kristen M. Martinenza

Kristen M. Martinenza, P.E., CFM
Branch Chief
Risk Analysis
FEMA Region IV

UNC Western Campuses Hazard Mitigation Plan 2021

Table of Contents:

SECTION 1
INTRODUCTION

This section of the plan provides a general introduction to the Western Campus 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, and man-made and technological hazards are a part of the world around us. Their occurrence is 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.

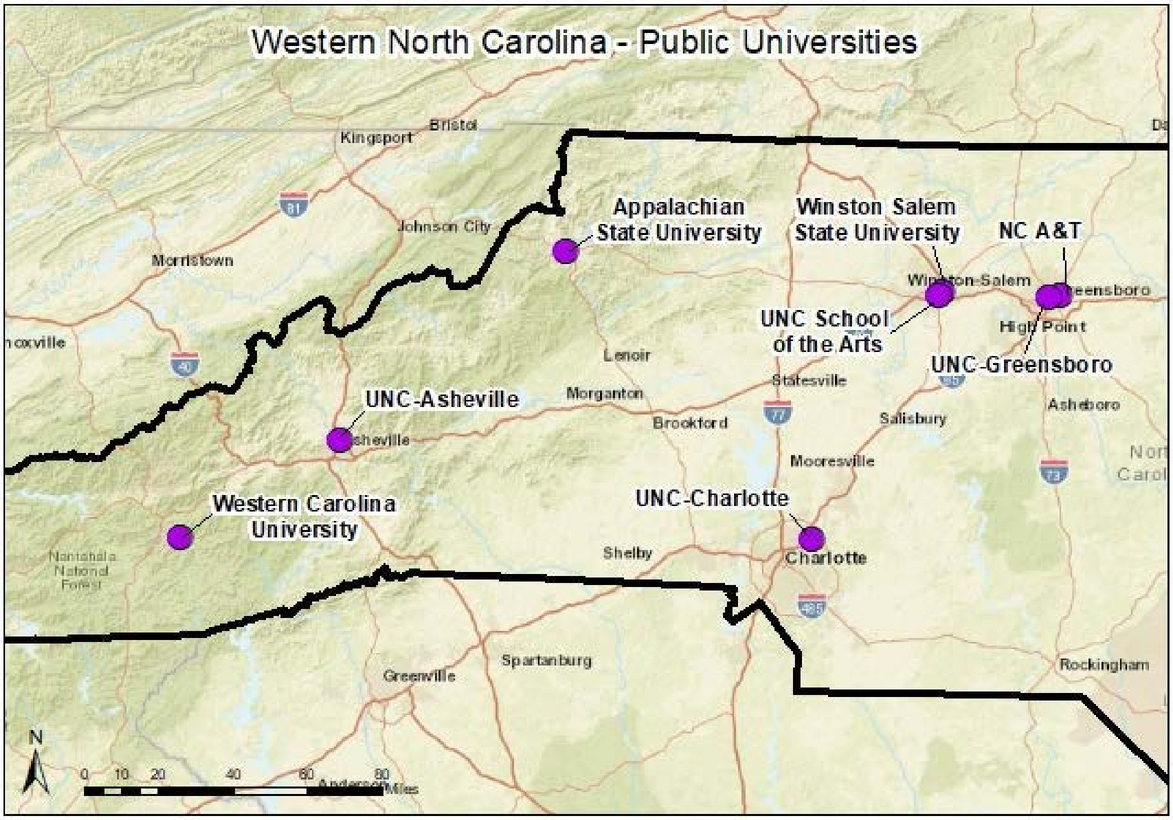
North Carolina's public universities and special-purpose institutions across the state have a significant investment in terms of buildings, facilities, infrastructure, historical and cultural landmarks, library and art collections, laboratories and other essential assets. Many of these assets and investments are vulnerable to the impacts of natural hazards. The UNC System is equally committed to the protection of life and safety of campus populations, and has established policies and procedures to ensure that emergency preparedness is a priority at all of it 17 institutions.

The University of North Carolina's Western Campuses are comprised of the following eight institutions:

- Appalachian State University,
- North Carolina A&T State University,
- University of North Carolina at Asheville,
- University of North Carolina at Charlotte,
- UNC Greensboro,
- UNC School of the Arts,
- Western Carolina University, and
- Winston-Salem State University.

Figure 1:1 provides an overview of the general locations of each campus.

FIGURE 1.1: UNIVERSITIES PARTICIPATING IN THE UNC WESTERN CAMPUSES HAZARD MITIGATION PLAN



Each campus has their own unique landscape and susceptibility to a wide range of natural and manmade/technological hazards. For a majority of the campuses the primary natural hazards to which they are exposed are: severe winter weather, high winds, tornadoes, flooding, and earthquakes. However, additional a variety of other natural hazards and manmade/technological hazards also threaten the campuses. These hazards threaten the life and safety of residents and faculty on campus and have the potential to damage or destroy property, disrupt day-to-day operations, and impact the overall quality of life on campus.

While the threat from hazard events may never be fully eliminated, there is much we can do to lessen their potential impact upon our campuses and our students, faculty and staff. 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 campus planning and capital improvements policies and the creation of public awareness programs). A comprehensive mitigation approach addresses hazard vulnerabilities that exist today and in the foreseeable future. Therefore, it is essential that projected patterns of future growth are evaluated and considered in terms of how that growth will increase or decrease the campus's overall hazard vulnerability.

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

The University of North Carolina System, using funds from the Federal Emergency Management Agency (FEMA), has been working since 2007 to develop a Pre-Disaster Mitigation (PDM) Planning Process for the UNC System as a whole, and on each of the 17 campuses. In early 2008, all of the campuses in the UNC system agreed to participate in this project. This effort resulted in the Eastern Campuses and Western Campuses 2010 Pre-disaster Mitigation Plans.

The 2021 update of this institutional plan draws from the University System's 2010 Pre-disaster Mitigation Plan and the relevant components for each campus, along with updated data and new methods of analysis. The plan development process for the 2021 update of the plan is detailed in Section 2: Planning Process.

At its core, the Plan recommends specific actions to minimize hazard vulnerability and protect the universities 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. Policies on campus growth and development, incentives for natural resource protection, and public awareness and outreach activities are examples of other actions considered to reduce 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.

1.2 PURPOSE

The purposes of the Western University Campuses Hazard Mitigation Plan, as reflected through the plan goals are as follows:

- Reduce the impact of natural hazards on each campus[1];
- Develop a natural hazards mitigation plan that meets planning criteria outlined in 44 CFR, Part 201;
- Develop a model PDM planning process for a multi-campus university system;

[1] As previously noted, the 2021 update of this plan expanded the scope of hazards addressed to include manmade and technological hazards.

- Develop an innovative approach based on ASCE/ Building Security Council national standards; and
- Provide a mechanism to obtain FEMA Mitigation Project Grant funding for facility improvements.

1.3 SCOPE

The focus of the Western University Campuses Hazard Mitigation Plan is on those hazards determined to be “high” or “moderate” risks to the campuses in the Western part of the State, 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 universities 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 extent of each main campus across the Western Campuses planning region (see Figure 1.1). **Figures 1.2 – 1.9** shows the campus extents. It is recognized that some universities may operate satellite campuses outside their main campus. It is up to each university to determine how this plan applies to their satellite campuses.

FIGURE 1.2: APPALACHIAN STATE UNIVERSITY’S MAIN CAMPUS

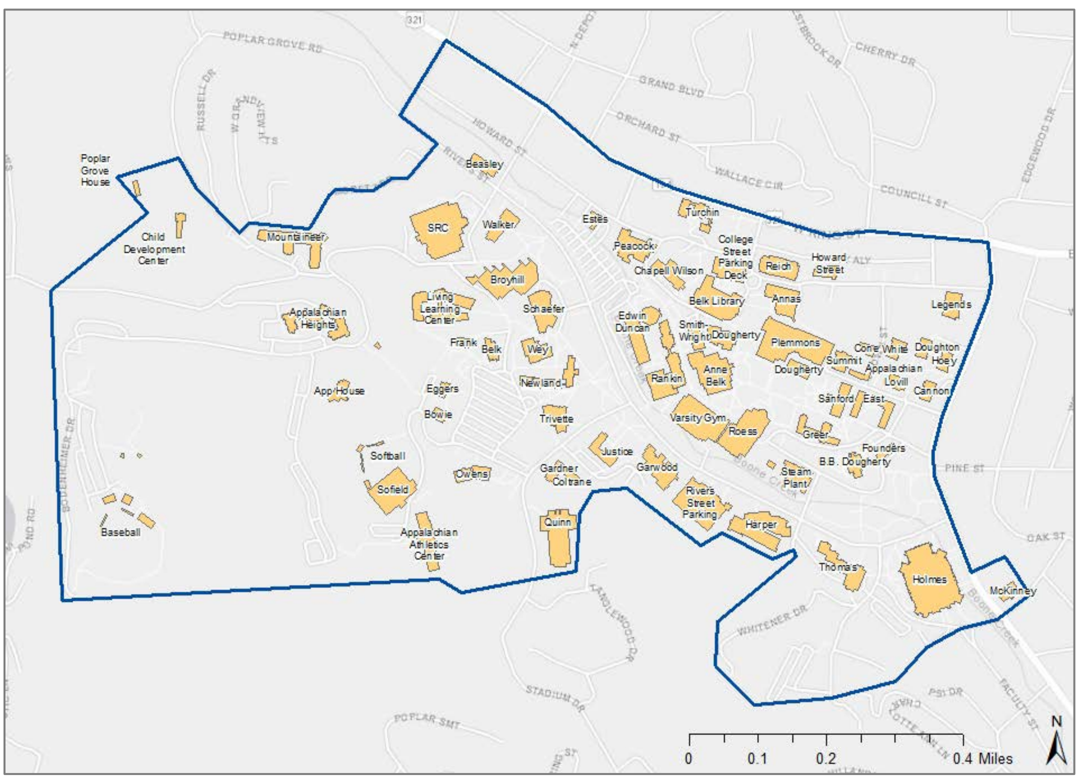


FIGURE 1.3: NORTH CAROLINA AGRICULTURAL AND TECHNICAL UNIVERSITY'S MAIN CAMPUS

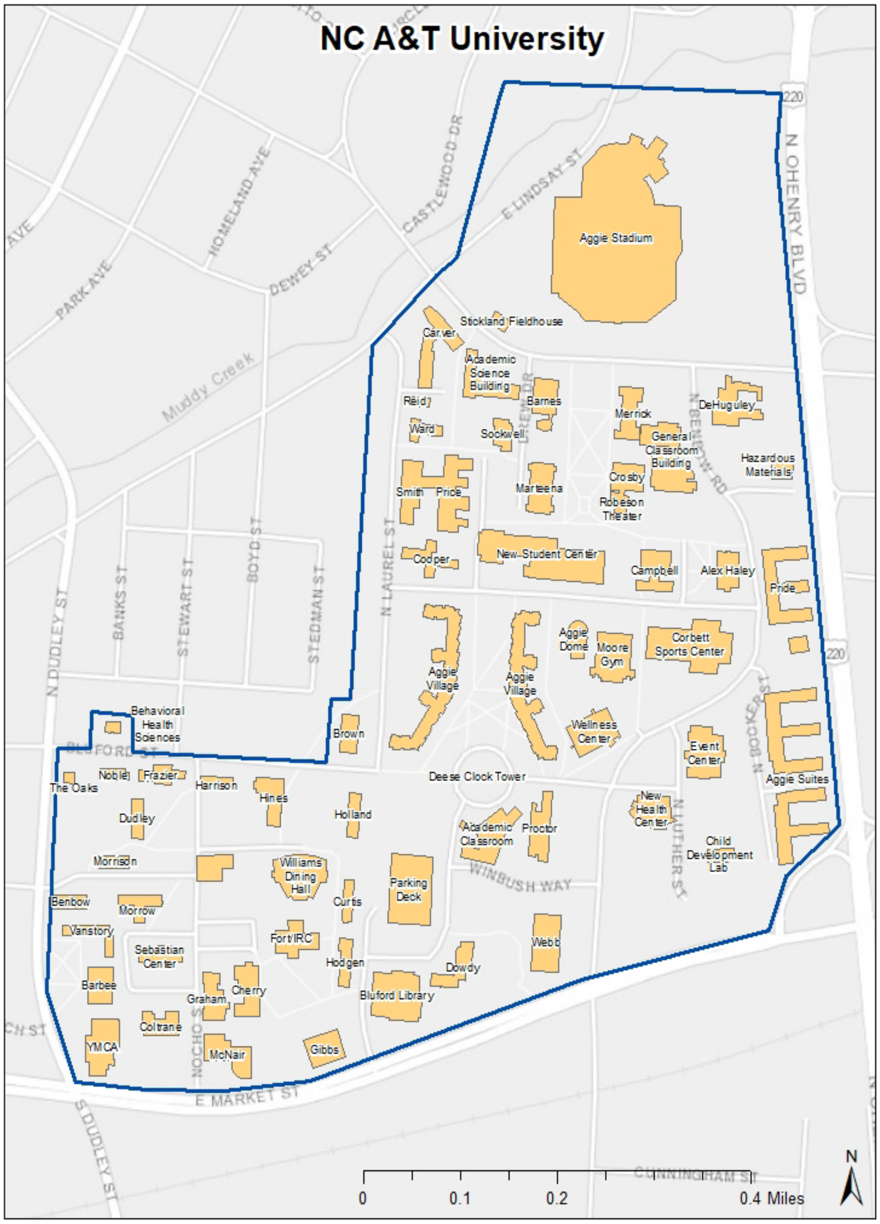


FIGURE 1.4: UNIVERSITY OF NORTH CAROLINA AT ASHEVILLE MAIN CAMPUS

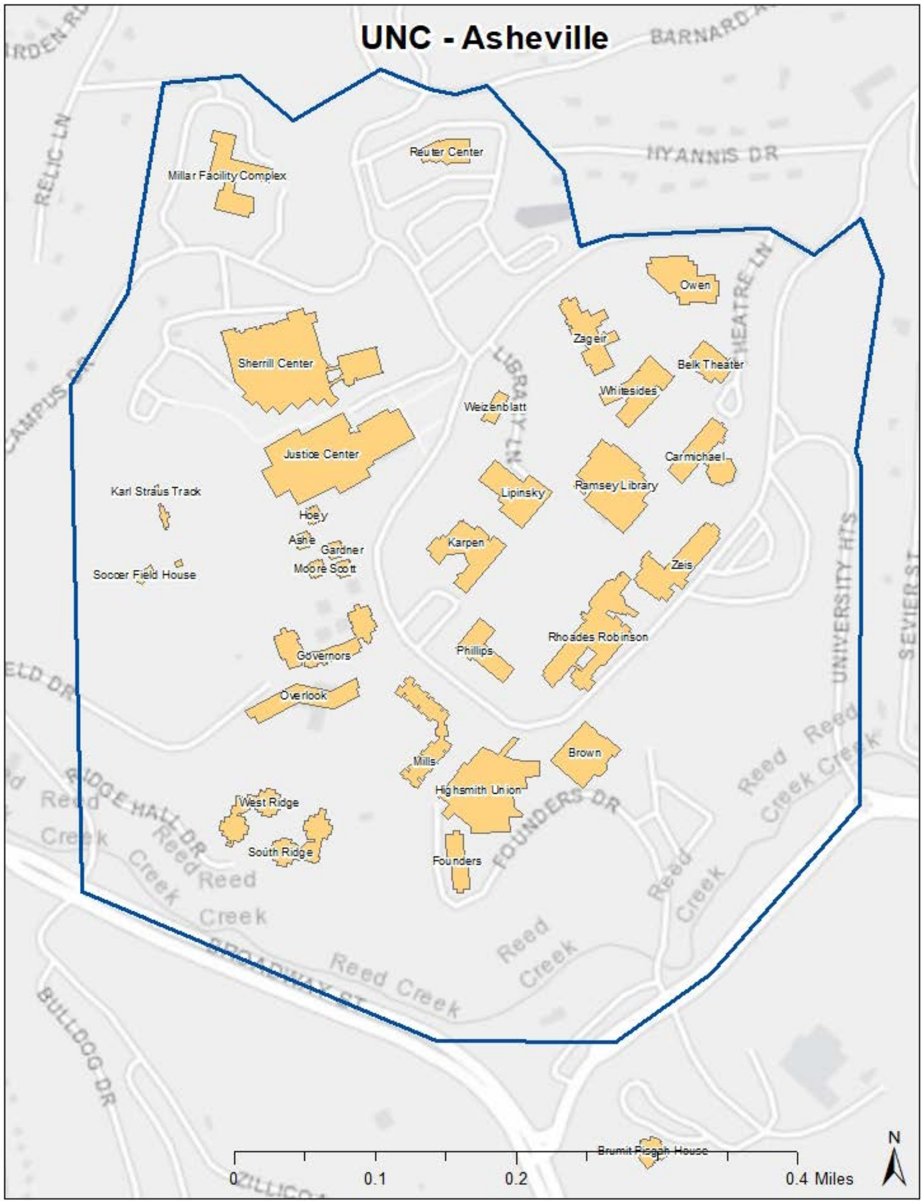


FIGURE 1.5: UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE MAIN CAMPUS

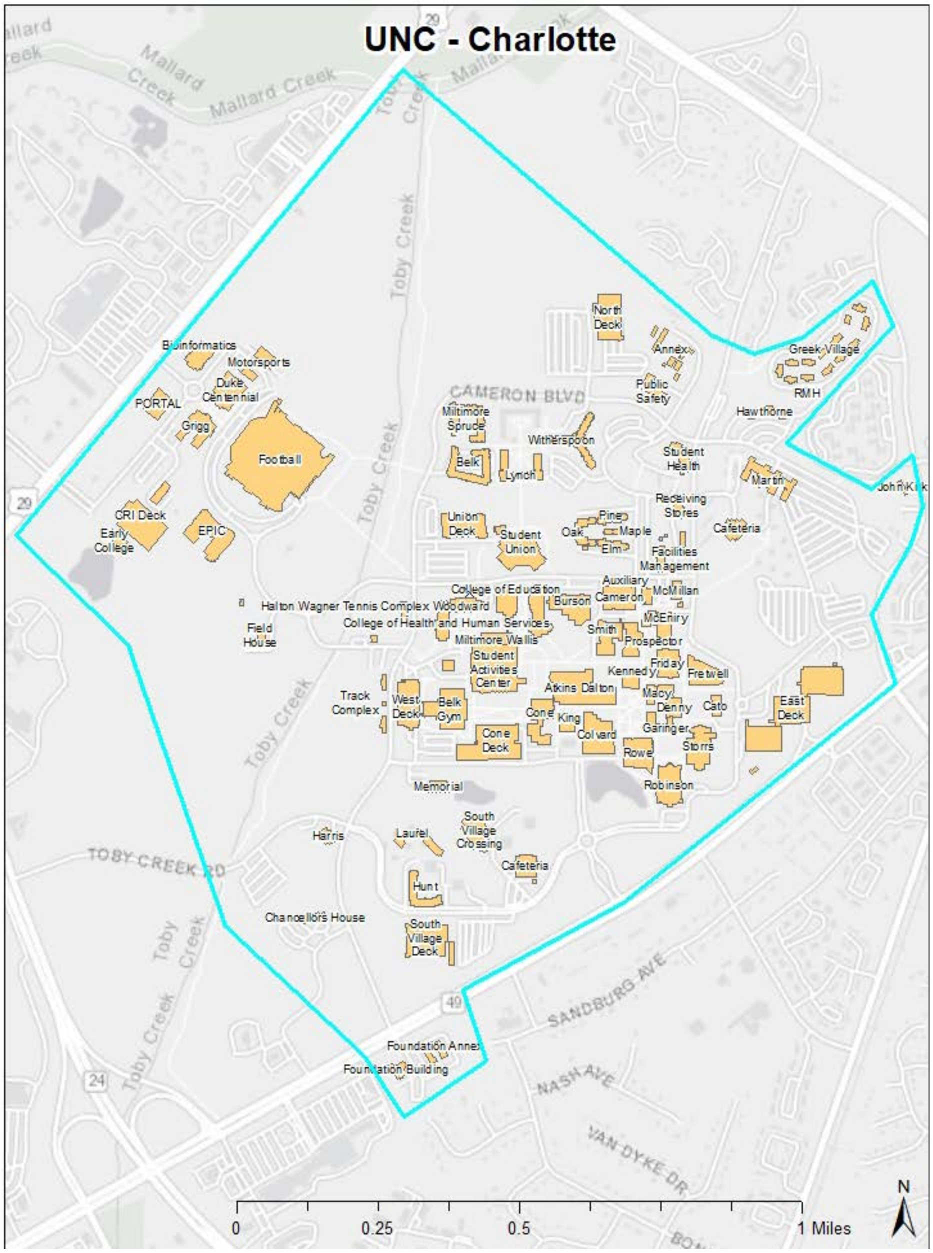


FIGURE 1.6: UNC GREENSBORO MAIN CAMPUS

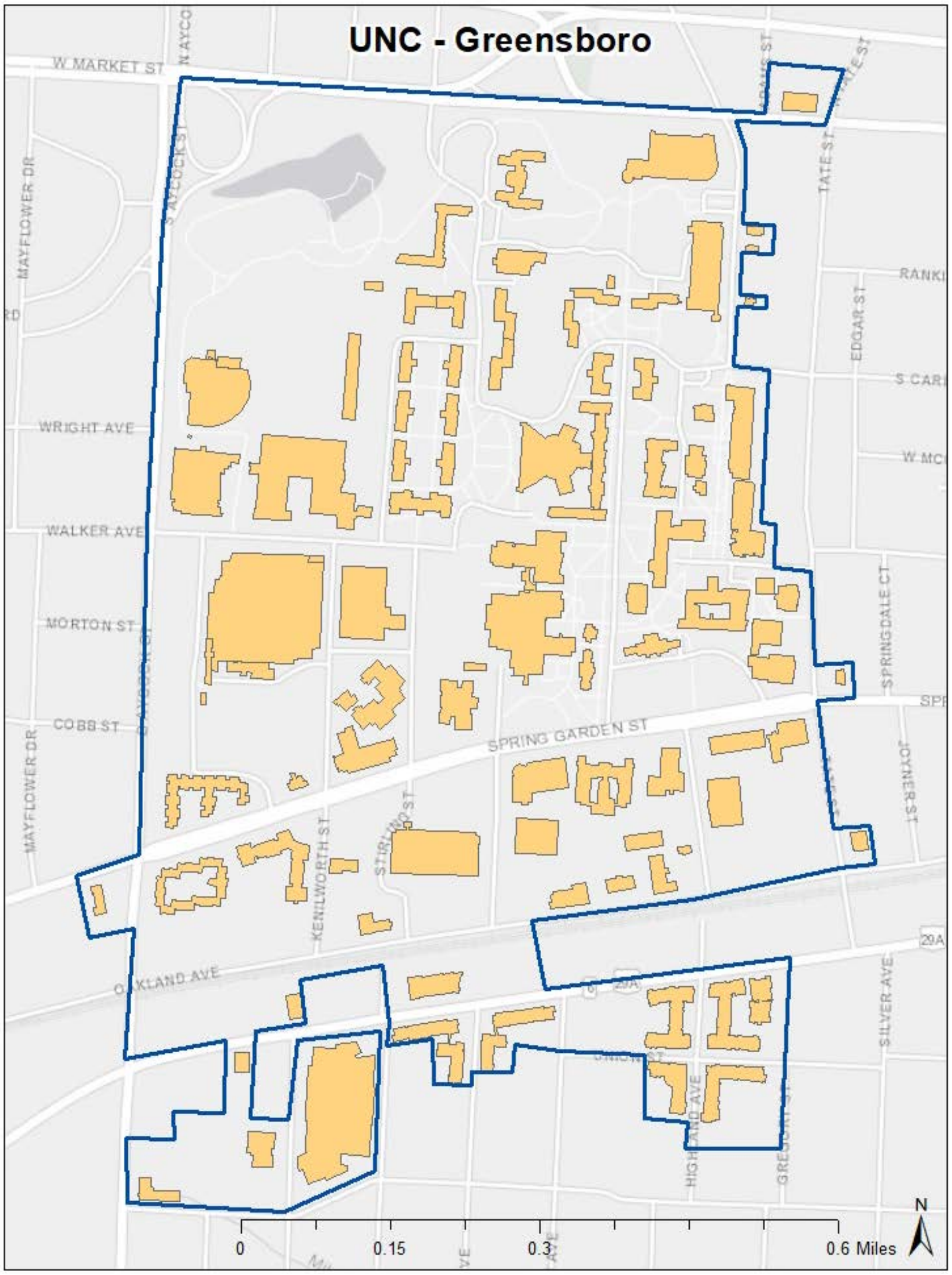


FIGURE 1.7: UNIVERSITY OF NORTH CAROLINA SCHOOL OF THE ARTS MAIN CAMPUS

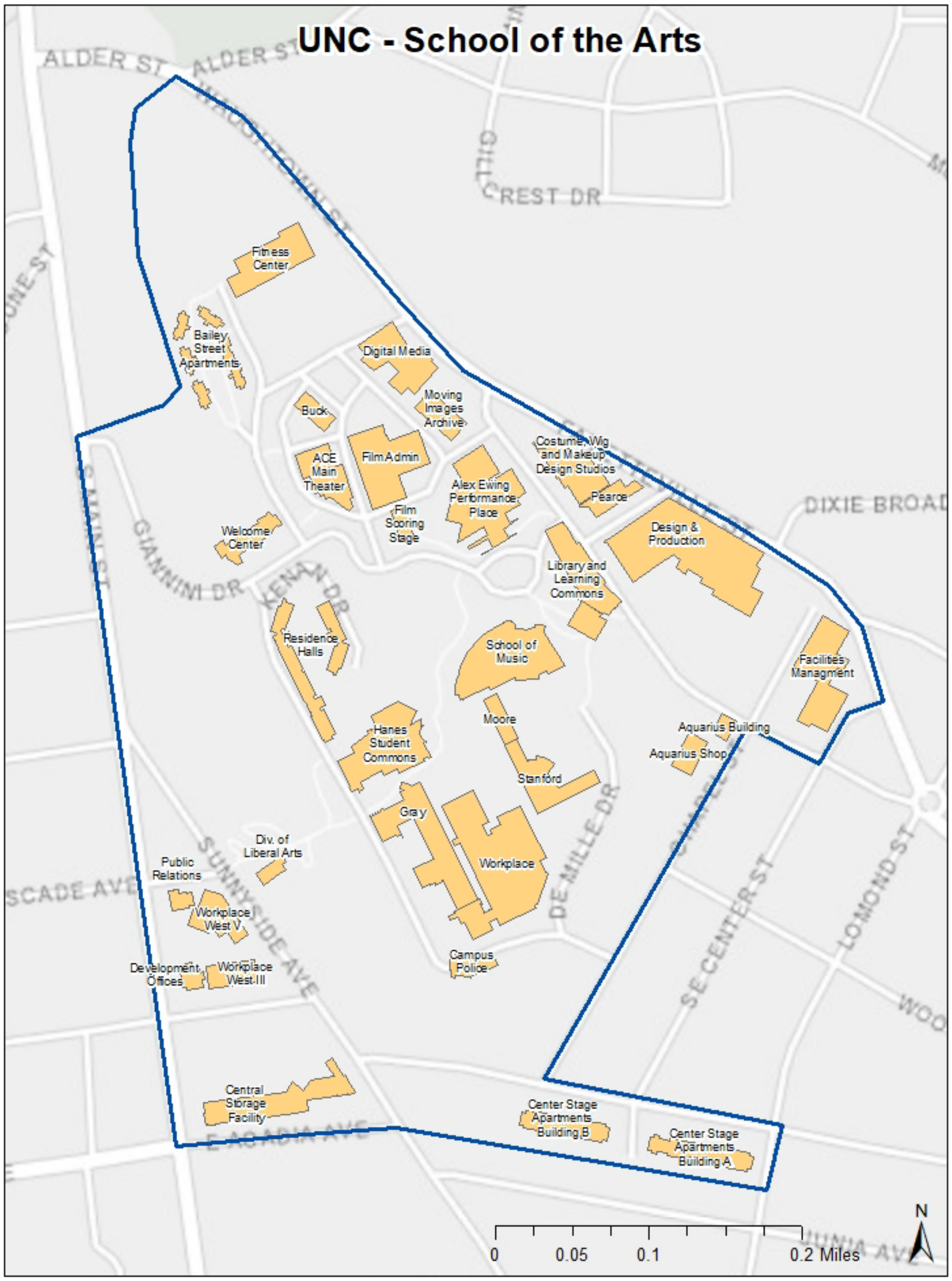


FIGURE 1.8: WESTERN CAROLINA UNIVERSITY MAIN CAMPUS

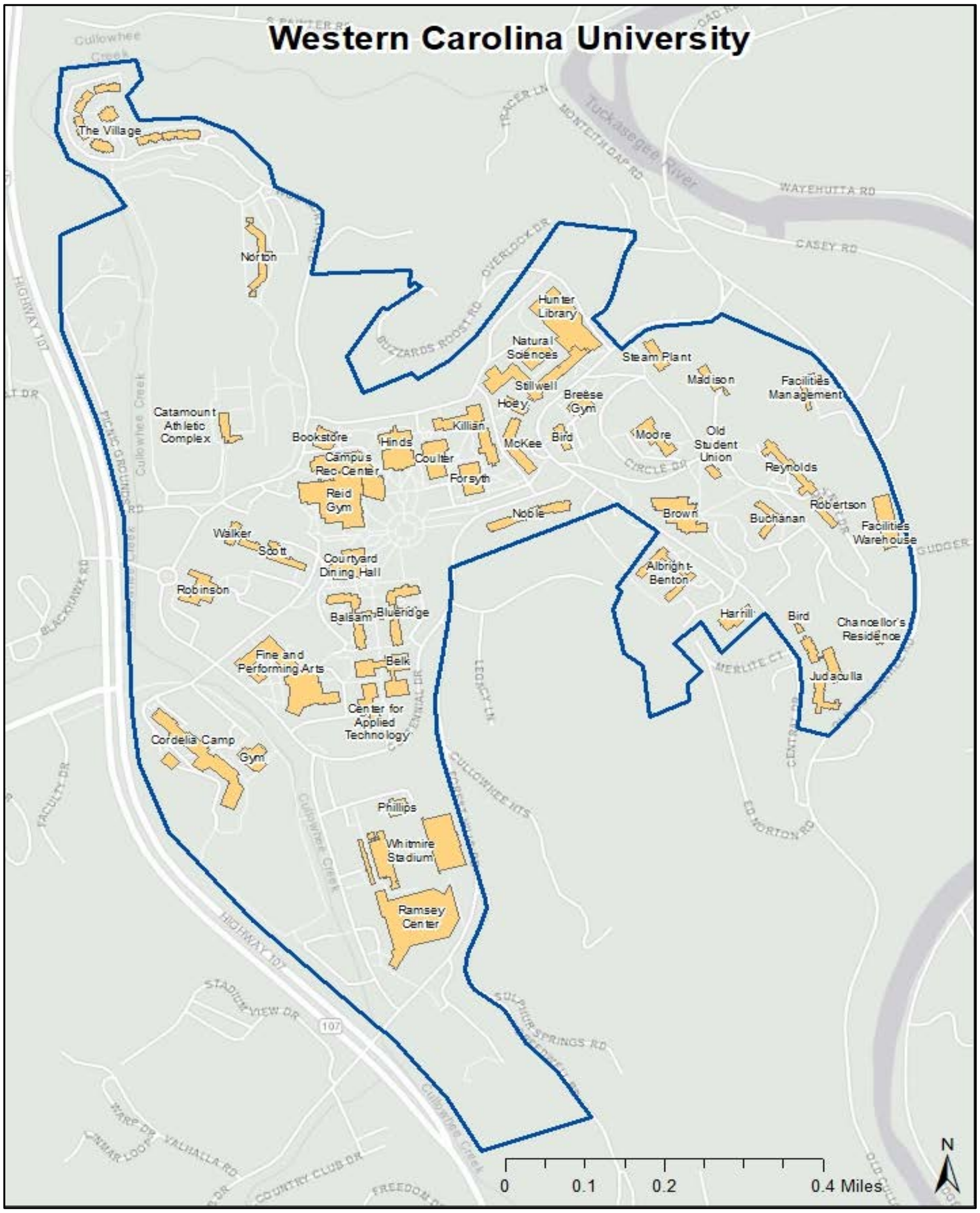
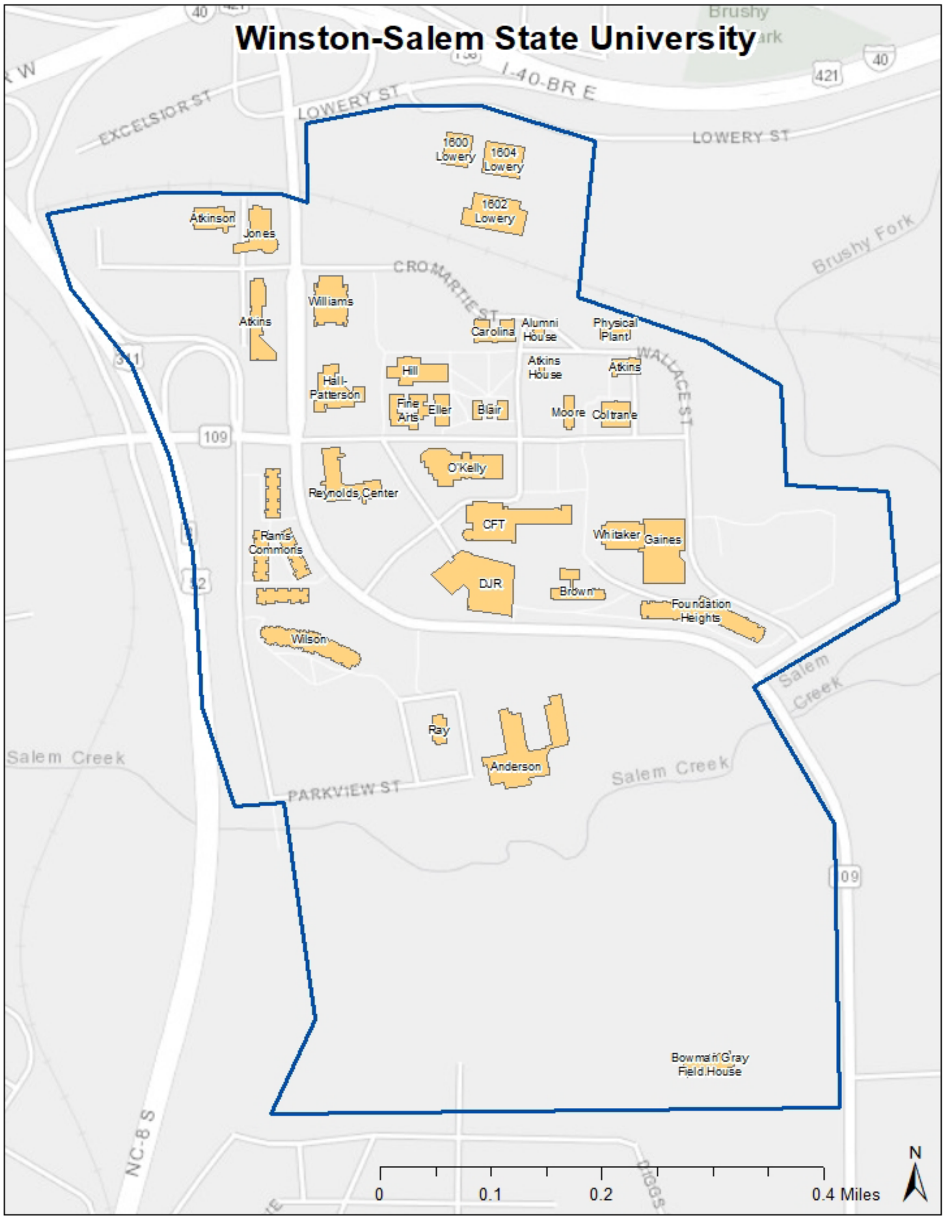


FIGURE 1.9: WINSTON-SALEM STATE UNIVERSITY MAIN CAMPUS



1.4 AUTHORITY

The Western Campuses Hazard Mitigation Plan has been developed in accordance with current state and federal rules and regulations governing university hazard mitigation plans and has been adopted by each participating campus in accordance with standard university procedures. Copies of the adoption resolutions for each participating campus are provided in Section 6. 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. University-specific planning processes are described in the plan Annexes.

The ***Hazard Identification and Hazard Profiles*** presented in Section 3 serve to identify, analyze, and assess hazards that pose a threat to the campuses. This section begins by identifying hazards that threaten the campuses. 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 UNC System universities seek to determine the most appropriate mitigation actions to pursue and implement—enabling university officials to prioritize and focus their efforts on those hazards of greatest concern and those structures or planning areas facing the greatest risk(s). Campus-specific risk and vulnerabilities are addressed in the plan Annexes.

The ***Mitigation Strategy***, found in Section 4, consists of broad goal statements as well as an analysis of hazard mitigation techniques for the participating campuses to consider in reducing hazard vulnerabilities. The strategy provides the foundation for a detailed ***Mitigation Action Plan***, found in the plan Annexes, which links specific mitigation actions for each campus 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 campus less vulnerable to the damaging forces of hazards. 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, recreation, transportation improvements, environmental quality, land development, and public health and safety.
Plan Maintenance, found in Section 5, includes the measures that the university 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.

Campus-specific information is contained in the plan's ***Annexes.*** Each Annex contains the following information for each of the participating campus in the Western Region.

- ***Planning Process Details*** specific to each campus to include information about the Campus Hazard Mitigation Planning Teams and the meetings that were held as part of the plan update process.

- A ***Campus Profile*** that provides a general overview of each campus, 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 university officials recognize those structural and environmental factors that ultimately play a role in determining the campus's vulnerability to hazards.

- The ***Asset inventory*** includes the types, numbers and values of the buildings on each campus. This section also includes a ranking of the most critical buildings on the campuses as determined by the Campus Hazard Mitigation Planning Teams.

- ***Hazard Profiles*** – campus specific (location, extent, historical occurrences, probability of future occurrences. The profiles also include information about the specific vulnerabilities that each campus faces. (methodology, loss estimates, future development)

- The ***Capability Assessment*** provides a comprehensive examination of each University's capacity to implement meaningful mitigation strategies and identifies opportunities to increase and enhance that capacity. Specific capabilities addressed include planning and regulatory capability, staff and organizational (administrative) capability, technical capability, fiscal capability, and political capability. 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.

- Campus-specific ***Mitigation Action Plans*** that provide the specific plan action that the campuses have identified for decreasing vulnerability and increase resiliency. Each action serves as an effective measure (project or policy) to reduce hazard risk on the campus.

SECTION 2
PLANNING PROCESS

This section describes the planning process undertaken to develop the update of the UNC Western Campuses Hazard Mitigation Plan. Information about the development of the 2010 Pre-Disaster Mitigation Plan can be found in that plan.

- 2.1 Overview of Hazard Mitigation Planning
- 2.2 History of Hazard Mitigation Planning for the UNC Western Campuses
- 2.3 Updating the Plan in 2021
- 2.4 The Multi-Campus Hazard Mitigation Steering Committee and the Campus Hazard Mitigation Planning Teams
- 2.5 Meetings and Workshops
- 2.6 Involving the Public
- 2.7 Involving the Stakeholders
- 2.8 Documentation of Plan Progress

2.1 OVERVIEW OF HAZARD MITIGATION PLANNING

Campus hazard mitigation planning is the process of organizing institution 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 campus 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 the Mitigation Action Plans in the Annexes). 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 5: *Plan Maintenance*).

Organizations 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 university 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 the campus facilities to re-establish themselves in the wake of a disaster, getting regular university activities 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 goals, such as preserving open space, maintaining environmental health, and enhancing recreational opportunities. Thus, it is vitally important that any campus mitigation planning process be integrated with other concurrent planning efforts, and any proposed mitigation strategies must take into account other existing campus goals or initiatives that will help complement or hinder their future implementation.

2.2 HISTORY OF HAZARD MITIGATION PLANNING FOR THE UNC SYSTEM

The initial hazard mitigation planning efforts for the UNC Western Campuses began in 2008 with the development of the first version of this plan. The first plan was completed in 2010.

During the development of the 2010 plan, all of the aforementioned plans and practices were considered while attempting to create a unified plan. The goal was to simplify planning efforts for the university and allow resources to be shared amongst the different departments and facilities responsible for safety on campus. The 2010 plan was important and successful first start for the UNC System's hazard mitigation planning efforts and that success has carried over into the 2021 update of the plan.

2.3 UPDATING THE PLAN IN 2021

FEMA requires that hazard mitigation plans be updated every five years to remain eligible for federal mitigation and public assistance funding. To prepare the *2021 UNC Western Campuses 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 and recommendations provided by North Carolina Emergency Management (NCEM) mitigation planning staff[1].

[1] A copy of the negotiated contractual scope of work between NCEM and ESP is available through NCEM upon request.

The process used to prepare this Plan included twelve major steps that were completed over the course of approximately thirty-one months beginning in October of 2018[2]. 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 UNC WESTERN CAMPUSES

2.4 THE MULTI-CAMPUS HAZARD MITIGATION STEERING COMMITTEE AND THE CAMPUS HAZARD MITIGATION PLANNING TEAMS

In order to guide the development of this Plan, a Multi-Campus Hazard Mitigation Steering Committee was formed. The Steering Committee was comprised of a primary point of contact from each of the eight universities participating in this planning process.

Beginning in August 2019, the Multi-Campus Hazard Mitigation Steering Committee engaged in regular discussions as well as 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

[2] The plan update process took longer than normal to complete because of the onset of the COVID-19 pandemic in 2020 which essentially paused the planning process for a number of months.

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 Campus Hazard Mitigation Planning Committee members included:

- participate in Multi-Campus Hazard Mitigation Steering 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 Campus 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 *2021 UNC Western Campuses Hazard Mitigation Plan.*

Table 2.1 lists the members of the Multi-Campus Hazard Mitigation Steering Committee who were responsible for participating in the development of the Plan.

TABLE 2.1: MULTI-CAMPUS HAZARD MITIGATION STEERING COMMITTEE MEMBERS

LAST NAME	FIRST NAME	UNIVERSITY REPRERSENTED	TITLE
Marshburn	Jason	Appalachian State University	Director EH&S and EM
Auman	Travis	North Carolina Agricultural and Technical University	Emergency Management Director
Weldon	David	UNC Asheville	Emergency Management Director
Gonyar	Chris	UNC Charlotte	Emergency Management Director
Smith	Zachary	UNC Greensboro	Emergency Management Director
Davis	Clarisse	UNC School of the Arts	Emergency Management Coordinator
Stovall	Shane	Western Carolina University	Emergency Services Director
Stogner	Jason	Winston-Salem State University	Emergency Management Director

Each of the primary points of contact from the Multi-Campus Hazard Mitigation Steering Committee was responsible for workings with their respective universities to establish University Hazard Mitigation Teams that were specific to their university. These teams were responsible for coordinating all elements of the planning process that were campus specific including the following:

- Participate in the planning process,
- Provide university-specific information on risk and vulnerabilities,
- Identify and rank the most critical buildings on campus,
- Provide information on campus capabilities to implement a mitigation strategy,
- Provide updates for existing mitigation actions and identify any new mitigation actions,
- Provide review comments on drafts of the plan and,
- Help facilitate adoption or acceptance of the plan by University Governing Authority once completed.

The primary university points of contact were provided with guidance material from FEMA's *Building a Disaster-Resistant University* document that gave them a listing of potential university stakeholders to invite to participate on the University Hazard Mitigation Planning Teams. The composition of these teams was left entirely up to each university. Specific information about the teams and details about their meetings can be found in the plan Annexes.

Additional participation and input from other identified stakeholders and the general public was sought 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).

2.5 MEETINGS AND WORKSHOPS

The preparation of this Plan required a series of meetings and workshops for facilitating discussion, gaining consensus and initiating data collection efforts with university officials, facilities staff, 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[3]. 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

October 17, 2018 – Initial Project Kickoff Meeting

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

A conference call was held with all of the participating campuses to initiate the project and to introduce the project consultant. The meeting was facilitated by Chris Crew, NCEM's Hazard Mitigation Plans Chief. Representatives from each of the eight participating campuses were on the call. Mr. Crew introduced the project contractors and discussed the need to document time spent working on the plan by all university staff in order to meet in-kind services requirements for the grant. He then indicated that Nathan Slaughter, Project Manager from the project consultant, ESP Associates would be contacting them in the future to officially kick off the project.

August 1, 2019 – Project Kickoff Meeting – Online Meeting

The Project Manager, Nathan Slaughter, from the Project Consulting Firm, ESP Associates, Inc. held a project kickoff call with the Core Hazard Mitigation Planning Team. The purposes of the meeting were to:

- Provide a refresher on hazard mitigation and why planning is needed,
- Provide a project overview to include discussion of key objectives, project tasks, project schedule and staffing
- Discuss roles and responsibilities,
- Discuss next steps and
- Address any questions, issues or concerns.

Mr. Slaughter started the meeting by explaining that the project was funded by a FEMA PDM grant and that NCEM was managing the grant and secured the contractor support for the plan. Mr. Slaughter indicated that ESP Associates was selected for the Western Campuses plan because of their familiarity with the Western counties having worked with all of them on mitigation planning efforts at the County and municipal levels through the regional hazard mitigation plans.

He then provided an overview of hazard mitigation and gave a review of the Disaster Mitigation Act of 2000 and NC Senate Bill 300. 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 on campus (buildings, infrastructure 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 a discussion about various mitigation techniques. He briefly explained the six different categories of mitigation techniques: emergency services, prevention, natural resource protection, structural projects, public education and awareness, and property protection. The attendees were then asked what types of mitigation projects would be needed the most at their campuses if FEMA funding was available. This helped demonstrate how priorities in mitigation actions should be considered for the plan.

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

- Coordinate between the eight participating campuses to update the existing plan,

- Update the plan to demonstrate progress and reflect current conditions,
- Complete the update in a timely manner because the existing plan expired in October of 2017,
- Increase public awareness and education,
- Maintain grant eligibility for participating campuses, and
- Maintain compliance with State and Federal requirements.

Mr. Slaughter reviewed the list of participating campuses with the group. He also explained the project tasks to be accomplished. These included the planning process, risk assessment, capability assessment, mitigation strategy, mitigation action plan, and plain maintenance procedures.

He explained that the project as being managed by a Campus Hazard Mitigation Steering Committee that had one representative from each of the eight campuses. He also indicated that each of the lead representatives from each campus would be tasked with helping establish a Campus Hazard Mitigation Team that was specific for their campus. Mr. Slaughter said that he would help with suggesting who should be on the membership of those planning teams.

Mr. Slaughter explained that this update would expand the scope of the plan to not only address natural hazards, as was previously done for the existing plan, but that it would also address manmade/technological hazards as well. This was done to ensure alignment with the State of North Carolina's Hazard Mitigation Plan.

Mr. Slaughter explained that the plan would address campus vulnerability, where feasible, to identify specific types and numbers of campus assets that are at risk to the identified hazards. He said that an attempt would be made to address other types of vulnerability as well to include social, economic and environmental vulnerabilities.

He then discussed the capability assessment and how the plan would include a discussion on each University's capability to address their hazard vulnerability through mitigation. Next, he discussed the mitigation strategy and explained how that section of the plan would be reviewed and updated as required by FEMA.

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

Mr. Slaughter then reviewed the roles and responsibilities of ESP Associates, Inc, the university leads, stakeholders and the University Hazard Mitigation Planning Teams. The presentation concluded with a discussion of the next steps to be taken in the project development. He explained that a Hazard Mitigation Public Survey was being developed and that it would be distributed soon. He then explained the need to determine the membership of the Campus Hazard Mitigation Teams and that he would begin working closely with the primary POCs from each campus to schedule meeting with those teams He also indicated that he would begin data collection efforts to collect data needed for the risk assessment.

Following a brief question and answer period, the meeting was adjourned.

2.6 INVOLVING THE PUBLIC

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 *UNC Western Campuses Hazard Mitigation Plan* was sought using two methods: (1) public survey instruments were made available in hard copy and online; and (2) copies of the draft plan deliverables were made available for public review online. Thus, the public was provided three opportunities to be involved in the development of the Campus 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.

Each participating campus will formally adopt or approve the plan either by resolution or by acceptance of the plan by the Governing Authority of the University. Plan adoptions are addressed in Section 6.

2.6.1 Public Participation Survey

The Campus Hazard Mitigation Teams were successful in getting citizens, faculty, staff and students 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 anyone with an interest in communicating their comments regarding hazards, and mitigation of hazards for the various campuses. The survey allowed those that might not be able to attend public meetings the opportunity or participate through other means in the mitigation planning process.

Copies of the *Public Participation Survey* were distributed to the Campus Hazard Mitigation Planning Teams and it was requested that they be made available for faculty, staff and students at each campus. A link to an electronic version of the survey was also posted by various means by each campus.

A total of 330 survey responses were received, which provided valuable input for the Campus Hazard Mitigation Planning Committees to consider in the development of the plan update. Survey summary results are included in Appendix B.

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

During the planning process, stakeholders from outside of the participating universities were approached about participating in the planning process. They were approached by university staff and the project consultant. Additional stakeholders that were invited to participate in the process and did participate include:

- University of North Carolina System staff
- North Carolina Department of Insurance staff
- North Carolina State Property Office
- County Emergency Management Coordinators in the Counties where the universities are located
- North Carolina Emergency Management staff including Hazard Mitigation Staff and Risk Management staff

Documentation of outreach efforts to external stakeholders and meeting sign-in information can be found in Appendix B.

The Campus Hazard Mitigation Committee encouraged more open and widespread participation in the mitigation planning process. The Steering Committee and Campus Hazard Mitigation Planning Teams went above and beyond in its outreach efforts through the design and distribution of the *Hazard Mitigation Public Survey*. This opportunity was provided for campus officials, students, faculty, staff, businesses, and other private interests on campus to be involved and offer input throughout the mitigation planning process.

2.8 DOCUMENTATION OF PLAN PROGRESS

Progress in hazard mitigation planning for the campuses is documented in this plan update. Since hazard mitigation planning efforts officially began for the UNC System with the development of the initial Hazard Mitigation Plans in 2010, many mitigation actions have been completed and implemented on the campuses. These actions will help reduce the overall risk to natural hazards for the people and property on the campuses. The actions that have been completed are documented in the campuses Annexes in the Mitigation Action Plans. Further documentation of plan implementation progress can be found in the Capability Assessment. Institution capability continues to improve across the campuses with the implementation of new plans, policies and programs that help to promote hazard mitigation at the campus and building level. The current state of capabilities is captured in the individual Annexes for each campus. The campuses continue to demonstrate their commitment to hazard mitigation and hazard mitigation planning and have proven this by reconvening the Steering Committee and the Campus Hazard Mitigation Planning Teams to update the Plan and by continuing to involve faculty, students, and staff in the hazard mitigation planning process.

SECTION 3
HAZARD IDENTIFICATION & HAZARD PROFILES

This section describes how the Multi-Campus Hazard Mitigation Steering Committee and Campus Hazard Mitigation Planning Teams identified the hazards to be included this plan. It consists of the following five subsections:

- 3.1 Overview
- 3.2 Risk Assessment Methodology
- 3.3 Hazard Identification
- 3.4 Hazard Profiles
- 3.5 Conclusions on Hazard Risk

44 CFR Requirement
44 CFR Part 201.6©(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.

3.1 Overview

The UNC Western Campuses are 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. However, to reflect the same hazards as included in the North Carolina State Hazard Mitigation Plan (2018), the UNC Western Campuses have included a comprehensive assessment of both types of hazards.

3.2 Risk Assessment Methodology

The Disaster Mitigation Act of 2000 requires that the Multi-Campus Hazard Mitigation Steering Committee and Campus Hazard Mitigation Planning Teams evaluate the risks associated with each of the hazards identified through the planning process. Each hazard was evaluated to determine where it may occur, the severity of potential events, records of past events, the probability of future occurrences, and potential impacts from the hazard. Where feasible, vulnerability assessments were conducted for each hazard using quantitative and/or qualitative methods depending on the available data, to determine its potential to cause significant human and/or monetary losses. A consequence analysis was also completed for each hazard.

To account for regional differences in hazard risk across each of the campuses, this risk assessment is divided into two parts:

1. A set of summary hazard profiles describing each hazard and summarizing the risk findings for each campus.
2. A campus-specific risk assessment profiling the location, extent, historical occurrences, probability of future occurrences, and vulnerability of each campus, presented in each campus annex

For each hazard, the following information is provided.

Hazard Description
This section provides a description of the hazard, including discussion of its duration and speed of onset or warning time, as well as any secondary effects followed by details specific to the planning area.

Climate Change
Where applicable, this section discusses how climate change may or may not influence the risk posed by the hazard on the planning area in the future.

Consequence Analysis
This section summarizes the potential negative consequences of the hazard across the seven criteria set by the Emergency Management Accreditation Program (EMAP).

3.2.1 Priority Risk Index

The conclusions drawn from the hazard profiling and vulnerability assessment process are used to prioritize all potential hazards to the UNC Western Campuses planning area. The Priority Risk Index (PRI) was applied for this purpose because it provides a standardized numerical value so that hazards can be compared against one another (the higher the PRI value, the greater the hazard risk). PRI values are obtained by assigning varying degrees to risk five categories (probability, impact, spatial extent, warning time, and duration) for each hazard. Each degree of risk was assigned a value (1 to 4) and a weighting factor as summarized in **Table 3.1**. PRI Ratings are provided by category throughout each hazard profile. Ratings specific to each campus are provided at the beginning of each hazard profile and are detailed in the campus annexes.

TABLE 3.1: PRIORITY RISK INDEX FOR UNC WESTERN CAMPUSES

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. Little to no impact on the environment, and own operations.	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. Limited impact on the environment and own operations.	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. Impacts felt on environment and own operations impacted.	3	
	Catastrophic	High number of deaths/injuries possible. More than 50% of property in affected area damaged or destroyed. Complete	4	

PRI Category	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
		shutdown of critical facilities for 30 days or more. Significant impacts on environment and own operations including potential need for implementing Continuity of Operation Plans.		
Spatial Extent	Negligible	Less than 1% of area affected	1	20%
	Small	Between 1 and 10% of area affected	2	
	Moderate	Between 10 and 50% of area affected	3	
	Large	Between 50 and 100% of area affected	4	
Warning Time	More than 24 hours	Self-explanatory	1	10%
	12 to 24 hours	Self-explanatory	2	
	6 to 12 hours	Self-explanatory	3	
	Less than 6 hours	Self-explanatory	4	
Duration	Less than 6 hours	Self-explanatory	1	10%
	Less than 24 hours	Self-explanatory	2	
	Less than one week	Self-explanatory	3	
	More than one week	Self-explanatory	4	

The sum of all eight risk assessment categories equals the final PRI value, demonstrated in the equation below (the lowest possible PRI value is a 1.0 and the highest possible PRI value is 4.0).

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

The purpose of the PRI is to prioritize all potential hazards for each campus in the UNC Western Campuses planning area as high, moderate, or low risk. The summary hazard classifications generated through the use of the PRI allows for the prioritization of those high and moderate hazard risks for mitigation planning purposes. Mitigation actions are not developed for hazards identified as low risk through this process.

3.3 Hazard Identification

Upon a review of the full range of natural hazards suggested under FEMA planning guidance, the participating universities in UNC Western Campuses region have identified a number of hazards that are to be addressed in its Hazard Mitigation Plan. These hazards were identified through a process that utilized input from the Campus Hazard Mitigation Planning Teams members, research of past disaster declarations in the surrounding county[1], and review of the previous UNC Western Campuses Pre-Disaster Mitigation Plans. To maintain consistency, the Multi-Campus Hazard Mitigation Steering Committee and Campus Hazard Mitigation Planning Teams voted to assess the same hazards that were identified in the most recent update of the North Carolina State Hazard Mitigation Plan (2018). Therefore, since the development of the previous plan, the hazard identified and included in the plan have changed. A list of all previous hazards covered in the previous UNC Western Campuses Pre-Disaster Mitigation Plans are viewable in **Table 3.2**, 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.

[1] A complete list of disaster declarations for every county where UNC Western campuses are located can be found below in Section 3.2.

TABLE 3.2: 2020 UNC WESTERN CAMPUSES HAZARDS UPDATE

2010 UNC Western Campus Identified Hazards		2021 UNC Western Campus Identified Hazards		Description of hazards covered in 2021 Plan and Explanations
Atmospheric Hazards	Drought	**Natural Hazards**	Drought	Agricultural Drought, Hydrological Drought
	Driving Rain			
	Other High Wind events			
			Excessive Heat	
	Hurricane		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
	Tornado		Tornadoes/Thunderstorms	Hailstorm, Torrential Rain associated with Severe Thunderstorms, Thunderstorm Wind, Lightning, Waterspout, High Wind
	Electrical Storm			
	Severe Winter Weather, including ice or snow events		Severe Winter Weather	Freezing Rain, Snowstorms, Blizzards, Wind Chill, Extreme Cold
Hydrologic Hazards			Dam Failures	
	Flood		Flooding	
Geologic Hazards	Earthquake		Earthquakes	
	Landslide, Rockslide, and other Geologic		Geological	Landslides, Sinkholes, Erosion
Other Hazards	Wildfire or Building Fire	**Other Hazards**	Wildfires	
	Animal borne and other Infectious Diseases		Infectious Disease	
	Accidental Explosion	**Technological Hazards**		
			Hazardous Substances	Hazardous Materials, Hazardous Chemicals, Oil Spill
			Radiological Emergency – Fixed Nuclear Facilities	
			Terrorism	Chemical, Biological, Radiological, Nuclear, Explosive
			Cyber	
			Electromagnetic Pulse	

3.4 Hazard Profiles

Table 3.3 lists the full range of hazards initially identified for inclusion in the Plan and provides a brief description for each. This table includes 27 individual hazards which were considered for their relevance to the UNC Western Campuses. Some of these hazards are considered to be interrelated or cascading, but for preliminary hazard identification purposes these individual hazards are broken out separately. Some of the hazards that were initially considered for inclusion in the plan were determined to not be applicable for all campuses and have thus not been included in any narrative or analysis past the hazard identification. For hazards that are ruled out, a brief discussion about how that determination was made, has also been provided in Table 3.3.

TABLE 3.3: DESCRIPTIONS OF THE FULL RANGE OF INITIALLY IDENTIFIED HAZARDS

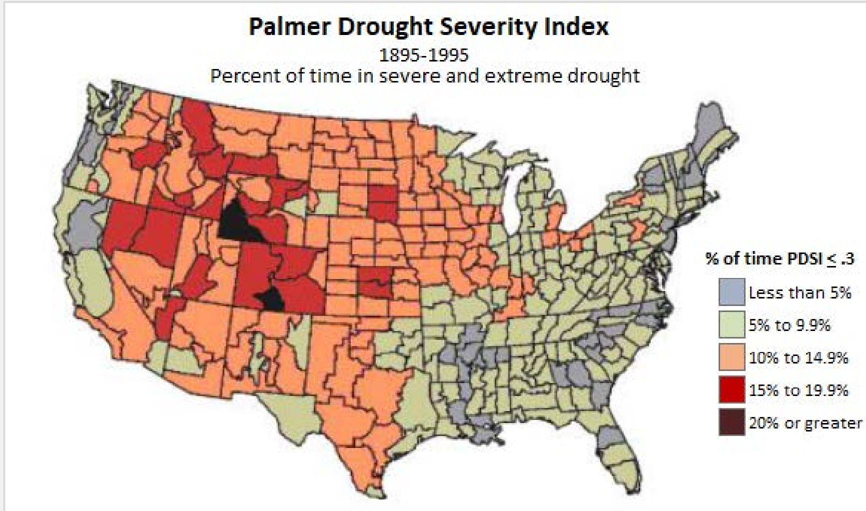
Hazard	Description
Natural Hazards	
Avalanche	A rapid fall or slide of a large mass of snow down a mountainside. Because North Carolina does not get the snowfall amounts that causes avalanches, avalanche is not an applicable hazard to any of the campuses and is not included in the hazard profiles or vulnerability assessment.
Drought	Drought is 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. Droughts are typically classified into one of four types: 1) meteorological, 2) hydrologic, 3) agricultural, or 4) socioeconomic. **Table 3.4** presents definitions for these types of drought. (Table 3.4 below) 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 3.1**, the Palmer Drought Severity Index Summary Map for the United States, drought affects most areas of the United States, but is less severe in the Eastern United States.

TABLE 3.4: DROUGHT CLASSIFICATION DEFINITIONS

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

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

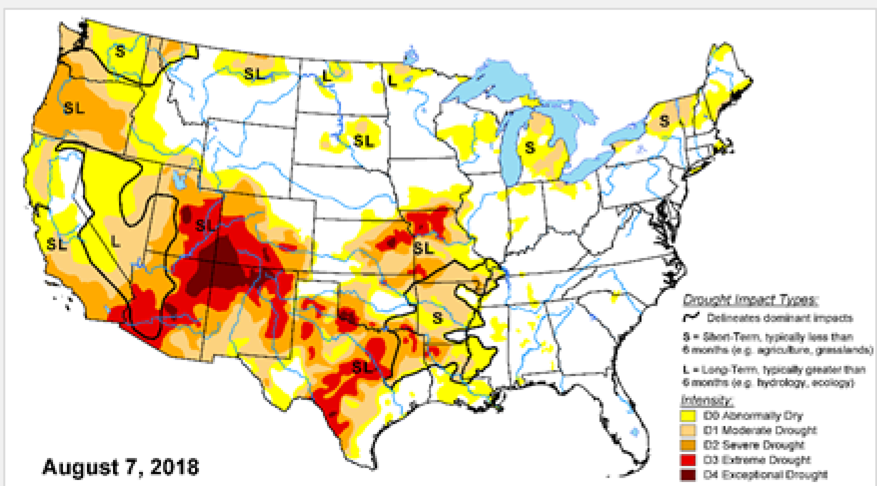
FIGURE 3.1: PALMER DROUGHT SEVERITY INDEX SUMMARY MAP OF THE UNITED STATES



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 3.2** and more recent data is provided by the US Drought Monitor on a weekly basis to reflect the most current drought conditions in the US.

FIGURE 3.2: US DROUGHT MONITOR



Source: US Drought Monitor

The North Carolina Drought Management Council also reports data on North Carolina drought conditions from 2000 to 2018 through the North Carolina Drought Monitor. It classifies drought conditions used 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 3.5**.

TABLE 3.5: 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

Table 3.6 below provides summary information about which Western UNC campuses are potentially impacted by drought. **Table 3.7** provides the PRI summary information for the drought hazard for each Western UNC campus.

TABLE 3.6: CAMPUSES AT RISK TO DROUGHT HAZARD

ASU	NCAT	UNCA	UNCC	UNCG	UNCSA	WCU	WSSU
●	●	●	●	●	●	●	●

TABLE 3.7: PRI SUMMARY FOR DROUGHT HAZARD BY CAMPUS

Campus	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
ASU	Likely	Minor	Moderate	More than 24 hours	More than 1 week	2.3
NCAT	Likely	Minor	Large	More than 24 hours	More than 1 week	2.5
UNCA	Likely	Minor	Moderate	More than 24 hours	More than 1 week	2.3
UNCG	Likely	Minor	Large	More than 24 hours	More than one week	2.6
UNCC	Likely	Minor	Moderate	More than 24 hours	More than 1 week	2.3
UNCSA	Likely	Minor	Large	More than 24 hours	More than 1 week	2.5
WCU	Likely	Minor	Moderate	More than 24 hours	More than 1 week	2.3
WSSU	Likely	Minor	Large	More than 24 hours	More than 1 week	2.5

Climate Change

The Fourth National Climate Assessment reports that average and extreme temperatures are increasing across the country and average annual precipitation is decreasing in the Southeast. Heavy precipitation events are becoming more frequent, meaning that there will likely be an increase in the average number of consecutive dry days. As temperature is projected to continue rising, evaporation rates are expected to increase, resulting in decreased surface soil moisture levels. Together, these factors suggest that drought will increase in intensity and duration in the Southeast.

TABLE 3.8: DROUGHT CONSEQUENCE ANALYSIS

Category	Consequences
Public	Drought can have a detrimental effect on the livelihood of farmers and agricultural producers in North Carolina. Efforts to mitigate against drought, such as using irrigation equipment, have a high initial cost, including the need for an increase in management requirements, cost of operation and maintenance, and the lack of good quality water resources—which during times of drought would be severely affected. Although the general public may be subject to water restrictions during extreme drought events, it is unlikely that public confidence in the state's governance would be impacted severely as a result of a drought.
Responders	Although drought would have many of the same impacts on responders as it would on the public, the overall effects would be relatively limited when compared to the impacts other hazards could potentially have on responders. Since a drought is typically a slowly developing event, the risk and exposure that responders would face is minimal.
Continuity of Operations (including Continued Delivery of Services)	Drought would have minimal impacts on continuity of operations due to the relatively long warning time that would allow for plans to be made to maintain continuity of operations. Normal operations would very likely be able to continue throughout the event and there would likely be little change to the program's management overall.
Property, Facilities and Infrastructure	Water Use Drought has the potential to affect North Carolina's water supply for residential, commercial, institutional, industrial, and government-owned areas. Drought can reduce water supply in wells and reservoirs. When drought conditions persist with no relief, local or state governments often institute water restrictions which may have an impact on personal property to some degree, though generally these restrictions are meant to protect life safety by ensuring adequate supplies of drinking water for consumption and other critical purposes. Irrigation Drought would affect irrigation and outdoor landscaping efforts around residential, commercial, institutional, industrial, and government-owned land. Water conservation strategies can limit the amount of water used to maintain the aesthetic environment around buildings, businesses, and areas such as golf courses. This would include automatic and non-automatic spray irrigation systems, hose-end sprinklers, handheld hoses, bucket watering, drip irrigation, athletic field irrigation, swimming pools, car washing, pressure washing, and reuse water.
Environment	Drought may also lead to pollution of water sources as a result of lack of rainwater to dilute industrial and agricultural chemical runoff. This poses a risk to plants and animals and makes it difficult to maintain a clean drinking water supply. Lack of water reaching the soil may also cause the ground to become dry and unstable. Erosion can increase and loss of topsoil can be severe if a high-intensity rain falls on ground lacking a ground

		cover of plants. As a result of these environmental impacts, habitats may be degraded through a loss of wetlands, lake capacity, and vegetation.
	Economic Condition of the Jurisdiction	Drought can have a detrimental effect on agricultural and agribusiness industry sectors which account for one-sixth of North Carolina's income and employees.9 Extreme drought also has the potential to depress local businesses and industries such as landscaping, recreation and tourism, and public utilities. Nursery and landscape businesses can also face significant losses from a drought. Losses include reduction of output and sales of crops, reduction in plant sales, and an increase in watering costs. This can lead to the closing of many business locations, laying-off employees, and increases in bankruptcy filing. Agriculture The agriculture sector of North Carolina is particularly susceptible to drought damage. The table below shows there are more than 50,000 farms in North Carolina, with over ¼ of the land area of the state being farmland.10 Agricultural drought has the potential to directly affect much of the land in North Carolina. Agricultural areas at particular risk are cropland and pastures. Crops Prolonged periods of dry weather are the most difficult and damaging problem faced by crop growers and agricultural suppliers. North Carolina has 4,378,097 acres of harvested cropland, which is 14.1 percent of total land area of state. Short- or long-term moisture deficits—even with the use of irrigation methods—during critical stages of crop development can severely reduce yields, with the amount of yield lost depending on when the drought occurs (see table below for a list of North Carolina crop specific information), the growth stage of the crop, the severity of dry conditions, and the amount of available water that the soil can hold.
	Public Confidence in the Jurisdiction's Governance	When drought conditions persist with no relief, local or State governments must often institute water restrictions, which may impact public confidence.
Hailstorm (included in Thunderstorms/ Tornados)	A hailstorm is any storm that produces hailstones that fall to the ground. This term 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. Frozen droplets gradually accumulate on the ice crystals until they develop to a sufficient weight and fall as precipitation. Haul 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 3.9** shows the TORRO Hailstorm Intensity Scale which is a way of measuring hail severity.	

TABLE 3.9: TORRO HAILSTORM INTENSITY SCALE

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

Climate Change

Few studies conducted indicate that a strong positive relation exists between hailstorm activity and hailstorm damage, as predicted by minimum temperatures using simple correlations. This relation suggests that hailstorm damage may increase in the future if global warming leads to further temperature increase.

Consequence Analysis

See Tornados/Thunderstorms Consequence Analysis.

Excessive Heat

A heat wave may occur when temperatures hover 10 degrees or more above the average high temperature for the region and last for several weeks. Humid 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 also lead to dust storms and low visibility. A heat wave combined with a drought can be very dangerous and have severe economic consequences on a community.

According to the National Oceanic and Atmospheric Administration, heat is the number one weather related killer among natural hazards, followed by frigid winter temperatures. The National Weather Service devised the Heat Index as a mechanism to better inform the public of heat dangers. The Index Chart, show in **Figure 3.3** used air temperature and humidity to determine the heat index or apparent temperature. **Table 3.10** shows the dangers associated with different heat index temperatures. Some populations, such as the elderly and young, are more susceptible to heat dangers than other segments of the populations.

FIGURE 3.3: NWS HEAT INDEX CHART

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	17	127										
100	87	95	103	112	121	132										

Caution | Extreme Caution | Danger | Extreme Danger

Source: NOAA, National Weather Service

TABLE 3.10: 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 orders to better inform and warn the public to heat dangers. A Heat 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 can concrete (which store heat longer) gradually release heat at night.

Table 3.11 below provides summary information about which Western UNC campuses are potentially impacted by extreme heat. **Table 3.12** provides the PRI summary information for the extreme heat hazard for each Western UNC campus.

TABLE 3.11: CAMPUSES AT RISK TO EXCESSIVE HEAT

ASU	NCAT	UNCA	UNCC	UNCG	UNCSA	WCU	WSSU
	●		●	●	●		●

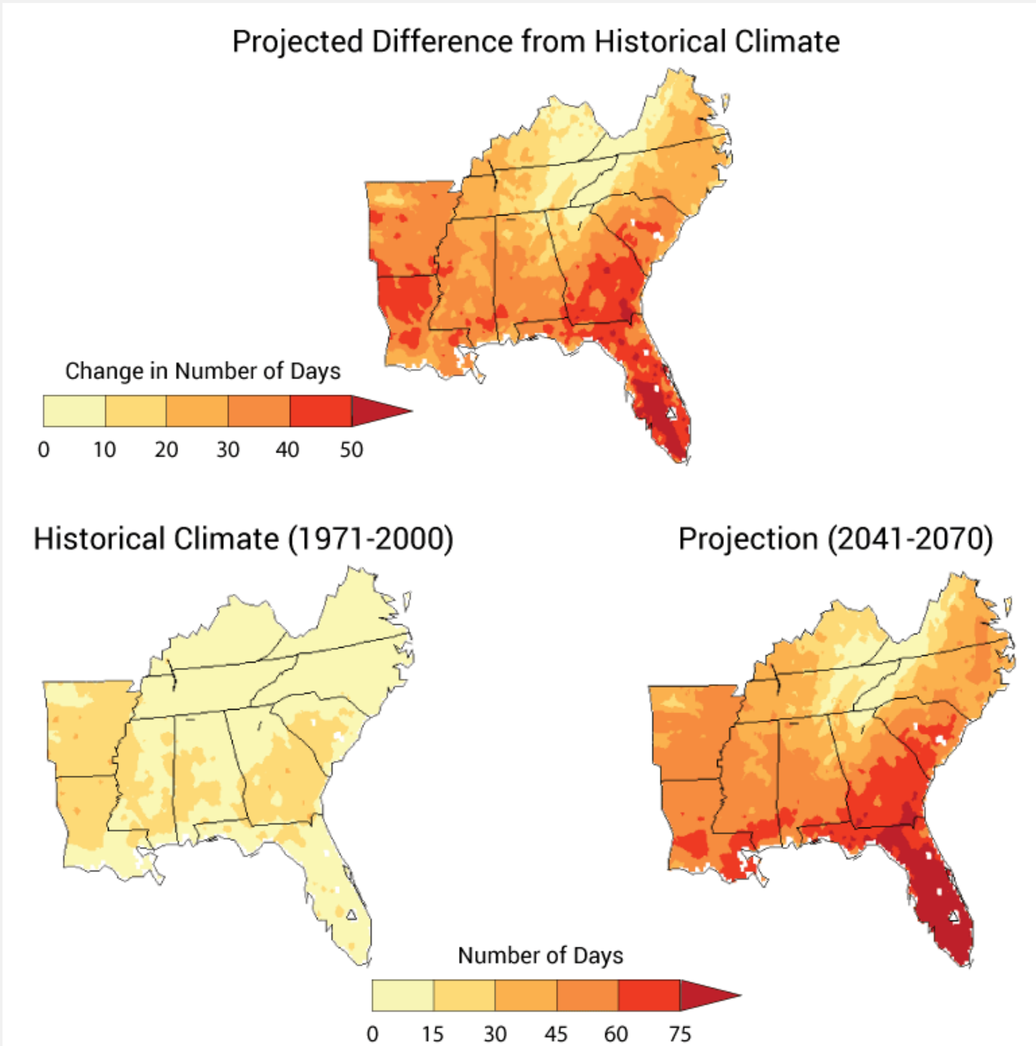
TABLE 3.12: PRI SUMMARY FOR EXCESSIVE HEAT HAZARD BY CAMPUS

Campus	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
NCAT	Possible	Minor	Large	More than 24 hours	Less than 1 week	2.1
UNCC	Possible	Minor	Large	More than 24 hours	Less than 1 week	2.1
UNCG	Likely	Minor	Large	More than 24 hours	Less than one week	2.5
UNCSA	Likely	Minor	Large	More than 24 hours	Less than one week	2.5
WCU	Unlikely	Minor	Large	More than 24 hours	Less than one week	1.8
WSSU	Likely	Minor	Large	More than 24 hours	Less than one week	2.5

Climate Change

Research shows that average temperatures will continue to rise in the Southeast United States and globally, directly affecting North Carolina. Per the Fourth National Climate Assessment, "extreme temperatures are projected to increase even more than average temperatures. Cold waves are projected to become less intense and heat waves more intense." The number of days over 95°F is expected to increase by between 20 and 30 days annually, as shown in **Figure 3.4**.

FIGURE 3.4: PROJECTED CHANGE IN NUMBER OF DAYS OVER 95°F



Source: NOAA NCEI from 2014 National Climate Assessment

TABLE 3.13: EXTREME HEAT CONSEQUENCE ANALYSIS

Category	Consequences
Public	Extreme heat can affect many people and to varying degrees. Often the elderly and very young are susceptible to the most detrimental impacts, but heat stroke and exhaustion can plague anyone. People who are overweight, who overexert during work or exercise, and who are ill or are on certain medications are also at greater risk of suffering from heat-related illness. Risks from exposure to extreme heat include heat cramps, heat exhaustion, heat stroke, and death. Many of the impacts of extreme heat on people are the result of heat exhaustion or improperly functioning air conditioning units. A heat wave or extreme heat event would have minimal effects on public confidence as these events are frequent and the public likely understands the potential impacts. However, if an extreme heat event results in a large number of illnesses and fatalities, government organizations may be accused of failing to properly prepare for or respond to the threat, and public confidence could suffer.
Responders	Extreme heat can also affect responders who are often more susceptible to heat stroke and exhaustion due to the nature of their work. This work forces police and emergency medical providers to be exposed to the elements, physically exert themselves, or wear heavy personal protective equipment. In these cases, responders could be negatively impacted by extreme heat and will need to protect themselves and prepare accordingly.
Continuity of Operations (including Continued Delivery of Services)	Extreme heat would likely have few impacts on continuity of operations as the warning time for these events is usually long and direct impacts to large numbers of personnel or other resources necessary to maintain operations are unlikely. If air conditioning systems in operations centers break down due to overuse, operations could be interrupted or forced to move to secondary facilities.
Property, Facilities and Infrastructure	Extreme heat would likely have a minor effect on the built environment, although high temperatures could potentially put a strain on infrastructure such as power generation and water systems due to higher demand. During times of extreme heat, air conditioning units work harder and require more electricity, making brownouts and blackouts possible if electricity demands exceed generation. Extreme heat can also cause transportation infrastructure such as roads, bridges, railways, and runways to buckle, crack, or shatter.
Environment	The environment would be impacted by extreme heat as many plants and animals that are not able to withstand the heat may die off and crops and livestock may be impacted by unusually high temperatures, resulting in death or illness. Heat waves can also contribute to higher levels of air pollution since air becomes stagnant and traps emitted pollutants, often causing increased levels of surface ozone.
Economic Condition of the Jurisdiction	An extreme heat event could potentially have a negative impact on the economy in the short term as the public may be advised to stay indoors, causing them to reduce overall spending and negatively

	impact businesses in the community. Additionally, extreme heat events can also result in decreased worker productivity as high temperatures can result in decreased energy, loss of concentration, and heat-related illness in workers. This can cause disruptions to the regular working of the local economy. Extended periods of extreme heat may also disrupt the local economy if agricultural, dairy, and livestock production declines, resulting in income loss for farmers and other related industries as well as increased prices for consumers.
Public Confidence in the Jurisdiction's Governance	Extreme heat is unlikely to impact public confidence.

Hurricane and Coastal Hazards

Hurricanes and coastal 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 deem a hurricane. Hurricane intensity is further classified by the Saffir-Simpson Scale in **Table 3.14** below. The Saffir-Simpson Scale rates hurricane intensity on a scale of 1 to 5, with 5 being the most intense.

TABLE 3.14: 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 3.15** 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 3.15: 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

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.

Table 3.16 below provides summary information about which Western UNC campuses are potentially impacted by hurricanes and coastal storms. **Table 3.17** provides the PRI summary information for the hurricanes/coastal storms for each Western UNC campus.

TABLE 3.16: CAMPUSES AT RISK TO HURRICANES/COASTAL HAZARDS

ASU	NCAT	UNCA	UNCC	UNCG	UNCSA	WCU	WSSU
●	●	●	●	●	●	●	●

TABLE 3.17: PRI SUMMARY FOR HURRICANES/COASTAL HAZARDS BY CAMPUS

Campus	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
ASU	Possible	Critical	Large	More than 24 hours	Less than 24 hours	2.6
NCAT	Possible	Limited	Large	More than 24 hours	Less than one week	2.3
UNCA	Possible	Critical	Large	More than 24 hours	Less than 24 hours	2.6
UNCC	Possible	Limited	Large	More than 24 hours	Less than 24 hours	2.3
UNCG	Likely	Critical	Large	More than 24 hours	Less than 24 hours	3.0
UNCSA	Likely	Critical	Large	More than 24 hours	Less than 24 hours	2.9
WCU	Possible	Limited	Large	More than 24 hours	Less than 24 hours	2.3
WSSU	Likely	Critical	Large	More than 24 hours	Less than 24 hours	2.9

Climate Change

One of the primary factors contributing to the origin and growth of tropical storm and hurricanes systems is water temperature. Per the Fourth National Climate Assessment, “There is growing evidence that the tropics have expanded poleward by about 70 to 200 miles in each hemisphere since satellite measurements began in 1979, with an accompanying shift of the subtropical dry zones, midlatitude jets, and both midlatitude and tropical cyclone tracks.” It is unclear as of yet whether these changes can be attributed to climate change, but current climate science suggests cyclones would become more frequent and intense as water temperatures warm. In addition to occurring with greater frequency, intense hurricanes are also expected to produce greater amounts of rainfall. The 2017 hurricane season is considered an indicator of these potential changes.

TABLE 3.18: HURRICANES/COASTAL HAZARDS CONSEQUENCE ANALYSIS

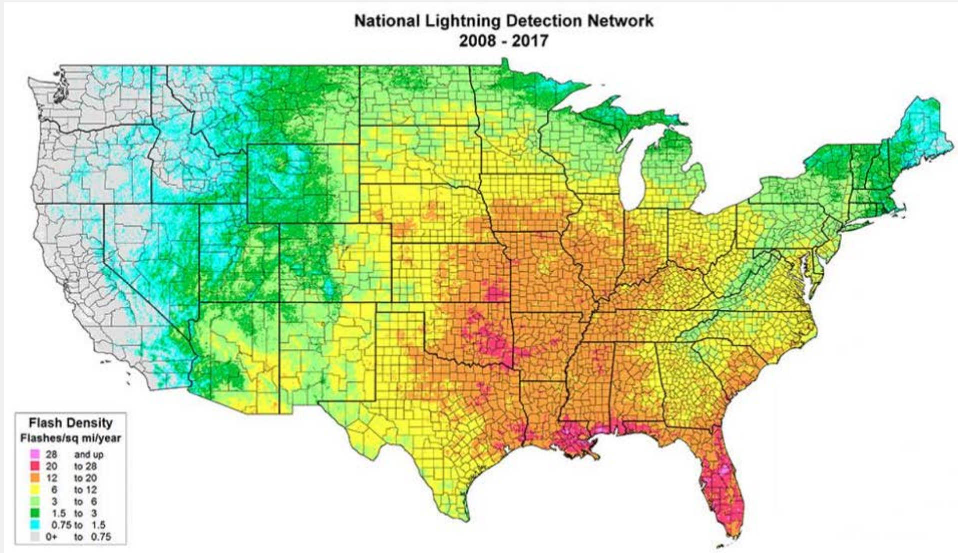
Category	Consequences
Public	During previous hurricane events in North Carolina, there have been significant losses of life and injuries to citizens. A number of people are expected to be displaced from their homes and will require accommodations in temporary public shelters due to a hurricane. Many people may also be permanently displaced and require longer term housing after a major event. In addition, many of the same health and property damage effects listed under the flood hazard would also likely occur as a result of a hurricane. A major difference is that hurricanes can also bring negative effects from high winds and storm surge (especially in coastal areas). High winds can shatter glass and cause personal injury and storm surge and rip tides prior to and during the event can cause loss of life if

	members of the public are not cautious and continue normal activities in the ocean prior to a hurricane event. Hurricane Matthew, which was perhaps the most impactful hurricane the state has experienced since the 1990s, had major implications for the people of North Carolina.
Responders	The impacts on responders from this type of storm could potentially be very high as responders may be physically injured or killed during a storm event by flooding or high winds. In addition, their homes and personal effects could also be impacted, which would limit their response capability. In terms of their actual response capacity, downed trees in the wake of a hurricane often block roads and make ingress and egress difficult, thereby causing issues with response time. This is also often true of the resulting floodwaters. Moreover, due to the large-scale spatial impact of hurricanes and the number of citizens affected by the storm, response time will be reduced because of the number of incidents that require emergency responders.
Continuity of Operations (including Continued Delivery of Services)	Continuity of operations in a hurricane event can be severely affected if power is lost or if critical facilities or infrastructure are damaged during an event. Although North Carolina has a plan in place to maintain continuity of operations in the event of a storm, a hurricane with a high magnitude would likely disrupt operations to some degree due to the impacts it would have on personnel. Some may experience damage from the storm themselves and be unable to work putting a strain on staff who are working as they will be forced to take on additional responsibilities during and after an event. In major events, all staff will likely be called on to work additional hours to maintain continuity of operations, which may result in fatigue and a reduced capability of employees in the long run.
Property, Facilities and Infrastructure	Many buildings and structures could be impacted by a hurricane or tropical storm event including many local and state critical facilities such as police stations, fire stations, medical facilities, and other key buildings. There are also a number of important historic locations located along the coast such as Large-scale damage to infrastructure such as bridges and roads could occur from flood waters and storm surge especially in coastal areas such as the Outer Banks where roadways such as Highway 12 have been damaged severely during past events. Stormwater infrastructure such as culverts could also be damaged if they are clogged with debris from the storm or their design capacity is overrun. Many utilities including water/wastewater may be affected as a result of their location near rivers and other water sources. Power lines may be downed by falling trees or limbs and, due to high demand across the state, utility companies may face challenges in restoring power in a timely manner.
Environment	Flooding and wind damage are the main impacts that would be felt by a hurricane in North Carolina. Hurricane winds can down trees and cause disruptions to local ecosystems, particularly if damage is heavy in areas where endangered or protected species are present. As mentioned in the flood analysis, flood waters may cause some losses in species population. In coastal areas, sensitive habitats

		could be drastically impacted by hurricane events if the storm damages dune systems via storm surge. This may also cause local communities to become more vulnerable to future events as dunes provide a natural barrier against storm surge. Additionally, estuarine habitats may be impacted if floodwaters inundate these complex ecosystems with additional freshwater or saltwater, thereby causing an abnormality in a system that relies on a particular balance of salinity. Hurricane events can also sometimes cause spills of hazardous materials which would have damaging effects on the environment (as detailed further in the hazardous substances analysis below).
	Economic Condition of the Jurisdiction	In general, the economy would be severely impacted by a hurricane or tropical storm event. Due to the massive scale of these events and multiple types of impacts from flooding and high winds, commerce would definitively slow down as efforts to rebuild are undertaken. Businesses may be shut down for long periods as owners try to rebuild after damage from flood waters, downed trees, or wind. Even business owners without direct physical damage to their workplaces may be shut down temporarily by loss of power or because employees are unable to come in to work as a result of roads that are shut down or personal property damage. As mentioned in the flooding analysis, many businesses that shut down after a major disaster never re-open their doors, which can have a major negative impact on local economies, especially in smaller communities.
	Public Confidence in the Jurisdiction's Governance	This hazard could potentially have a large negative effect on public confidence due to the possibility of a high magnitude event and the difficulties that might arise for local governments in terms of response and recovery. As has been the case with several previous events, members of the public who are displaced or whose homes/property are damaged may be frustrated causing a failure of confidence in the government's ability to respond to disasters.

Lightning (included in Thunderstorms/ Lightning)	Lightning is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a "bolt" when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes, but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes thunder. 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. **Figure 3.5** shows a lightning a flash density map for the years 2008-2017 based upon data provided by Vaisala's U.S. National Lightning Detection Network (NLDN).

FIGURE 3.5: LIGHTING FLASH DENSITY IN THE UNITED STATES



Source: Vaisala U.S National Lightning Detection Network

Lightning strikes occur in very small, localized areas. For example, they may strike a building, electrical transformer, or even a person. According to FEMA, lighting injuries 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.

Climate Change
Included in Tornados/Thunderstorms discussion on climate change.

Consequence Analysis

Included in Tornados/Thunderstorms EMAP.

Nor'easter

Similar to hurricanes, nor'easters are ocean storms capable of causing substantial damage to coastal areas in the Eastern United States due to their associated strong winds and heavy surf. Nor'easters are named for the winds that blow in from the northeast and drive the storm up the East Coast along the Gulf Stream, a band of warm water that lies off the Atlantic coast. They are caused by the interaction of the jet stream with horizontal temperature gradients and generally occur during the fall and winter months when moisture and cold air are plentiful. Nor'easters are known for dumping heavy amounts of rain and snow, producing hurricane-force winds, and creating high surf that causes severe beach erosion and coastal flooding.

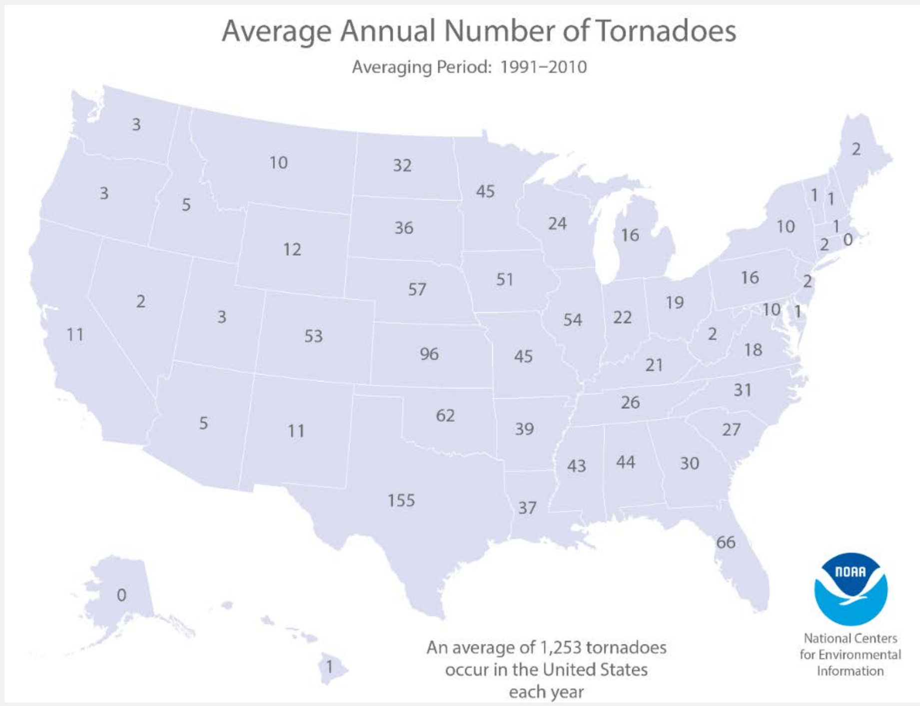
Nor'easters do not pose a risk to the UNC Western campuses and is not included in the hazard profiles or vulnerability assessment.

Tornadoes

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. The most violent tornadoes have rotating winds of 250 miles per hour or more and c=are capable of causing extreme destruction and turning normally harmless objects into deadly missiles. Each year, an average of over 1,200 tornadoes are reported nationwide, resulting in an average of 56 deaths and 1,500 injuries. 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. 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 3.6** shows tornado activity in the United States based on the number of recorded tornadoes per 10,000 square miles.

FIGURE 3.6: 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 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 3.19**). Tornado magnitudes that were determined in 2005 and later were determined using the Enhanced Fujita Scale (**Table 3.20**).

TABLE 3.19: THE FUJITA SCALE (EFFECTIVE PRIOR TO 2005)

F-Scale Numb er	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	Devastatin g 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	Inconceiva ble 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 3.20: 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.

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

Table 3.21 below provides summary information about which Western UNC campuses are potentially impacted by tornadoes. **Table 3.22** provides the PRI summary information for tornadoes for each Western UNC campus.

TABLE 3.21: CAMPUSES AT RISK TO THE TORNADO/SEVERE THUNDERSTORMS HAZARD

ASU	NCAT	UNCA	UNCC	UNCG	UNCSA	WCU	WSSU
●	●	●	●	●	●	●	●

TABLE 3.22: PRI SUMMARY FOR TORNADO/SEVERE THUNDERSTORMS HAZARD BY CAMPUS

Campus	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
ASU	Highly Likely	Critical	Moderate	Less than 6 hours	Less than 6 hours	3.2
NCAT	Highly Likely	Critical	Moderate	Less than 6 hours	Less than 6 hours	3.2
UNCA	Highly Likely	Critical	Moderate	Less than 6 hours	Less than 6 hours	3.2
UNCC	Highly Likely	Critical	Moderate	Less than 6 hours	Less than 6 hours	3.2
UNCG	Highly Likely	Critical	Moderate	Less than 6 hours	Less than 6 hours	3.4
UNCSA	Highly Likely	Critical	Moderate	Less than 6 hours	Less than 6 hours	3.2
WCU	Highly Likely	Critical	Large	12 to 24 hours	Less than 6 hours	3.0
WSSU	Highly Likely	Critical	Moderate	Less than 6 hours	Less than 6 hours	3.2

Climate Change

Climate is more than a measure of average conditions; it also is the range of weather variability, which can include the frequency and severity of extreme events like tornadoes and storms. Changing weather patterns may result in more frequent and more severe tornadoes in North Carolina. A US Government Accountability Report in 2017 states that $350 billion has been incurred by the US Government from extreme weather, and these costs are expected to increase as rare events become more common.

Additionally, according to the National Aeronautics and Space Administration (NASA), tornado and thunderstorm events in the future are likely to become more frequent in the southeast as a result of weather extremes. Thunderstorm/tornado potential is measured by an index that NASA created that is called the Convective Available Potential Energy (CAPE) index. This measures how warm and moist the air is, which is a major contributing factor in thunderstorm/tornado formation. NASA projects that by the period of 2072-2099, the CAPE in the southeastern United States will increase dramatically. Parts of North Carolina are in an area that will likely experience the greatest increase in CAPE in the United States and all of the state is likely to experience at least some increase. This indicates that there will potentially be even more frequent thunderstorms/tornadoes in the state going forward.

TABLE 3.22: TORNADOES/SEVERE THUNDERSTORMS HAZARD CONSEQUENCE ANALYSIS

Category	Consequences
Public	The entire State of North Carolina's population is vulnerable to the impacts of a tornado regardless of the measured magnitude. Because it cannot be predicted where a tornado will touch down, it cannot be said which areas of the population within the state are most vulnerable. However, injuries and deaths resulting from tornadoes are the most significant impacts and are most likely to occur to those living in mobile homes or older homes that have not been built to current design standards. Tornadoes often have a high likelihood of affecting public confidence due to their destructive and highly visible impacts. Thunderstorms are generally associated with several other hazards such as high wind and flooding, the latter of which is caused by torrential rain. As such, the public could be impacted in a number of ways by a thunderstorm event. High wind can cause trees to fall and potentially result in injuries or death and rising floodwaters can lead to drowning or other serious injury. Although often not as severe as tornadoes, the impacts on the public from thunderstorms can be significant, especially in the long run. However, the public confidence is usually not affected to a large degree as a result of thunderstorms.
Responders	Responders could be critically affected by tornado events as the onset is often very rapid and unpredictable, thereby putting response personnel potentially in harm's way. Many responders may be out in the open while on duty when a tornado forms and they may be caught in a dangerous position as a result. Due to the unpredictability of such events, response may also be hindered post-event as responders may be unable to access those that have been affected if storm conditions persist and they are unable to safely enter affected areas. Responders are not generally affected to any great degree by thunderstorm events, although it should be noted that they could be impacted in many of the same ways as the public. Otherwise, responders could be affected by road blockages caused by downed trees or floodwaters, which would ultimately reduce their response time.

Continuity of Operations (including Continued Delivery of Services)	Continuity of operations could be greatly impacted by a tornado as personnel may be harmed and critical resources damaged or destroyed during a tornado. In many ways, since the impacts of a tornado are unpredictable, it is also difficult to predict and plan for the appropriate ways to ensure continuity of operations. Although North Carolina is prepared for such an event, disruption of operations will likely take place to some degree if the event is large enough and spurs multiple tornadoes across the state, as has happened frequently in the past. In general, continuity of operations during a thunderstorm event can be maintained as these events are common in all parts of the state. Thunderstorm events often affect power in much the same way as tornadoes and hurricanes, which ultimately may impact operations. However, thunderstorm events are typically not large enough to severely affect normal operations and their impacts are not wide enough to disrupt continuity of operations at the state level.
Property, Facilities and Infrastructure	Building Inventory According to the National Climatic Data Center, North Carolina has been impacted by tornadoes ranging in intensity from F0/EF0 to F4/EF4 based on the Fujita scale. An F5/EF5 has never been experienced, but it is certainly possible. Because it cannot be predicted where a tornado may touch down, all buildings, facilities, and infrastructure within the state are considered exposed to the hazard and at risk for being impacted. Older buildings that are constructed with less-advanced building techniques are at higher risk as are mobile homes. Building materials play a role in how well a structure can withstand tornado force winds. Buildings that use structural steel, reinforced concrete, or load-bearing masonry have the best change of withstanding a tornado event in the state. Homes constructed of wood or manufactured material are most at risk. Non-engineered structures in the state are far more vulnerable than engineered buildings to damage from tornado winds. It is also notable that materials that are well-tied to all other building components are also more likely to survive extreme wind events.13The magnitude of the tornado will determine the extent of damage and impacts that are felt throughout the county. These impacts can include structural failure, debris damage, and loss of facility functionality. Critical Infrastructure The state's infrastructure system is also vulnerable to the impacts of a tornado. This includes critical infrastructure such as roads, railroads, bridges, utilities (power and gas), and pipelines. Any number of these infrastructure systems could be damaged in the event of a tornado, although often power lines are the most common assets that are affected during a tornado. Impacts could include structural damage, impassable or blocked roadways, failed utility lines, railway failure, and impassable bridges. Thunderstorms often have their greatest impact on the built environment as they can cause damage to homes via strong winds or flooding and will often impact facilities and infrastructure in the same way. Power losses often occur due to damage to power lines and roads can flood and cause damage as well. In fact, thunderstorms are often considered one of the greater hazards of concern for local communities, even though any given event will cause relatively little damage, because damaging events occur so frequently.

Environment	Downed trees and other forms of vegetation are often one of the most visible impacts to the environment from a tornado. Additionally, building material or other debris can be carried or thrown great distances by the force of wind and end up spread out in unexpected places such as natural areas. Coordinated statewide cleanup efforts after a tornado can include removal of debris, but much debris ends up remaining in local habitats. Finally, if hazardous materials facilities are impacted by the tornado, these may release dangerous chemicals into the environment that can cause long-term harm. Thunderstorms can impact crops via high wind and flooding and can also impact the natural environment through these elements. Flooding can kill plants and animals as well as contaminate drinking water supplies for human populations. High wind can harm forests by bringing down trees and cause fires from downed power lines that impact the environment.
Economic Condition of the Jurisdiction	A tornado can impact any area of North Carolina at any time and bring with it significant property damage costs to individual citizens and the disrupt the regular functioning of the local economy. After past events, there has been a substantial halt to many economic activities and losses to businesses have often been high. The loss of power can also interrupt local economies and have a strong negative impact on daily functioning of business activities. Similarly, economic impacts from thunderstorm events can often be far reaching as the damage from these events are often widespread, affecting both homes and businesses. This damage can result in business and economic disruption through the recovery process.
Public Confidence in the Jurisdiction's Governance	Likely to impact public confidence due to possibility of major event requiring substantial response and long-term recovery effort.

Severe Thunderstorms (included in Thunderstorms/ Tornadoes)

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.

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.

Down bursts 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 drafts from the base of a convective thunderstorm cloud. It occurs when rain-cooled air within the cloud becomes heavier than its surroundings. This, air rushes towards the ground in a destructive yet isolated manner. There are two types of downbursts. Downbursts less than 2.5 miles wide, duration less than 5 minutes, and winds up to 168 miles per hour are called "microbursts." Larger events greater than 2.5 miles at the surface and longer than 5 minutes with winds up to 130 miles per hour are referred to as "macrobursts."

Climate Change

Included in Tornados/Thunderstorms discussion about climate change.

	Consequence Analysis Included in Tornados/Thunderstorms EMAP.
Severe Winter Weather	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. 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 ta 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 the severe winter water 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 tree limbs and create hazardous driving conditions. Furthermore, communication and power may be disrupted for days. Nearly the entire continental United States is susceptible to severe winter weather 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. Table 3.23 below provides summary information about which Western UNC campuses are potentially impacted by severe winter weather. Table 3.24 provides the PRI summary information for severe winter weather for each Western UNC campus.

TABLE 3.23: CAMPUSES AT RISK TO THE SEVERE WINTER WEATHER HAZARD

ASU	NCAT	UNCA	UNCC	UNCG	UNCSA	WCU	WSSU

●	●	●	●	●	●	●	●

TABLE 3.24: PRI SUMMARY FOR THE SEVERE WINTER WEATHER HAZARD BY CAMPUS

Campus	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
ASU	High Likely	Critical	Large	More than 24 hours	Less than one week	3.3
NCAT	High Likely	Critical	Large	More than 24 hours	Less than one week	3.3
UNCA	High Likely	Critical	Large	More than 24 hours	Less than one week	3.3
UNCC	High Likely	Critical	Large	More than 24 hours	Less than one week	3.3
UNCG	Likely	Limited	Large	More than 24 hours	Less than one week	2.8
UNCSA	Likely	Limited	Large	12 to 24 hours	Less than 6 hours	2.6
WCU	High Likely	Critical	Large	More than 24 hours	Less than one week	3.3
WSSU	Likely	Limited	Large	12 to 24 hours	Less than 6 hours	2.6

Climate Change

Warmer air can contain more water vapor than cooler air. Global analyses show that the amount of water vapor in the atmosphere has in fact increased over both land and oceans. Climate change also alters dynamical characteristics of the atmosphere that in turn affect weather patterns and storms. In the mid-latitudes, where most of the continental U.S. is located, there is an upward trend in extreme precipitation in the vicinity of fronts associated with mid-latitude storms[2].

More intense snowstorms are being recorded all across the U.S., even in warmer climates where scientists expected average snowfall or snow cover to decline[3]. As the climate continues to fluctuate in extreme heating and cooling patterns during the seasons, more intense severe winter weather events may produce more adverse consequences for the region.

TABLE 3.25: SEVERE WINTER WEATHER HAZARD CONSEQUENCE ANALYSIS

Category	Consequences
Public	Winter weather most often impacts people indirectly and has differing impacts in different areas of the state. Mountainous areas in the western

[2] *https://nca2014.globalchange.gov/report/our-changing-climate/heavy-downpours-increasing*
[3] *https://www.scientificamerican.com/article/love-snow-heres-how-its-changing/*

	part of the state are much more accustomed to winter weather and therefore, are often more prepared to deal with it. However, these areas are also much more likely to experience larger accumulations of precipitation and colder temperatures than areas further east. Across the state, winter weather can create dangerous driving conditions by limiting visibility for drivers or creating slick conditions that make maneuverability difficult. Loss of power can create very cold conditions for residents, making it difficult to stay warm. Residents may try to heat their home using alternative means, which runs the risk of carbon monoxide poisoning caused by improperly ventilated heating sources. In addition, dangerously cold temperatures increase the risk of wind chill, frostbite, and hypothermia. Another indirect impact of winter weather on the public is its potential to impact public and private school schedules through closings and delays. Poor driving conditions, lack of power and heat, and mechanical problems with school buses and equipment due to cold weather conditions are potential concerns. School closures and delays can lead to logistical problems for teachers and school administrators, especially in the event of end-of-term exams and standardized testing schedules. It can also result in logistical problems for making up school days. Winter storms generally do not have a large impact on public confidence, but it could be somewhat impacted if road clearing or response operations are slow
Responders	Responders in severe winter weather events face a variety of hazards, including slick or icy roads that could cause accidents if they are attempting to quickly respond to an emergency as is often the case. The chances of crashed emergency vehicles and injuries to responders are always a possibility, but increase during a winter storm event due to difficult driving conditions. Winter weather can also make it difficult to access more rural areas if roads are snowed/iced over and emergency vehicles cannot pass through.
Continuity of Operations (including Continued Delivery of Services)	Generally, continuity of operations can be maintained during a winter weather event in North Carolina. However, winter weather does have the potential to affect power transmission as the weight of ice and snow can cause trees and limbs to fall and damage transmission lines. Winter precipitation can also freeze to roadways or create slick conditions that make it difficult for emergency management employees to get to work. As a result, there will likely be some disruption of operations during a winter weather event.
Property, Facilities and Infrastructure	One of the primary identified impacts of winter weather in North Carolina is the disruption of utilities. Utilities that are at risk of being affected include telephone, internet, cable, and water. Newspaper reports typically cite trees falling on electrical wires—as well as trees that have already been damaged from previous incidents that fall during a winter storm—or the stress caused by ice accumulation as main causes for power outages. Damage to this infrastructure is one of the major consequences of a winter weather event in the state and can lead to life-threatening situations if the public is unable to utilize central heating systems to keep warm during the concurrent cold weather that often accompanies winter weather. Winter weather also has the potential to create hazardous driving conditions leading to accidents on roadways. The North Carolina Climate

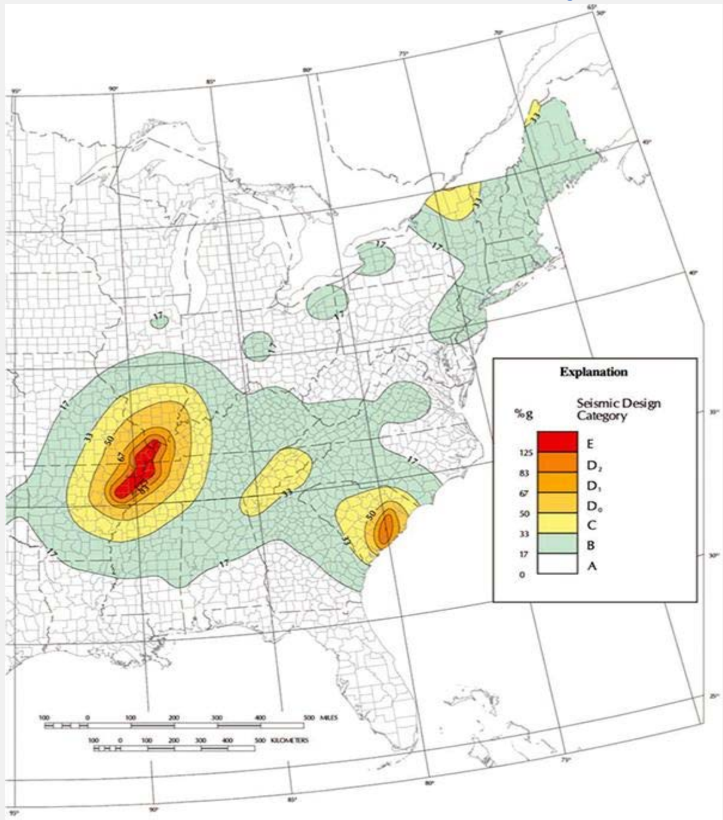
	Office reports that 70 percent of winter-weather–related injuries are a result of accidents on the road.4 The North Carolina Highway Patrol call volume can double during a winter storm compared to a typical 24-hour period. This creates significant problems for emergency workers. Accidents can cause highways to become “large parking lots” as well as cause motorists to strand their vehicles, making it difficult for emergency workers to reach those who need assistance. In general, major and local roadways become severely impacted when temperatures drop, making pre-treatment solutions ineffective. Transportation impacts can be minimized during early- and late-season events when paved surfaces are able to warm sufficiently to prevent winter precipitation accumulation. Winter weather can also cause delays and cancellations of flights at airports in the state due to slick conditions on runways. There is also the potential of a loss of power that can close the airport.
Environment	Winter weather has an impact on the environment through the clearing of roadways. Snow on the roads can pick up contaminants from chemicals and oil products in traffic as well as the salt mixture that is used to de-ice the roads. These contaminants can be carried to nearby waterways, which contaminates water sources and is absorbed by groundwater. In addition, vegetation can be damaged by these storm types, which harms habitats and may threaten wildlife.
Economic Condition of the Jurisdiction	In the event of winter weather, there is a high potential of business and office closures, modified business and office hours, and cancellation or postponement of sporting and other planned events in the state. This can be attributed to poor road conditions (including icy and slick conditions) that result in fewer people using the roads to get to their destination or a loss of power and heat that result in a loss of operations at specific facilities. In general, absenteeism is higher during winter weather events as many employers rightly encourage employees to stay home and avoid potential injury in unsafe driving conditions. According to the Bureau of Labor Statistics, although any major weather event can cause absences at work, workers are more likely to be absent because of bad weather during winter months because winter weather tends to impact much larger areas and makes travel difficult throughout much more of the transportation network.
Public Confidence in the Jurisdiction’s Governance	Ability to respond and recover may be questioned and challenged if planning, response, and recovery not timely and effective.

Earthquakes

A sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the surface. This movement forces the gradual building and accumulation of energy. Eventually, strain becomes so great that the energy is abruptly released, causing the shaking at the earth’s surface which we know as an earthquake. Roughly 90 percent of all earthquakes occur at the boundaries where plates meet, although it is possible for earthquakes to occur entirely within plates. Earthquakes can affect hundreds of thousands of square miles; cause damage to property measured in the tens of billions of dollars; result in loss of life and injury to hundreds of thousands of persons; and disrupt the social and economic functioning of the affected area.

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 States does face moderate risk to less frequent, less intense earthquakes events. **Figure 3.7** shows relative seismic risk in the United States.

FIGURE 3.7: EASTERN UNITED STATES EARTHQUAKE HAZARD MAP



Source: Federal Emergency Management Agency

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 3.26**). 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 3.27**.

TABLE 3.26: 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

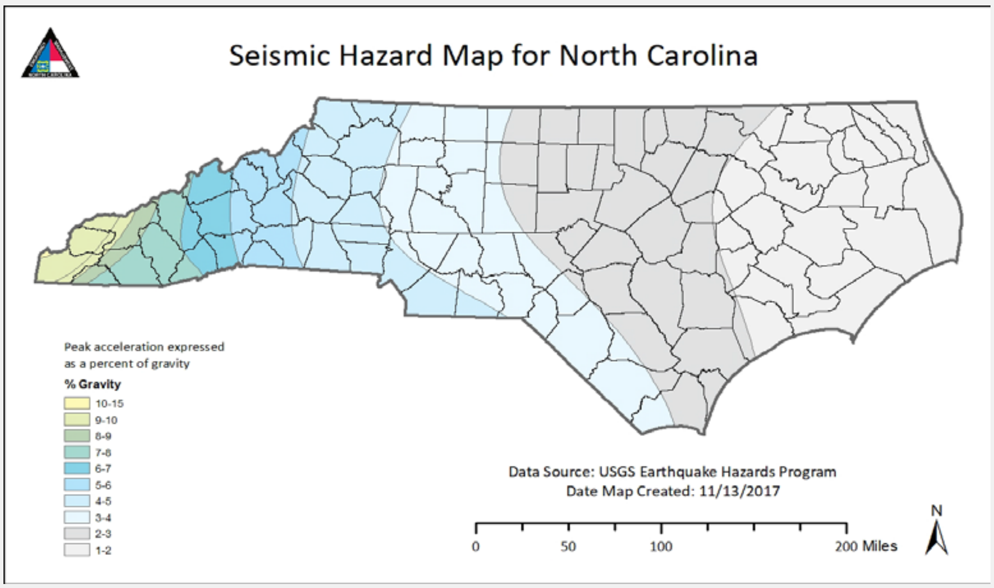
TABLE 3.27: MODIFIED MERCALLI INTENSITY SCALE OF EARTHQAUKES

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

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 3.8** is a map showing geological and seismic information for North Carolina.

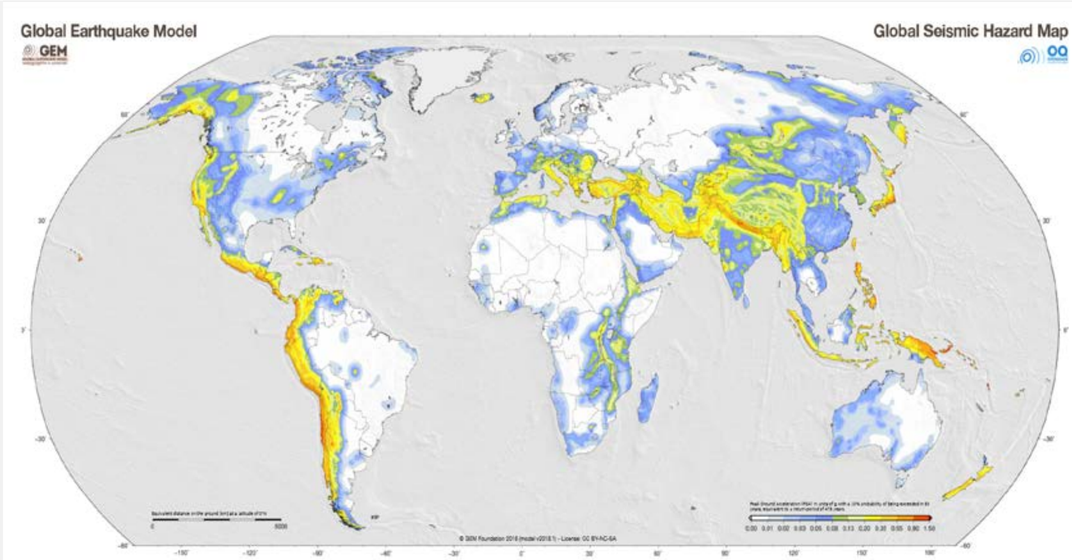
FIGURE 3.8: GEOLOGICAL AND SEISMIC INFORMATION FOR NORTH CAROLINA



Source: North Carolina Geological Survey

Figure 3.9 shows the intensity level associated with the world, 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 3.9: PEAK ACCELERATION WITH 10 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS



Source: Global Earthquake Model, 2018

Table 3.28 below provides summary information about which Western UNC campuses are potentially impacted by earthquakes. **Table 3.29** provides the PRI summary information for earthquakes for each Western UNC campus.

TABLE 3.28: CAMPUSES AT RISK TO THE EARTHQUAKE HAZARD

ASU	NCAT	UNCA	UNCC	UNCG	UNCSA	WCU	WSSU
●	●	●	●	●	●	●	●

TABLE 3.29: PRI SUMMARY FOR THE EARTHQUAKE HAZARD BY CAMPUS

Campus	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score

ASU	Possible	Minor	Moderate	Less than 6 hours	Less than 6 hours	2.3
NCAT	Possible	Minor	Moderate	Less than 6 hours	Less than 6 hours	2.3
UNCA	Possible	Minor	Moderate	Less than 6 hours	Less than 6 hours	2.3
UNCC	Possible	Minor	Moderate	Less than 6 hours	Less than 6 hours	2.3
UNCG	Possible	Minor	Moderate	Less than 6 hours	Less than 6 hours	2.4
UNCSA	Possible	Minor	Moderate	Less than 6 hours	Less than 6 hours	2.3
WCU	Possible	Minor	Moderate	Less than 6 hours	Less than 6 hours	2.3
WSSU	Possible	Minor	Moderate	Less than 6 hours	Less than 6 hours	2.3

Climate Change

Scientists are beginning to believe there may be a connection between climate change and earthquakes. Changing ice caps and sea-level redistribute weight over fault lines, which could potentially have an influence on earthquake occurrences. However, currently no studies quantify the relationship to a high level of detail, so recent earthquakes should not be linked with climate change. While not conclusive, early research suggest that more intense earthquakes and tsunamis may eventually be added to the adverse consequences that are caused by climate change.

TABLE 3.30: EARTHQUAKE HAZARD CONSEQUENCE ANALYSIS

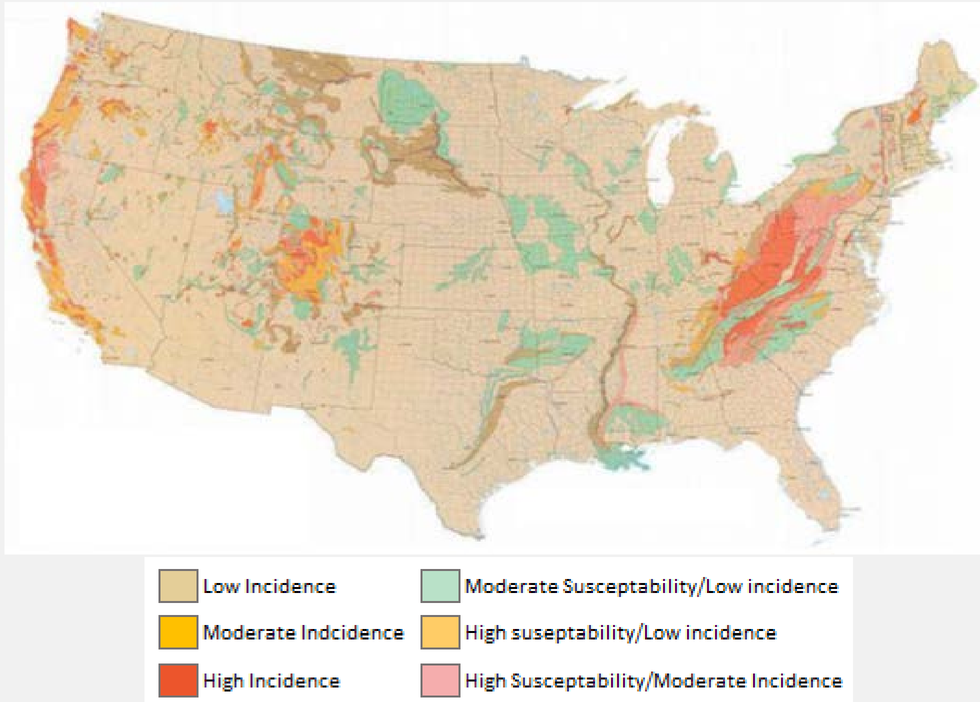
Category	Consequences
Public	Earthquakes in North Carolina generally are not high impact events that cause injury or death as most are moderate in terms of impacts. The public typically experiences some shaking in these events and the greatest threat to health and well-being is often from objects falling, from shelves or off walls. The western and southeastern parts of the state are where people are most likely to be impacted by an earthquake, but even in these cases, a major disaster would be unlikely. Therefore, public confidence would likely not be affected in the event of an earthquake.
Responders	There would be little impact on responders in the event of an earthquake, because North Carolina is only likely to experience a moderate earthquake magnitude. Since there would be minimal damage to structures and infrastructure, responders would likely not be impacted in their ability to respond to an earthquake. If there were any major collapses of buildings or infrastructure however, responders will need to take care when accessing these structures in case they have become structurally unstable and unsafe. It should also be noted that because earthquakes can knock items such as candles off shelves or damage gas lines, fires are possible directly after an event. This may cause additional emergency calls for responders and create a burden on response operations.
Continuity of Operations (including	During and after an earthquake, continuity of operations could relatively easily be maintained and there would likely be little disruption to services or operations during an event, especially at the state level. The most likely impact

Continued Delivery of Services)	may be downed communication networks which could cause interruptions to normal operations.
Property, Facilities and Infrastructure	Ground shaking is the primary cause of damage to the built environment during an earthquake. There are three important variables that determine the amount of damage: the intensity of the earthquake, local soil characteristics, and the quality of the impacted structures. The amount of damage caused by an earthquake is strongly influenced by soil characteristics. The velocity at which the rock or soil transmits shear waves is the main contributor to ground shaking. Shaking is increased by soft, thick, or wet soil types. Certain building types are particularly vulnerable to earthquake damage: wood-frame multi-unit buildings, single-family homes, mobile homes, and unreinforced masonry buildings. The most susceptible structures are wood-frame, multi-story, mixed-use buildings that have large openings on the first floor for garages or commercial space and housing on the upper floors. During an earthquake, these types of structures could sway or even collapse. Single-family homes built prior to the 1970s are often not bolted to their foundations, and walls surrounding crawl spaces are not braced (i.e., cripple walls). Typical earthquake damage to these structures include cracked foundations, chimneys breaking at the roof line, wood frames coming off their foundations, and racking of cripple walls. Mobile homes that are built of light-weight metal or a combination of steel frame and wood are easily damaged by a quake. Mobile homes installed prior to 1995 were often not attached to their foundations and could shift off their supports. The last type of susceptible building material is unreinforced masonry—masonry walls that have not been reinforced with steel. These buildings were often built before 1960 in an era when reinforcing was not generally used, anchorage to floors and roofs was missing, and use of low-strength lime mortar was common. Earthquake damage to these buildings can be severe. A lack of reinforcement and tie-downs can result in substantial damage in the form of cracked or leaning walls. Damage may also occur between the walls, and separation between the framing and walls could lead to full collapse due to a lack of vertical support. Critical Infrastructure There are a handful of key resource categories that could be impacted by an earthquake including transportation systems, communication systems, and utility systems. Historically, the state has not been impacted by an earthquake with more than a moderate intensity so damage to these resources would be very minor; however, an inspection of certain features after a strongly felt earthquake may be necessary.
Environment	There would be very minor impacts to the environment following a significant earthquake that is felt in North Carolina with a moderate intensity. Secondary effects from the damage of key resources mentioned above (e.g. utility systems) could impact the environment, but the probability of this type of situation is very small. For instance, a ruptured pipeline could release dangerous materials that could damage the surrounding environment, but the likelihood of an earthquake causing this in North Carolina is relatively low.
Economic Condition of the Jurisdiction	There are several sources of economic loss typically associated with an earthquake including property damage and business interruption costs; cost to repair public transportation, communication, or utility systems; and debris removal costs. Historically, there have been relatively minor economic losses

		from earthquakes in the state that have not already been described under the impacts to the built environment above.
	Public Confidence in the Jurisdiction’s Governance	Ability to respond and recover may be questioned and challenged if response, and recovery are not timely and effective.

Expansive Soils	Soils that will exhibit some degree of volume change with variations in moisture conditions. The most important properties affecting degree of volume change in a soil are clay mineralogy and the aqueous environment. Expansive soils will exhibit expansion caused by the intake of water and, conversely, will exhibit contraction when moisture is removed by drying. Generally speaking, they often appear sticky when wet, and are characterized by surface cracks when dry. Expansive soils become a problem when structures are built upon them without taking proper design precautions into account with regard to soil type. Cracking in walls and floors can be minor, or can be severe enough for the home to be structurally unsafe. None of the UNC Western Campuses are located in an area where expansive soils are a concern. Therefore, expansive soils will not be included in the hazard profiles or vulnerability assessment.
Landslides (included in Geological)	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. 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. 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. **Figure 3.10** delineates areas where large numbers of landslides have occurred and areas that are susceptible to land sliding in the conterminous United States.

FIGURE 3.10: LANDSLIDE OVERVIEW MAP OF THE UNITED STATES



Source: USGS

Table 3.31 below provides summary information about which Western UNC campuses are potentially impacted by geological hazards. Table 3.32 provides the PRI summary information for geological hazards for each Western UNC campus.

TABLE 3.31: CAMPUSES AT RISK TO GEOLOGICAL HAZARDS

ASU	NCAT	UNCA	UNCC	UNCG	UNCSA	WCU	WSSU
●	●	●	●	●	●	●	●

TABLE 3.32: PRI SUMMARY FOR GEOLOGICAL HAZARDS BY CAMPUS

Campus	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score

ASU	Possible	Limited	Small	Less than 6 hours	Less than 6 hours	2.3
NCAT	Possible	Limited	Small	Less than 6 hours	Less than 6 hours	2.3
UNCA	Likely	Limited	Small	Less than 6 hours	Less than 6 hours	2.6
UNCC	Possible	Limited	Small	Less than 6 hours	Less than 6 hours	2.3
UNCG	Possible	Limited	Small	Less than 6 hours	Less than 6 hours	2.5
UNCSA	Possible	Limited	Small	Less than 6 hours	Less than 6 hours	2.1
WCU	Possible	Limited	Small	Less than 6 hours	Less than 6 hours	2.3
WSSU	Possible	Limited	Small	Less than 6 hours	Less than 6 hours	2.1

Climate Change

Per the Fourth National Climate Assessment, frequency and intensity of heavy precipitation events is expected to increase across the country. Additionally, increases in precipitation totals are expected in the Southeast. Increased flooding may also result from more intense tropical cyclone; researchers have noted the occurrence of more intense storms bringing greater rainfall totals, a trend that is expected to continue as ocean and air temperatures rise. More rainfall falling in more intense incidents could contribute to an increase in landslide events.

Direct effects from global warming and climate change such as an increase in droughts, floods and hurricanes could contribute to an increase in sinkholes. Climate change raises the likelihood of extreme weather, meaning the torrential rain and flooding conditions which often lead to the exposure of sinkholes are likely to become increasingly common. Certain events such as a hurricane following a period of drought can trigger a sinkhole due to low levels of groundwater combined with a heavy influx of rain. Therefore, an increase in the occurrence of sinkholes in the future is possible.

TABLE 3.33: GEOLOGICAL HAZARDS CONSEQUENCE ANALYSIS

Category	Consequences
Public	Geological hazards such as landslides/rock falls and sinkholes can pose a threat to human life and safety, as these events often occur with very little warning time due to a lack of available data on risk. Landslides/rock falls are especially a risk in the more mountainous western part of the state where several fatalities have been caused by in this region historically. The quick and unexpected slide of rocks, dirt, and other debris is extremely dangerous and can cover and destroy homes, thereby causing injuries and death. Sinkholes are a much larger risk in the eastern part of the state where soils are more conducive to this type of activity. Similar to landslides/rock falls, these events are often unexpected as they can develop from underneath the ground and suddenly cause a collapse of soil at the surface level, causing loss of life or injury. Any event that can cause loss of life could potentially have an impact on public confidence, however, since these events are often geographically confined to a small area and do not have wide-ranging impacts on large

	segments of the population, public confidence is typically not affected to a great degree.
Responders	In most cases, responders are not directly impacted by geological events to any greater degree than the public. However, it should be noted that responders should generally be wary when responding to a geological event because of the risk of secondary events (additional landslides/rock falls or sinkholes). When the ground has been disrupted by one of these events, it could set the stage for additional events and any disruption to the soil by responders during their response may further exacerbate those conditions. Additionally, responders working on site of a geological event may find that the uneven terrain provides an extra challenge in terms of operating normally and carrying out life-saving tactics.
Continuity of Operations (including Continued Delivery of Services)	Continuity of operations during a geological event is unlikely to be interrupted in any major way. As mentioned previously, geological events tend to be confined to small areas and so it is unlikely that operations centers would be impacted. If they are, it should not prove too much of a challenge to move operations to a backup facility and continue normal operations from there.
Property, Facilities and Infrastructure	Impacts on the built environment are probably the greatest effect of geological events. During both landslide/rock fall and sinkhole events, people's homes and/or businesses may be impacted and most typical insurance policies in the state do not cover these kinds of events so homeowners may suffer total losses to their homes. Even when these events do not cause complete destruction of homes, they can frequently damage foundations of structures and make them unsafe for dwelling. Similarly, landslides/rock falls and sinkholes that occur around major infrastructure such as roadways and other utilities can cause severe damage to key facilities. In western North Carolina, landslides/rock falls have occurred a number of times along major highways such as I-40 and caused local and state officials to have to shut down these roadways until equipment can be brought in to remove the large boulders and return the road to normal conditions. Similarly, sinkholes in the eastern part of the state have caused breaks in roadways, making them unsafe for driving. In many locations across the state, sinkholes have shut down primary roadways for weeks while the issues were addressed and roads were rebuilt. At times the cause of these sinkholes are man-made as leaking or faulty water/wastewater infrastructure can create the same conditions that cause sinkholes to form naturally.
Environment	In general, the environment would be unaffected by a geological event. Some of the minor impacts that might be expected are damage to trees and habitats from falling rocks/debris or from other types of damage to the soil/ground. In past events, large swaths of mountainside have been torn away creating large dead areas where plant life is ripped away. These impacts would be generally confined to a small area and therefore would not have sweeping implications for the ecosystems overall. It is also possible that debris or structural materials could end up in streams or rivers as a result of the event and cause damage to localized populations in these habitats.
Economic Condition of the Jurisdiction	Although geological events could impact local businesses and therefore affect the economy, this would likely have very minor effects overall. The greatest impact to the economy from an economic standpoint would be related to the impacts on infrastructure such as roadways. When these are shut down for long periods of time, local economies can be dramatically affected, especially

	in more rural areas. If traffic has to be re-routed around these areas due to road closures for weeks or even just days, losses in revenue could be significant and have a negative impact on business owners. Both landslides/rock falls and sinkholes have the capacity to cause this level of shutdown as has been the case during a number of past events in the state.
Public Confidence in the Jurisdiction's Governance	Landslides and sinkholes in the planning area are unlikely to be severe and would not be expected to affect public confidence.

Erosion (included in Geological)

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

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

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

Climate can affect the amount of runoff, especially the frequency, intensity, and duration of rainfall and storms. When rainstorms are frequent, intense, or of long duration, erosion risks are high. Seasonal changes in temperature and rainfall amounts define the period of highest erosion risk of the year.

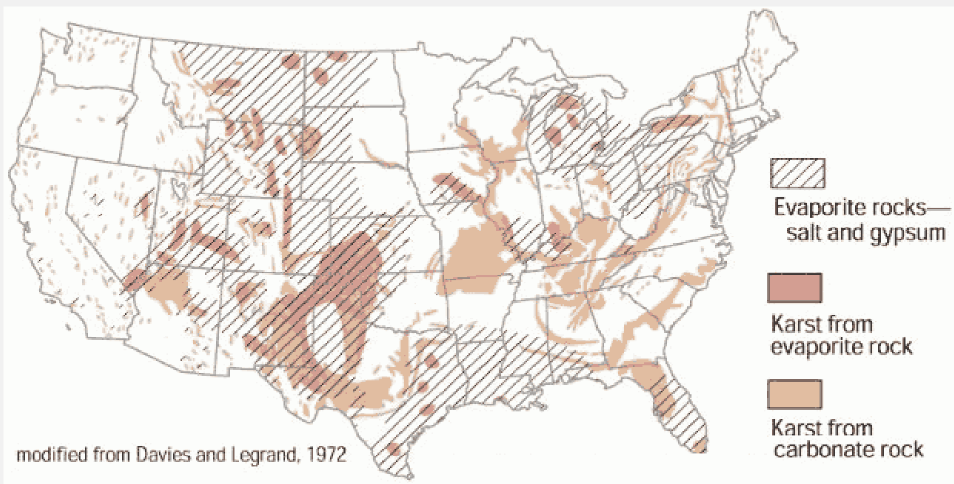
During the past 20 years, the importance of erosion control has gained the increased attention of the public. Implementation of erosion control measures consistent with sound agricultural and construction operations is needed to minimize the adverse effects associated with harmful chemicals run-off due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

Climate Change

Expected increases in rainfall as a result of climate change could lead to increased erosion.

Sinkholes (included in Geological)

A sinkhole is an area of ground that has no natural external surface drainage--when it rains, 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 more than 100 feet deep. Some are shaped like shallow bowls or saucers whereas others have vertical walls; some hold water and form natural ponds. Typically, sinkholes form so slowly that little change is noticeable, but they can form suddenly when a collapse

	occurs. 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. **Figure 3.11** 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 3.11: UNITED STATES GEOLOGICAL SURVEY OF KARST MODIFIED FROM DAVIES AND LEGRAND, 1972**  **Climate Change** Similar to landslides, sinkholes can be triggered by heavy rains and flooding. An increase in the number and intensity of severe storms, and resulting heavy rains and flooding, may also result in sinkholes developing more frequently.
Land Subsidence	The gradual settling or sudden sinking of the Earth's surface due to the subsurface movement of earth materials. Causes of land subsidence include groundwater pumpage, aquifer system compaction, drainage of organic soils, underground mining, hydro compaction, natural compaction, sinkholes, and thawing permafrost. Land subsidence does not pose a risk to any of the UNC Western campuses and is therefore not included in the hazard profiles or vulnerability assessment.

Tsunami

A series of waves generated by an undersea disturbance such as an earthquake. The speed of a tsunami traveling away from its source can range from up to 500 miles per hour in deep water to approximately 20 to 30 miles per hour in shallower areas near coastlines. Tsunamis differ from regular ocean waves in that their currents travel from the water surface all the way down to the sea floor. Wave amplitudes in deep water are typically less than one meter; they are often barely detectable to the human eye. However, as they approach shore, they slow in shallower water, basically causing the waves from behind to effectively "pile up", and wave heights to increase dramatically. As opposed to typical waves which crash at the shoreline, tsunamis bring with them a continuously flowing 'wall of water' with the potential to cause devastating damage in coastal areas located immediately along the shore.

Tsunamis do not pose a risk to any of the UNC Western campuses and is therefore not included in the hazard profiles or vulnerability assessment.

Volcano

A mountain that opens downward to a reservoir of molten rock below the surface of the earth. While most mountains are created by forces pushing up the earth from below, volcanoes are different in that they are built up over time by an accumulation of their own eruptive products: lava, ash flows, and airborne ash and dust. Volcanoes erupt when pressure from gases and the molten rock beneath becomes strong enough to cause an explosion.

Volcanoes do not pose a risk to any of the UNC Western campuses and is therefore not included in the hazard profiles or vulnerability assessment.

Dam Failure

Dam failure is the collapse, breach, or other failure of a dam structure resulting in downstream flooding. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and severe property damage if development exists downstream of the dam. Dam failure can result from natural events, human-induced events, or a combination of the two. The most common cause of dam failure is prolonged rainfall that produces flooding. Failures due to other natural events such as hurricanes, earthquakes or landslides are significant because there is generally little or no advance warning.

The North Carolina Division of Energy, Mineral, and 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 3.34** explains these classifications.

TABLE 3.34: 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

Table 3.35 below provides summary information about which Western UNC campuses are potentially impacted by dam failures. Table 3.36 provides the PRI summary information for dam failures for each Western UNC campus.

TABLE 3.35: CAMPUSES AT RISK TO THE DAM FAILURE HAZARD

ASU	NCAT	UNCA	UNCC	UNCG	UNCSA	WCU	WSSU
●	●		●	●	●	●	●

TABLE 3.36: PRI SUMMARY FOR THE DAM FAILURE HAZARD BY CAMPUS

Campus	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
ASU	Unlikely	Critical	Moderate	More than 24 hours	Less than 6 hours	2.0
NCAT	Unlikely	Critical	Moderate	More than 24 hours	Less than 6 hours	2
UNCA	Unlikely	Critical	Moderate	More than 24 hours	Less than 6 hours	2
UNCC	Unlikely	Critical	Moderate	More than 24 hours	Less than 6 hours	2.0
UNCG	Unlikely	Minor	Small	Less than 6 hours	Less than 24 hours	2
UNCSA	Unlikely	Critical	Moderate	More than 24 hours	Less than 6 hours	2
WCU	Unlikely	Critical	Moderate	More than 24 hours	Less than 6 hours	2.0
WSSU	Unlikely	Critical	Moderate	More than 24 hours	Less than 6 hours	2

Climate Change

Studies have been conducted to investigate the impact of climate change scenarios on dam safety. Climate change impacts on dam failure will most likely be those related to changes in precipitation and flood likelihood. Climate change projections suggest that precipitation may increase and occur in more extreme events, which may increase risk of flooding, putting stress on dams and increasing likelihood of dam failure. The safety of dams for the future climate can be based on an evaluation of changes in design floods and the freeboard available to accommodate an increase in flood levels. The results from the studies indicate that the design floods with the corresponding outflow floods and flood water levels will increase in the future, and this increase will affect the safety of the dams in the future. Studies concluded that the total hydrological failure probability of a dam will increase in the future climate and that the extent and depth of flood waters will increase by the future dam break scenario.

TABLE 3.37: DAM FAILURE HAZARD CONSEQUENCE ANALYSIS

Category	Consequences
Public	Many of the impacts associated with a dam/levee failure are the same as those that would be associated with a flood event. However, the primary difference for members of the public in the case of a dam/levee failure is that often citizens who might be impacted by a dam/levee failure may believe themselves to be protected from flood events as a result of the dam/levee and therefore, may not be anticipating the event. This may have a severe impact on public confidence in the long run as citizens may view this as a failure of government institutions to properly regulate and control the dam/levee. That is to say, they may ultimately view the incident as preventable, unlike a flood that occurs purely from natural causes.
Responders	Similar to the issues associated with the flood hazard, responders would be impacted by a dam/levee failure as they may be forced to attempt to assist citizens who have become trapped in their homes or in flood waters. Responders may have difficulty accessing homes or other structures where they need to provide support and their lives and well-being will likely be put at risk if they are forced to assist in a flooded area.
Continuity of Operations (including Continued Delivery of Services)	A dam/levee failure would be unlikely to impact continuity of operations as the event would likely be confined to a specific area directly surrounding the dam/levee and most operations-related facilities in the state are not at risk of being impacted by a dam/levee failure.
Property, Facilities and Infrastructure	A dam/levee failure may impact any properties located downstream of a dam/levee, especially any that are within identified inundation zones. The effects of a dam/levee failure on property, facilities, and infrastructure would be similar to those that have been outlined in the flood analysis although it is possible that the damage may be more severe, as high volumes of water are released all at once rather than over time. For example, during Hurricane Matthew a number of homes were damaged by dam breaks that were caused by massive rainfall in the state. Many of these dam breaks were at private dams and were the result of uncoordinated releases among operators along the river systems. In this scenario, when one dam failed, it caused a rush of water that impacted the downstream dams and resulted in similar failures and flooding of buildings.
Environment	The impacts on the environment from a dam/levee failure might be that ecosystems and habitats that existed while a dam was in place on a stream/river could be destroyed as floodwaters destabilize areas by inundating places that had not previously been under water or causing higher flow rates downstream. Similar to flood events, if a facility that houses hazardous materials is impacted by flooding from a dam/levee failure, there may be contamination of the stream/river and ultimately the water supply. Although the dam failure itself would likely disrupt habitats in the short term, in some sense, a dam failure may restore the environment to a more natural state by allowing the river to return to its natural course

	and flow. That is to say, the absence of a dam/levee may be a long-term boon to the local environment.
Economic Condition of the Jurisdiction	The economic costs of a dam/levee failure could be significant as there will likely be a high economic cost for the owner of the structure (whether it be a privately or publicly-owned) to rebuild or reconstruct the dam/levee. If a dam/levee fails, the owner may also need to rebuild the new structure to a higher standard to prevent future failures. If the dam was involved in electricity production as is the case for many dams in the state (Lake Jocassee Dam, Fontana Dam, High Rock Lake Dam), the failure will result in a loss of revenue for the owner, which could impact local utilities and may also result in temporary power outages (although most communities do not rely solely on hydroelectric power, so this is less likely). Many of these dams/levees are also used to create recreational lakes (Kerr Lake, Lake Gaston, Lake Norman) and when this type of dam fails, that recreational resource will be lost, which in turn may reduce tourism and visitors to the area and reduce property values in and around the lake.
Public Confidence in the Jurisdiction’s Governance	Localized impact expected to primarily adversely affect only the dam owner and local entities. A catastrophic failure could result in more widespread loss of public confidence.

Flooding

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 1990. Nearly 90 percent of presidential disaster declarations result from natural events where flooding was a major component.

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.

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.

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.

Floodplain boundaries are designated and routinely updated through Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) reports and these revisions are then shown on Flood Insurance Rate Maps (FIRMs), according to various flood hazard zones. Flood hazard zone designations will depend upon local conditions and the date when the map was issued, but all will show the 100-year or base floodplain (1-percent annual chance), as well as areas of the 500-year floodplain (0.2-percent annual chance). Individual campuses are not required to maintain NFIP Flood Insurance as North Carolina is a self-insuring state. All state-owned facilities are covered by the NC General Assembly.

Table **3.38** below provides summary information about which Western UNC campuses are potentially impacted by flooding. Table **3.39** provides the PRI summary information for flooding for each Western UNC campus.

TABLE 3.38: CAMPUSES AT RISK TO THE FLOOD HAZARD

ASU	NCAT	UNCA	UNCC	UNCG	UNCSA	WCU	WSSU
●	●	●	●	●	●	●	●

TABLE 3.39: PRI SUMMARY FOR THE FLOOD HAZARD BY CAMPUS

Campus	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
ASU	Likely	Limited	Moderate	6 to 12 hours	Less than 24 hours	2.6
NCAT	Likely	Limited	Moderate	6 to 12 hours	Less than 24 hours	2.6
UNCA	Likely	Limited	Moderate	6 to 12 hours	Less than 24 hours	2.6
UNCC	Likely	Limited	Moderate	6 to 12 hours	Less than 24 hours	2.6
UNCG	Likely	Limited	Small	6 to 12 hours	Less than one week	2.8
UNCSA	Likely	Limited	Moderate	6 to 12 hours	Less than 24 hours	2.6
WCU	Likely	Limited	Moderate	6 to 12 hours	Less than 24 hours	2.6
WSSU	Likely	Limited	Moderate	6 to 12 hours	Less than 24 hours	2.6

Climate Change

Per the Fourth National Climate Assessment, frequency and intensity of heavy precipitation events is expected to increase across the country. More specifically, it is “very likely” (90-100% probability) that most areas of the United States will exhibit an increase of at least 5% in the maximum 5-day precipitation by late 21st century. Additionally, increases in precipitation totals are expected in the Southeast. The mean change in the annual number of days with rainfall over 1 inch for the Southeastern United States is 0.5 to 1.5 days. Therefore, with more rainfall falling in more intense incidents, the planning area may experience more frequent flash flooding. Increased flooding may also result from more intense tropical cyclone; researchers have noted the occurrence of more intense storms bringing greater rainfall totals, a trend that is expected to continue as ocean and air temperatures rise.

TABLE 3.40: FLOODING HAZARD CONSEQUENCE ANALYSIS

Category	Consequences
Public	During flood events, people are often stranded and have to be rescued by first responders. Often lives are lost or people are injured. Even when injuries and fatalities are avoided, the impact on the public can be great as

	many people will be forced into shelters or will need to find temporary lodging as they wait for flooding to recede. They may be unable to return to their homes if the damage is great and may find their homes uninhabitable if personal property has become waterlogged and is unusable. Another major impact on the public can be the deteriorating health conditions that result from flooding. After floodwaters recede, homes and personal property that were covered in water may begin to become infested with mold which can create serious health risks. Additionally, waterborne diseases can be pervasive in areas impacted by flooded sewer and water systems. Mosquitoes and other carriers of illnesses often thrive in post-flood conditions, increasing the chances of transmitting vector-borne diseases.
Responders	Responders are often affected by flooding because floods can trap people in their homes or in other locations, forcing responders to put their lives at risk to return members of the public to safety. Often responders in flood situations face blocked roads and have difficulty safely protecting citizens. Water rescues can be some of the most dangerous as rapidly moving flood waters are difficult to navigate. Rescuers are typically at high risk to loss of life or personal injury during flood events, especially compared to other types of natural hazards.
Continuity of Operations (including Continued Delivery of Services)	Flooding can impact continuity of operations by knocking out power sources and preventing emergency management personnel from being able to do their jobs properly. Floods typically have some impact on continuity of operations as they can cause severe disruption to normal operations and have done so in the past in North Carolina in nearly every county. Operations would be most impacted at a localized level as areas that are flooded would experience the most disruption to normal operations.
Property, Facilities and Infrastructure	Many buildings and structures could be impacted by a flood event, but critical infrastructure and key resources (CIKR) within the state are especially important to identify. When these facilities are located in flood-prone areas, there is a substantial risk to important functions of government such as law enforcement and medical care. This also includes any assets, systems, and networks that are vital to the continued operation of government services such as power generation facilities, transmission infrastructure, and road networks, among others. The incapacitation or destruction of these resources would have a debilitating and costly effect on many aspects of the state's normal functionality. Often, in the case of flooding, water and wastewater infrastructure are some of the most prominently impacted. Since these types of infrastructure deal directly with water, often they are located in the most flood prone areas and are severely impacted during flood events. When these facilities or infrastructure are flooded, it complicates recovery and impacts people who are unable to utilize normal water sources for drinking, sanitation, and other everyday uses. In addition, personal property such as homes and businesses have been impacted to a large degree by past flooding events and are a major concern in future flooding events. Although a great deal of effort has been undertaken to reduce the number of properties at risk through the use of progressively improved risk assessment and mitigation techniques, there are still a significant number of structures throughout the state that are located in flood zones or which have not been properly mitigated to reduce risk. These properties may sustain billions of dollars of damage during

	future flood events and are often a major focus of post-disaster recovery efforts.
Environment	The fluctuation of water levels in a wetland, especially flood waters, supports the biological diversity of low-lying areas by releasing nutrients into the soil and germinating wetland flora. Flooding also offers some control of invasive water weeds. Most features of the environment have come to adapt to the effects of a flood event and respond quickly, although it is possible that some species may not be resilient enough to survive and will experience population loss.
Economic Condition of the Jurisdiction	There are a variety of economic impacts that could result from a large-scale flood event. One major impact is on soil that is covered by flood waters, causing the rapid depletion of oxygen, which is essential for plant growth and development. This can hurt agricultural production in areas of the state were that is a key economic driver. Secondly, flooding often causes the shutdown of businesses, many of which never re-open after a flood event. Indeed, FEMA reports that almost 40 percent of small businesses never reopen their doors after a disaster because only small amounts of flood waters can cause thousands of dollars of damage. The shutdown of these small businesses in many communities can be devastating as many small, rural communities in the state rely heavily on these small businesses as economic drivers and the base of the local economy.
Public Confidence in the Jurisdiction's Governance	Public confidence is often impacted by flood events, especially when impacted people do not have flood insurance and are not covered by their home insurance policy. This can create public relations issues for the government and a loss of public confidence.

Storm Surge	A storm surge is a large dome of water often 50 to 100 miles wide and rising anywhere from four to five feet in a Category 1 hurricane up to more than 30 feet in a Category 5 storm. Storm surge heights and associated waves are also dependent upon the shape of the offshore continental shelf (narrow or wide) and the depth of the ocean bottom (bathymetry). A narrow shelf, or one that drops steeply from the shoreline and subsequently produces deep water close to the shoreline, tends to produce a lower surge but higher and more powerful storm waves. Storm surge arrives ahead of a storm's actual landfall and the more intense the hurricane is, the sooner the surge arrives. Storm surge can be devastating to coastal regions, causing severe beach erosion and property damage along the immediate coast. Further, water rise caused by storm surge can be very rapid, posing a serious threat to those who have not yet evacuated flood-prone areas. Storm surge does not pose a risk to any of the UNC Western Campuses and is therefore not included in the hazard profiles or the vulnerability assessment.
Other Hazards	
Wildfires	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. 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.

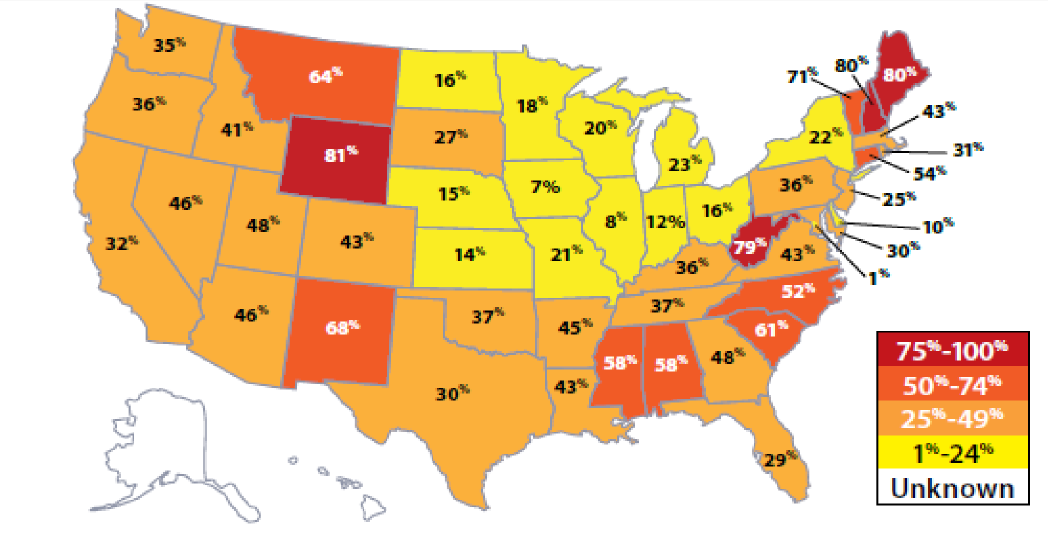
Many individual homes and cabins, subdivisions, resorts, recreational areas, organizational camps, businesses, and industries are located within high wildfire hazard areas. Furthermore, the increasing demand for outdoor recreation places more people in wildlands during holidays, weekends, and vacation 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.

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 3.12** 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 3.12: PERCENT OF TOTAL HOMES IN THE WILDLAND URBAN INTERFACE



Source: US Department of Agriculture

Table 3.41 below provides summary information about which Western UNC campuses are potentially impacted by wildfires. **Table 3.42** provides the PRI summary information for wildfires earthquakes for each Western UNC campus.

TABLE 3.41: CAMPUSES AT RISK TO THE WILDFIRE HAZARD

ASU	NCAT	UNCA	UNCC	UNCG	UNCSA	WCU	WSSU
●	●	●	●	●	●	●	●

TABLE 3.42: PRI SUMMARY FOR THE WILDFIRE HAZARD BY CAMPUS

Campus	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
ASU	Likely	Minor	Small	Less than 6 hours	Less than 1 week	2.3
NCAT	Likely	Minor	Small	Less than 6 hours	Less than 1 week	2.3
UNCA	Likely	Minor	Small	Less than 6 hours	Less than 1 week	2.3
UNCC	Likely	Limited	Small	Less than 6 hours	Less than 1 week	2.6
UNCG	Unlikely	Minor	Small	Less than 6 hours	Less than 24 hours	2
UNCSA	Likely	Minor	Small	Less than 6 hours	Less than 1 week	2.3
WCU	Likely	Limited	Small	Less than 6 hours	Less than 1 week	2.6
WSSU	Likely	Minor	Small	Less than 6 hours	Less than 1 week	2.3

Climate Change

A United States Government Accountability Office report dated September 2017 states that the Presidential budget proposal for 2017 references that the United States government has incurred direct costs of more than $350 billion because of extreme weather and fire events including:

- $205 billion for domestic disaster response and relief
- $90 billion for crop and flood insurance
- $34 billion for wildland fire management and
- $28 billion for maintenance and repairs to federal facilities and federally managed lands, infrastructure and waterways.

These costs are only expected to increase according to the U.S. Global Change Research Program that finds “impacts and costs of extreme events – such as floods, drought, and other events – will increase in significance as what are considered rare events become more common and intense because of weather extremes.”

TABLE 3.43: WILDFIRE HAZARD CONSEQUENCE ANALYSIS

Category	Consequences
Public	There are a number of potential losses from a wildland fire in North Carolina including loss of life and injury due to severe burns. Health hazards from smoke caused by wildland fires can include breathing difficulties and worsening of chronic breathing and/or cardiovascular disease. Smoke and air pollution pose a risk for children, the elderly, and those with respiratory and cardiovascular problems. Wildfire tends to create some issues with public confidence because of the very visible impacts that the fire has on the community.
Responders	Responders are often at great risk when responding to wildfire, especially firefighters who are responsible for putting out the blaze. All response personnel are potentially at risk when dealing with a wildfire, as changing winds and a number of other factors can often cause a fire to spread rapidly. Although many areas of the state are urbanized and are not at a high risk to wildfire, moderately-developed rural areas that are located in the wildland urban interface may require response personnel to be ready to act. Like the general public, first responders are also at risk for exposure to dangers from the initial incident and after-effects such as smoke inhalation and/or heat stroke. However, their risk is often more prominent as they are often in the middle of an incident through their responsibilities as a responder.
Continuity of Operations (including Continued Delivery of Services)	Since wildfire often moves quickly and can affect infrastructure that is important to maintaining continuity of operations, there is some level of concern for maintaining continuity. However, operations at the state level, which are generally run from urbanized areas, will probably not be impacted in a major way. Local continuity of operations in rural areas is much more susceptible to the impacts of a wildfire.

Property, Facilities and Infrastructure	Wildland fires have the potential to substantially burn forested areas as well as private residences. Damage and destruction to state, county, private, and municipal structures and facilities are major losses that are attributed to wildland fires. Private residences and communities that are located within the Wildland Urban Interface (WUI) are particularly susceptible to the threat. Population increases in North Carolina's WUI areas, for example, can create significant challenges for firefighters and residents. This is especially notable considering a study in 2000 showed that North Carolina ranked number one in terms of the amount of land area located within the WUI zones and fifth in number of homes located within the WUI.8 Many new homes are constructed without considering community wildland fire planning. This creates neighborhoods with limited accessibility, flammable building construction, and landscaping. A lack of firewise planning can also greatly increase the probability of a wildland fire occurrence with more homes and emergency personnel being threatened. All types of private property may suffer losses from wildfires. This includes business properties, homes, vehicles, and livestock. Damage to capital goods and equipment as well as evacuation expenses and other losses are directly related to fire and smoke damage. Additional potential losses include building and landscape maintenance expenses, firefighting equipment purchases, and fire-related business closures. Additional post-fire losses include cleanup, rehabilitation and repair expenses, equipment and capital goods replacement, drinking water pollution, smoke damage, deflated real estate values, and an increase in fire insurance premiums.
Environment	Wildland fires have the potential to damage or destroy forage on grazing lands, secondary forest products destruction, and/or degradation and loss of wildlife habitat on public lands. On private lands, vegetation losses could include agricultural crops that are either burned or impacted by wildland fire smoke. Indirect losses could include loss of growing stock as well as irrigation systems. Another potential loss includes damage and destruction to a wide variety of common or protected habitats in the state. Finally, the release of smoke from wildfires can pollute the air and reduce air quality. It should also be noted, however, that wildfires are a naturally occurring element of the environment and have played an important part in the development of many ecosystems in that they are regenerative and provide vital nutrients for the soil which can help sustain a forest habitat and all of the organisms living within it. Therefore, although there are some negative impacts of wildfire, there are also some positive impacts on the environment.
Economic Condition of the Jurisdiction	Given the fact that a number of homes, businesses, and infrastructure are located in areas that could be impacted by wildfire, there could be some significant economic impacts of a wildfire in the state. If homes or businesses are burned, the cost of rebuilding could be substantial. Impacts to agricultural crops are another economic loss that the state could face in the event of a wildland fire. Wildfires can be particularly damaging to the lumber and Christmas tree farming industries which are important to the state.
Public Confidence in the Jurisdiction's Governance	Wildfire events may cause issues with public confidence because they have very visible impacts on the community. Public confidence in the jurisdiction's governance may be influenced by actions taken pre-disaster to mitigate and prepare for impacts, including the amount of public education provided; efforts to provide warning to residents; response actions; and speed and effectiveness of recovery.

Hazardous Substances

Hazardous Substances 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.

Table 3.44 below provides summary information about which Western UNC campuses are potentially impacted by hazardous substances. **Table 3.45** provides the PRI summary information for hazardous substances for each Western UNC campus.

TABLE 3.44: CAMPUSES AT RISK TO THE HAZARDOUS SUBSTANCES HAZARD

ASU	NCAT	UNCA	UNCC	UNCG	UNCSA	WCU	WSSU
●	●	●	●	●	●	●	●

TABLE 3.45: PRI SUMMARY FOR THE HAZARDOUS SUBSTANCES HAZARD BY CAMPUS

Campus	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
ASU	Unlikely	Limited	Small	Less than 6 hours	Less than 24 hours	1.9
NCAT	Unlikely	Limited	Small	Less than 6 hours	Less than 24 hours	1.9
UNCA	Unlikely	Limited	Small	Less than 6 hours	Less than 24 hours	1.9
UNCC	Possible	Limited	Small	Less than 6 hours	Less than 24 hours	2.2
UNCG	Likely	Limited	Small	Less than 6 hours	Less than 24 hours	2.9
UNCSA	Unlikely	Limited	Small	Less than 6 hours	Less than 24 hours	1.9
WCU	Possible	Limited	Small	Less than 6 hours	Less than 24 hours	2.2
WSSU	Unlikely	Limited	Small	Less than 6 hours	Less than 24 hours	1.9

Climate Change

Some HAZMAT emergencies may be triggered by natural disasters and changing climatic conditions may cause more extreme weather events. Furthermore, as North Carolina's population continues to grow, more people become increasingly vulnerable to incidents involving hazardous substances. Therefore, it is important to critically monitor all hazardous fixed facilities and transportation routes and continue to attempt to prevent future incidents from occurring through continued preparedness, monitoring and training.

TABLE 3.46: HAZARDOUS SUBSTANCES CONSEQUENCE ANALYSIS

Category	Consequences
Public	The accidental or intentional release of a hazardous substance could have both immediate and long-lasting effects on the health of the public. Any release needs to be quickly identified and the proper response guidelines followed to reduce the possible impact on the public. Evacuation is always a consideration when dealing with harmful substances. The public should be aware that hazards exist from the presence of hazardous substances and should take preparedness actions at home and in the workplace to act should a release of substances occur. Hazardous substances can have a significant effect on public confidence in government as incidents often cause serious harm to people via long-term health impacts, contamination of soil or drinking water, and even death. Because of the dangers associated with many hazardous substances and the level of control that humans have over hazardous substance incidents compared to natural hazards, public confidence could be damaged severely in the event of an incident.
Responders	First responders must be vigilant when hazardous substances are suspected to be involved. The proper protective apparel must be worn and protocols must be followed to ensure that contaminated individuals and objects go through appropriate decontamination procedures prior to being moved away from the incident, regardless of the situation. Contamination of other responders or citizens must be avoided. The appropriate personnel, such as Hazardous Materials teams, must be notified to ensure that the proper measures are taken to prevent further harm.
Continuity of Operations (including Continued Delivery of Services)	During a hazardous substance incident, normal operations are likely to be maintained with only moderate stress on daily operations. In the event of a larger scale hazardous substance spill, there could be some loss of continuity of operations as a result of strain on personnel and equipment, but typically this will not be the case.
Property, Facilities and Infrastructure	Hazardous Materials Facilities A hazardous substance event is most likely to take place where the substance is created or stored. Hazardous materials facilities have their own highly-trained personnel for handling and cleaning up the particular substances stored onsite. The facility's plans are highly specific to the substances stored there, thus providing for effective responses to incidents that involve these substances. Some facilities contain hazardous substances that can spread or leak quickly, or are held in extremely dangerous concentrations. There can still be significant effects on workers and others in close proximity despite having good planning in place. These facilities are inventoried in the state through Tier II reporting and there have been some major incidents in the state historically. Utilities Natural gas distribution lines can be problematic with some hazardous substances if contact is made with the natural gas supply. Most of the natural gas infrastructure is located underground, making exposure highly unlikely. However, natural gas itself can be the hazardous substance involved in the incident. One example of how this may occur is if a utility, work crew, or citizen strikes a gas line causing a leak. Degradation of the line may also be

	the cause of a release. A gas leak would cause an immediate threat and explosions and fires would be significant concerns for the immediate vicinity. Transportation Systems Hazardous substances can have an impact on interstate transportation if a release occurs on or in the vicinity of the roadway which may be the case if a truck or other vehicle carrying hazardous materials is involved in a traffic accident. Significant traffic disruptions may occur, slowing commerce or forcing alternative routing and further congestion of other areas. Similarly, rail lines are one of the more prominent places that hazardous substances are transported. A hazardous substance event on the rail system can impact rail traffic and the overall system. Cleanup efforts wherever the event occurred could be costly and go on for extended periods, shutting down that part of the rail system for that time. Critical Facilities Hospitals utilize and store some hazardous substances on site. Biological materials and radioactive wastes are the primary concerns in a hospital setting. Plans are in place to manage these concerns in both routine and emergency situations. An external hazardous substance event that occurs near the hospital or directly impacts a hospital could create service disruptions such as patient care. A large event may also create a high demand on hospital services and cause an overload on resources. Similarly, some emergency services facilities such as emergency shelters may be opened if homes have been exposed to hazardous substances and evacuations occur. Other Structures Commercial, industrial, and residential buildings all may have hazardous substances contained within them that are not reported through the Tier II reporting system but which could still present a smaller scale hazard. Proper containers and labeling can prevent inappropriate use, but accidents can still cause workers to be exposed. Cleaning products, fertilizers, and pesticides are common examples of supplies that are considered hazardous substances and which could cause a smaller incident.
Environment	The environmental impact is highly dependent on the location and the severity of the event. Some of the substances involved in these incidents can be cleaned up or do not have lasting impacts on the areas affected. Others may cause crops and other vegetation to be destroyed, sometimes beyond the ability to grow back and animal populations may become displaced or killed. Some areas may be deemed uninhabitable or not fit for development. Water sources may also be impacted by hazardous substance releases or spills, which can affect fish, animal, and plant populations as well as humans that come in contact with contaminated water. The threat to water sources is perhaps the greatest potential threat of a hazardous substance spill on the environment. Water can rapidly transport the substance great distances and expand the scope of the incident. This can make it difficult to respond to the incident and cause serious health impacts.
Economic Condition of the Jurisdiction	The economic impact of a hazardous substance related incident can be significant locally. Affected commerce is the greatest concern, as spills and releases can force businesses such as shopping centers, markets, and financial centers to be shut down for indeterminate periods of time. Contaminated water can be especially problematic as it can cause extensive shutdowns and put many people in danger. The overall costs depend on the substance(s) involved, how much is released, the processes and time used to

		manage the spill or release, who or what is contaminated, whether a fire takes place, etc. Cleanup can be a less significant cost and is typically handled by the party responsible for the spill or release.
	Public Confidence in the Jurisdiction's Governance	A hazardous materials incident may affect public confidence if the environmental or health impacts are enduring.

Infectious Disease

Infectious diseases are caused by pathogenic microorganisms, such as bacteria, viruses, parasites or fungi; the diseases can be spread, directly or indirectly, from one person to another. Zoonotic diseases are infectious diseases of animals that can cause disease when transmitted to humans. The ongoing COVID-19 pandemic is an example of an infectious disease outbreak.

Table 3.47 below provides summary information about which Western UNC campuses are potentially impacted by infectious disease. **Table 3.48** provides the PRI summary information for infectious disease for each Western UNC campus.

TABLE 3.47: CAMPUSES AT RISK TO THE INFECTIOUS DISEASE HAZARD

ASU	NCAT	UNCA	UNCC	UNCG	UNCSA	WCU	WSSU
●	●	●	●	●	●	●	●

TABLE 3.48: PRI SUMMARY FOR THE INFECTIOUS DISEASE HAZARD BY CAMPUS

Campus	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
ASU	Unlikely	Minor	Small	More than 24 hours	More than 1 week	1.6
NCAT	Possible	Critical	Negligible	Less than 6 hours	Less than 1 week	2.4
UNCA	Unlikely	Minor	Small	More than 24 hours	More than 1 week	1.6
UNCC	Unlikely	Minor	Small	More than 24 hours	More than 1 week	1.6
UNCG	Possible	Critical	Moderate	6 to 12 hours	More than 1 week	3.1
UNCSA	Unlikely	Minor	Small	More than 24 hours	More than one week	1.6
WCU	Unlikely	Minor	Small	More than 24 hours	More than 1 week	1.6
WSSU	Unlikely	Minor	Small	More than 24 hours	More than one week	1.6

Climate Change

According to the U.S. Global Change Research Program, the influences of climate change on public health is significant and varied. The influences range from the clear threats of temperature extremes and severe storms to less obvious connections related to insects. Climate and weather can also affect water and food quality in particular areas, with implications for public health.

Higher temperatures and wetter conditions tend to increase mosquito and tick activity, leading to an increased risk of zoonotic diseases. Mosquitos are known to carry diseases such as West Nile virus (WNV), La Crosse/California encephalitis, Jamestown Canyon virus, St. Louis encephalitis, and Eastern equine encephalitis. The two major concerns associated with warmer and wetter conditions are that the mosquito species already found in Missouri and the diseases that they carry will become more prevalent, and that new species carrying unfamiliar diseases will start to appear for the first time.

Warmer winters with fewer hard freezes in areas that already see WNV-carrying mosquitos are likely to observe both a higher incidence of WNV and a longer WNV season, ultimately leading to an increase in human cases. Non-native mosquito species may move into Missouri if the climate becomes more suitable for them, bringing with them diseases such as Jamestown Canyon virus, Chikungunya, and Dengue Fever.

Ticks are also well-known disease vectors in North Carolina, carrying pathogens such as Lyme disease, anaplasmosis, Ehrlichiosis, Powassan virus, and Babesiosis. Warmer, wetter weather can lead to an increase in algal blooms and declining beach health. An increase in flood events may also be associated with an increased incidence of mold problems in homes and businesses, as well as contamination of wells and surface waters due to sewer overflows and private septic system failures.

If these predictions come true, communities must contend with the human health impacts related to the increased prevalence of infectious diseases, heat waves, and changes in air and water quality. Public health officials will need to focus on spreading information and enacting pest and disease reduction. Flood prone communities will need to focus on continuously improving flood controls and mitigation strategies, including restricting building and chemical storage in floodplains, upgrading well and septic requirements, and providing water testing kits to residents.

TABLE 3.49: INFECTIOUS DISEASE HAZARD CONSEQUENCE ANALYSIS

Category	Consequences
Public	The general public can be exposed to infectious diseases through different means based on the particular threat and its potential transmission routes. Vaccinations, when available, are the best means of preventing transmission and infection. Public health information messages will be disseminated via the media in order to provide preventative measures to limit or avoid exposure. According to the North Carolina Public Health Department, in terms of vaccine-preventable diseases, in 2016 there was a slightly higher occurrence rate of Hepatitis A and Mumps in 2016 compared to the five-year average from 2011-2015.14 There were also increased rates of non-vaccine-preventable diseases like Zika which have become more prominent across the United States in recent years. Public confidence in government organizations may be impacted by public health outbreaks. The level of confidence the public possesses is based upon societal expectations, media influence, and past experience following other outbreaks. An effective response to the outbreak can help to guide public confidence toward a favorable level. Collaboration with media outlets can also assist in keeping the public informed and helping to protect them from exposure.
Responders	During a disease outbreak, responders can expect an increase in workload and should practice a higher level of precaution toward

	exposure than they would normally. Plans exist for first response and health care to address the needs of such situations. Communication between these agencies regarding plans and procedures maximizes the efficiency and effectiveness of these combined efforts. Responders are much more likely on the whole to be impacted by an infectious disease since they will be working directly with those affected to help treat the disease (especially EMS personnel). This will make them more susceptible to becoming infected and, as such, it is critical that they wear the appropriate personal protective equipment to minimize their risk and ensure they can continue providing the care and assistance that is needed to help the public.
Continuity of Operations (including Continued Delivery of Services)	Continuity of operations may be impacted if those in governmental or other key roles are impacted by the disease or public health threat and cannot perform their normal duties. Although plans are in place to ensure continuity of operations, a large-scale event or one that has significant impacts on operational-level staff could negatively affect continuity of operations. Since many diseases are spread through some form of contact with others who have already been infected, a disease event could rapidly disable many of those who are working together to carry out normal operations. Due to their close proximity to one another and need to communicate and coordinate on a daily basis, it is incredibly important to try to reduce the spread of the disease among key personnel once an outbreak has been identified.
Property, Facilities and Infrastructure	An infectious disease would likely have little direct impact on the built environment itself as the disease would not affect the structural stability of any buildings or infrastructure. However, an infectious disease would have a major impact on the functioning of many structures that would be operating at a high capacity during an infectious disease event, especially medical care facilities. Hospitals and Medical Care Facilities The primary impacts for hospitals/medical facilities during disease outbreaks are an increase in patients and the spread of disease within hospitals. It is highly likely that those affected by the disease will make their way to a medical care facility and it may be necessary to implement quarantines or other measures to reduce the risk of disease spreading. Hospitals and other medical care facilities should have plans in place to deal with such a scenario and also reduce risk of spreading the disease to medical care providers whose workload may be increased as individuals infected with disease may require treatment.
Environment	The environmental impact is dependent on the particular biological substance or disease being transmittable to animal or plant life or if it can be distributed through the water supply. If the infectious disease in question can be transmitted to other species, there could be an extremely negative impact on species populations. Since animal life does not have the same capacity has humanity to understand the spread of disease and reduce transmission rates, the disease may spread more quickly through animal populations and cause larger-scale loss of life.
Economic Condition of the Jurisdiction	One of the more significant economic impacts that could be seen in North Carolina involves absenteeism at local businesses which could have a significant impact as the absence of several employees at a small business could force temporary shutdowns or reduced hours of availability. There would also likely be an impact on the local

		government budget as officials try to respond to the disease and assist those impacted. City centers and downtown areas tend to be where large masses of people congregate and thus may be where the likelihood of disease spread is more prominent. Many people may realize this and avoid these key economic hubs which would result in reduced revenue and a negative impact on the economy overall. Additionally, large events in communities across the state may have to be cancelled if the outbreak is large enough or has the potential to be spread easily and quickly. This would also reduce revenue for many local economies.
	Public Confidence in the Jurisdiction's Governance	Ability to respond and recover may be questioned and challenged if planning, response, and recovery not timely and effective.

Technological Hazards

Terrorism

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.

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. There is an ongoing concern on college campuses about active shooter events. Information from the National Center on Safe and Supportive Learning Environments, a recent study found between the 2001-2002 and 2015-2016 school years, 437 people were shot in 190 college campus shooting incidents[4].

Table 3.50 below provides summary information about which Western UNC campuses are potentially impacted by terrorism. Table 3.51 provides the PRI summary information for terrorism for each Western UNC campus.

TABLE 3.50: CAMPUSES AT RISK TO THE TERRORISM HAZARD

ASU	NCAT	UNCA	UNCC	UNCG	UNCSA	WCU	WSSU
●	●	●	●	●	●	●	●

TABLE 3.51: PRI SUMMARY FOR THE TERRORISM HAZARD BY CAMPUS

Campus	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
ASU	Unlikely	Critical	Small	Less than 6 hours	Less than 24 hours	2.2
NCAT	Unlikely	Critical	Small	Less than 6 hours	Less than 24 hours	2.2
UNCA	Unlikely	Critical	Small	Less than 6 hours	Less than 24 hours	2.2
UNCC	Unlikely	Critical	Small	Less than 6 hours	Less than 24 hours	2.2
UNCG	Unlikely	Critical	Moderate	Less than 6 hours	Less than 24 hours	2.8
UNCSA	Unlikely	Critical	Small	Less than 6 hours	Less than 24 hours	2.2
WCU	Unlikely	Critical	Small	Less than 6 hours	Less than 24 hours	2.2
WSSU	Unlikely	Critical	Small	Less than 6 hours	Less than 24 hours	2.2

Climate Change

Population growth continues to change the face of North Carolina. North Carolina is now ninth in the most populated state in the Nation. Population growth necessarily raises the odds of incidents involving terror within the state.

Terrorism is also driven by trends, technology, and information exchange. Terrorist propaganda and literature continues to play a role in educating terrorists in attack trends, tactics, technology, and procedures.

[4] https://safesupportivelearning.ed.gov/news/college-campus-shooting-statistics-you-should-know

TABLE 3.52: TERRORISM HAZARD CONSEQUENCE ANALYSIS

Category	Consequences
Public	In addition to the clear impacts that terrorism can have on human life and safety, there are a number impacts on the public that will be more widespread if major events take place. As seen after the attacks on September 1, 2001 in New York City and Washington, D.C., there can be significant impacts far away from the site of the incident. Fear and worry about additional attacks or for loved ones in areas affected are just a couple examples of impacts that could occur. Other impacts include discrimination or changed interactions between people of differing nationalities depending on the nature and intent of the attack(s) and who perpetrated the attack(s). During and after a terrorism event, the public will be expecting services to be provided despite the uncertainty of any existing hazards or further impacts. The partnership and involvement of the media is crucial not just for providing public guidance, but also for keeping the public informed of the efforts underway or of any obstacles or concerns hindering response efforts. Although public confidence will almost certainly be shaken, agencies and organizations in the government working together in an efficient and effective way will provide for the best chance of positive public perception of the government.
Responders	The danger to human life in a terrorist event is dependent on the form of attack utilized as well as its location, severity, and scope (see Section 3). In any terror incident, responders must conduct a scene size-up to determine hazards to themselves and others. Decisions must be made about how to handle victims and those in close proximity that may have been victimized or exposed. If hazardous materials are present, it could change the strategy as well. Fear and panic will be significant in the case of a terrorist act, whether it occurs in North Carolina or elsewhere in the nation. As front-line government officials, responders will be at a significant risk during an attack and may even be the object of the attack in some cases. Depending on the location, the scope, and the nature of the event(s), response efforts could last hours, days, or potentially longer. Collaboration at all levels can provide for the most stable, effective, and efficient effort in returning to normal activities and operations. Identification of further threats and open communication lines can prevent further harm or detriment to response operations.
Continuity of Operations (including Continued Delivery of Services)	A terrorist event would likely have a high impact on continuity of operations, especially due to the disorder that would result and the unpredictability of this kind of event. Emergency personnel may be directly affected or targeted, which would cause definitive harm to maintaining continuity of operations
Property, Facilities and Infrastructure	Major Events/Centers Often terrorist events are targeted at major events or at large event centers in an attempt to create widespread loss on a large number of people. Therefore, large arenas, convention centers, and event spaces may be at higher risk of a terrorist attack than most other buildings. Similarly, prominent or symbolic structures may also be at an elevated risk for targeting.

		Critical Facilities At hospitals, the primary concern with a terrorism event is the influx of patients requiring care. Terrorism may pose a specific hazard to a hospital structure itself, but it is more likely to be impacted when in close proximity to a target. Many patients could be injured or their medical condition worsened by the impacts of a terrorism event. In general, emergency services buildings are not considered high probability targets for terrorists to strike. In other countries, ambulance services and 9-1-1 centers have been targets; however, that pattern has not been seen here in the United States. Alternate locations should be set up so that emergency operations can continue if an emergency services facility was affected or targeted by a terrorism event. Shelters may need to be activated in a terrorism event to house and care for displaced individuals. Transportation Systems Bridges found throughout the interstate system may be targeted by terrorism. Not only would the actual structural failure affect those on, under, or near the bridge, but the loss of its functionality would also significantly hinder travel and commerce. Past experiences with terrorists using airplanes for terrorist activity suggest a need for planning and collaboration with all parties of interest at airports including local, state, and federal agencies. In terms of railway transportation, the most likely means of disrupting these lines would be the derailing of a train, primarily by sabotage of the rail or the switching control system. Using explosives would be more likely because hacking into systems to cause collisions and other undesired actions to moving rail cars would be more complex operations. In addition to disrupting rail traffic, a derailing can impact other means of travel such as a nearby road or airport. The rail cars involved in an incident could contain hazardous materials, which would add an element of complexity to the situation. Utilities Damage to high voltage lines or power plants structures could disrupt power distribution for a large area, affecting emergency response and other facets of government and business. The economic impacts may also be significant as extended outages can be costly. Natural gas lines are also a concern as a target for terrorists. Major pipelines run through the state, but natural gas itself must be exposed to oxygen before it could cause an explosion. Most natural gas explosions are small and rarely deadly. The real concern is in shutting off natural gas to end consumers. Sabotage of a pipeline could disconnect a significant number of homes and businesses for considerable periods of time. Other Structures Single-family dwellings and small businesses or industries are not likely to be targets for terrorism. However, areas that have high concentrations of certain targeted populations could be vulnerable to an attack. These populations may relate to a person or group's ethnicity, religion, and socioeconomic status. Dwellings in close
	Environment	Impacts on the environment depend on the type of attack utilized by terrorists. A biological, chemical, or other hazardous material can have impacts on human, animal, and plant populations alike. The impacts can vary depending on the particular hazard(s) at play, but there will certainly be at least some negative impacts from a terrorist attack

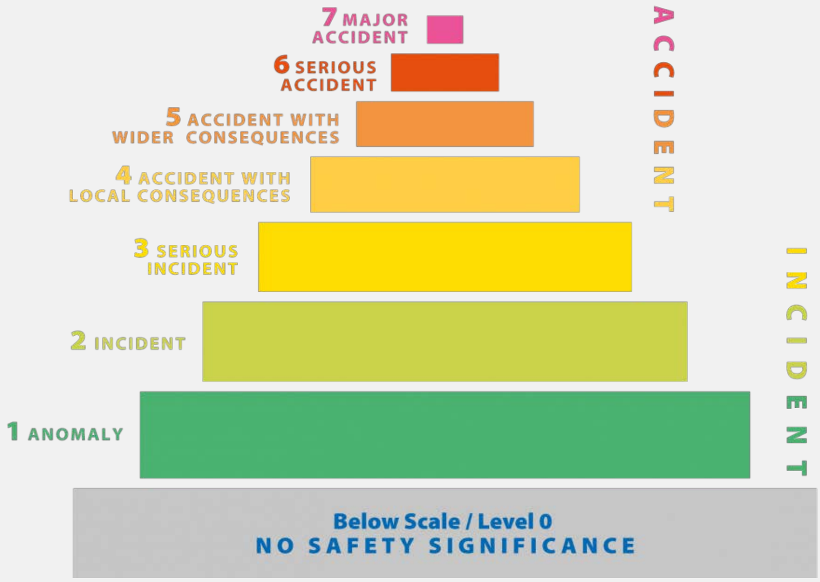
	including potentially the release of smoke, chemicals, or debris into the environment.
Economic Condition of the Jurisdiction	The economic impact of a terrorist attack can vary from minimal to severe. If the incident occurs in North Carolina, it could hinder the state's economy but may not have an impact at the national level. Tourism and some commerce could decline significantly if people, events, or businesses are hesitant to come to the area following an incident. An incident in a major city or a financial hub could affect the entire country. For example, the events of September 11, 2001 had an immediate impact on local, state, and national economies. This event and other large-scale attacks like it can drastically alter the economy in both the short- and long-term. Major Events/Centers Terrorism would mostly likely occur in city centers during large public gatherings or during business hours to cause the most harm and promote the most fear. Political gatherings would be high priority targets as well. Arenas can be targeted by terrorism, particularly during events that may have some form of political, cultural, or historical value, or simply any event with a large number of people in attendance. These could all have a negative impact economically on the state.
Public Confidence in the Jurisdiction's Governance	Loss of public confidence is likely should an attack be carried out; additional loss of confidence and trust may result if response and recovery are not swift and effective

Radiological Emergency - Fixed nuclear Facility

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 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.

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 3.13**).

FIGURE 3.13: 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.

Table 3.53 below provides summary information about which Western UNC campuses are potentially impacted by radiological emergencies. **Table 3.54** provides the PRI summary information for radiological emergencies for each Western UNC campus.

TABLE 3.53: CAMPUSES AT RISK TO RADIOLOGICAL EMERGENCIES

ASU	NCAT	UNCA	UNCC	UNCG	UNCSA	WCU	WSSU
	•		•	•		•	

TABLE 3.54: PRI SUMMARY FOR THE RADIOLOGICAL EMERGENCIES HAZARD BY CAMPUS

Campus	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
NCAT	Unlikely	Critical	Small	6 to 12 hours	Less than 1 week	1.9
UNCC	Unlikely	Critical	Small	6 to 12 hours	Less than 1 week	1.9
UNCG	Unlikely	Minor	Moderate	6 to 12 hours	Less than 1 week	2.1
WCU	Unlikely	Critical	Small	6 to 12 hours	Less than 1 week	1.9

Climate Change

Although North Carolina has not recently experienced nuclear catastrophes, severe weather is one of the causes of potential harm to nuclear facilities. The possibility of extreme weather due to changing climatic conditions is increasing, so it is critically important to continue to monitor radiological facilities in the state.

North Carolina's population growth is also a concern for nuclear emergencies; as the population increases, more people become subject to radiological effects. In the event of a disaster, millions of people could be harmed or killed. This growth is especially apparent in the areas surrounding the Harris Nuclear Plant, which is partially due to technological advances and increasing employment at Research Triangle Park. As more people move to or commute to the area, they are also more susceptible to a hazardous event occurrence.

The NRC and local governments study and develop evacuation time estimates (ETEs), which are part of the planning basis for each nuclear power plant. They are required to be performed to estimate the time needed to evacuate the public in the event of a disaster, and they are updated based on population growth near nuclear facilities. In North Carolina, the most recent ETE update took place in 2017 because of population booms. The number of Wake County residents in a 10-mile zone of a nuclear facility rose from 84,654 in 2008 to 118,967 in 2017. As the state's population continues to grow, it will be important to advance mitigation strategies as well.

TABLE 3.55: RADIOLOGICAL HAZARDS CONSEQUENCE ANALYSIS

Category	Consequences
Public	Although many areas of the state are well outside of the defined risk zones for a radiological emergency, there are also a number of areas that are located within the emergency planning risk zones, including several of the major metropolitan areas of the state. Areas located within 10 miles of a nuclear 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. In the 50-mile zone, the public would be most impacted from ingesting radiological materials through home grown crops, milk produced from

	livestock which have fed on contaminated grasses, and consuming contaminated surface water. Ingestion of radiological materials may result in internal contamination if ionizing radiation is released in the body. This can cause serious health risks, especially if critical organs are affected. Some organs such as the thyroid take in certain isotopes. It is extremely difficult to purge the material from the body.
Responders	First responders are vulnerable to the same impacts as the general public but will also be at greater risk due to their need to function outdoors and operate in contaminated environments. These responders will likely need to operate in personal protective equipment to limit their outdoor exposure. Proper decontamination is likely to be necessary to reduce the spread of contamination. Since responders will be first on the scene and directly dealing with the issues of a radiological incident, their risk will potentially be very high.
Continuity of Operations (including Continued Delivery of Services)	In the wake of a nuclear accident, continuity of operations could be impacted. It is very likely that many key employees could be a part of the evacuation if their homes are located within the 10-mile evacuation zone. This could cause many issues with maintaining continuity of operations and, depending on the severity of the event, there may be significant disruption to normal operations. Generally, it is likely that operations would proceed from outside their normal location, as there are plans at all stations for setting up command posts outside of high risk areas when incidents occur. This will likely impact continuity of operations to some degree, though exercises on radiological incidents are carried out frequently.
Property, Facilities and Infrastructure	It is unlikely that a radiological incident would cause the kind of damage that is typical of many other hazards identified in this plan as there would be minimal destruction of buildings and other infrastructure as a result of this type of incident. However, many structures and facilities could potentially be contaminated with radioactivity rendering it extremely dangerous for humans to be near them or live/work there. In this sense, a major radiological event may cause significant damage to the built environment and result in large areas that must be quarantined or considered off-limits to the public after an incident. Further, checkpoints and decontamination stations may need to be set up along routes that leave the evacuation zones, resulting in increased travel times along major roadways and necessitating traffic re-route
Environment	Environmental impacts as a result of a radiological incident may be very serious. Contaminants may impact the land and water for many years and wildlife may experience increased likelihood of cancer and other health problems. In general, habitats and ecosystems will suffer long-term from a radiological incident as the organisms within these areas will face similar impacts to those that humans experience, but since they are unable to evacuate or permanently migrate to new locations, they will be exposed for longer periods and be impacted to a greater degree.
Economic Condition of the Jurisdiction	Economies within the risk zones are likely to see decreased spending as evacuation takes place. Travel and tourism across the state may be limited for an extended period of time due to travelers associating the entire state with the incident. Interstate commerce may be impacted as decontamination stations may need to be established and some drivers may elect to attempt to circumnavigate the state altogether extending travel times and increasing the time to market for products on a regional

		and statewide level. Employers in the surrounding areas may see increased absenteeism and requests for leaves of absence to deal with the aftermath of the event and some employees may self-evacuate, resulting in a loss of productivity.
	Public Confidence in the Jurisdiction's Governance	The public will be extremely concerned about their health and safety during and after a nuclear incident. Confidence will be dependent upon the availability of information and perceived quality of response by government and non-government service providers, but it is likely that confidence in the state's governance will be a significant concern

Cyber

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 becomes 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 agency for investigating cyberattacks, 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 cyberattacks 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
- Miscellaneous Errors: Incidents in which unintentional actions directly compromise an attribute of a security asset
- Physical Threat and Loss: Incidents where an information asset went missing
- Crimeware: Instances involving malware that do not fit into 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: Any attack intended to compromise the availability of networks and systems that are designed to overwhelm systems, resulting in performance degradation or interruption of services

Figure 3.14 below displays nationwide cyberattack incident patterns from the 2018 Verizon Data Breach Investigations Report.

FIGURE 3.14: PERCENTAGE AND COUNTS OF INCIDENTS PER PATTERN

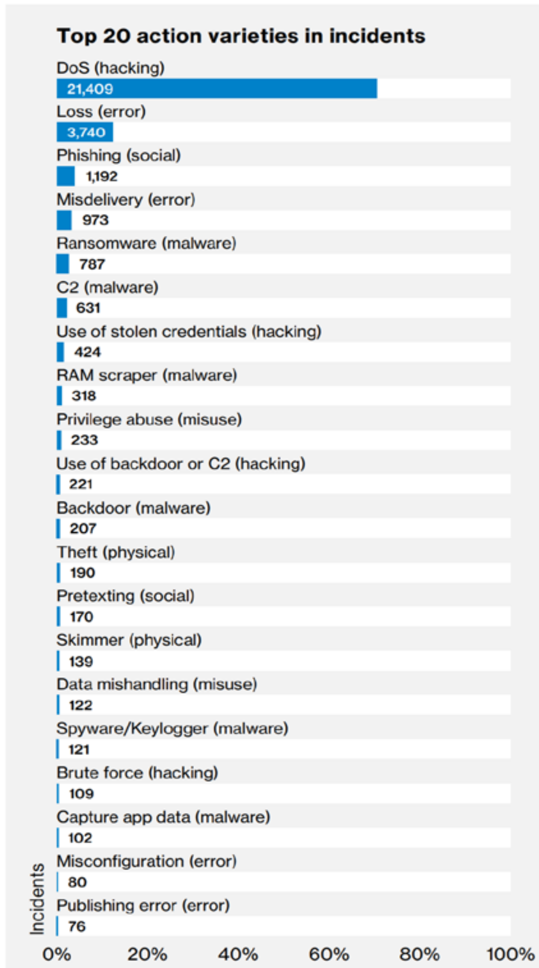


Figure 4. Top 20 threat action varieties (incidents) (n=30,362)

Source: 2018 Verizon Data Breach Investigation Report

In North Carolina, 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. Each university in the UNC Western Campuses region has staff that addresses cyber threats on a daily basis.

Table 3.56 displays the North Carolina Cybercrimes and Victim Counts in 2018.

TABLE 3.56: NORTH CAROLINA CYBERCRIMES AND VICTIM COUNTS IN 2018

Crime Type by Victim Count

Crime Type	*Victim Count*	*Crime Type*	*Victim Count*
Advanced Fee	436	Identity Theft	330
BEC/EAC	430	Investment	47
Charity	11	Lottery/Sweepstakes/Inheritance	213
Civil Matter	15	Malware/Scareware/Virus	49
Confidence Fraud/Romance	432	Misrepresentation	148
Corporate Data Breach	39	No Lead Value	246
Credit Card Fraud	306	Non-payment/Non-Delivery	1,647
Crimes Against Children	28	Other	172
Denial of Service/TDos	28	Overpayment	406
Employment	391	Personal Data Breach	1,125
Extortion	1,219	Phishing/Vishing/Smishing/Pharming	947
Gambling	4	Ransomware	29
Government Impersonation	255	Re-shipping	31
Hacktivist	2	Real Estate/Rental	286
Harassment/Threats of Violence	330	Spoofing	430
Health Care Related	9	Tech Support	361
IPR/Copyright and Counterfeit	30	Terrorism	2
Descriptors*			
Social Media	902	Virtual Currency	790

Source: FBI Crime Compliant Center, 2018

Table 3.57 below provides summary information about which Western UNC campuses are potentially impacted by cyber hazards. Table 3.58 provides the PRI summary information for cyber hazards for each Western UNC campus.

TABLE 3.57: CAMPUSES AT RISK TO THE CYBER HAZARD

ASU	NCAT	UNCA	UNCC	UNCG	UNCSA	WCU	WSSU
●	●	●	●	●	●	●	●

TABLE 3.58: PRI SUMMARY FOR THE CYBER HAZARD BY CAMPUS

Campus	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
ASU	Unlikely	Minor	Small	Less than 6 hours	Less than 24 hours	1.3
NCAT	Unlikely	Minor	Small	Less than 6 hours	Less than 24 hours	1.3
UNCA	Unlikely	Minor	Small	Less than 6 hours	Less than 24 hours	1.3
UNCC	Unlikely	Minor	Small	Less than 6 hours	Less than 24 hours	1.3
UNCG	Possible	Critical	Moderate	Less than 6 hours	Less than 1 week	3.2
UNCSA	Unlikely	Minor	Small	Less than 6 hours	Less than 24 hours	1.3
WCU	Unlikely	Minor	Small	Less than 6 hours	Less than 24 hours	1.3
WSSU	Unlikely	Minor	Small	Less than 6 hours	Less than 24 hours	1.3

Climate Change

Digital data continues to be the predominant format of data and there are no indications that will change. Therefore, it will be important to closely monitor computer systems as our technological capabilities expand.

TABLE 3.59: CYBER HAZARD CONSEQUENCE ANALYSIS

Consequence Analysis

Category	Consequences
Public	The aim of a cyber attack is typically to corrupt or exploit protected information. Depending on the target of the ploy, a significant number of people can be victims of identity theft, fraud, or other forms of technology-based crime. Anyone with an account, membership, or other relationship with an entity that requires storage of information is vulnerable. An individual/user must rely on the entity of affiliation to create and maintain safeguards against the intrusion of computerized systems. However, even the strongest of safeguards can be corrupted or evaded. Continual monitoring of attempted or successful attempts at cyber attacks is warranted to lessen the potential impacts. Public confidence in the response of government organizations may be impacted by a cyber attack based upon societal expectations and media influence with respect to cyber attacks. There may be an expectation that government entities should do a better job of patrolling cyber crime and hold those responsible accountable. Public confidence may be impacted by media interpretation and reporting of the event, positive or negative.
Responders	Cyber attacks may be used to try to intrude into electronic safety equipment or systems. This may increase call volume, block systems, or otherwise hinder emergency operations. Although responders are not likely to be at risk to a cyber attack in a physical sense, they may be impacted financially or through identity theft, much like members of the public.
Continuity of Operations (including Continued Delivery of Services)	In the event of a cyber attack, continuity of operations could be impacted if many of the services (such as internet or other IT programs) that are required to maintain daily operations are shut down by the attack. This could cause considerable disruption to normal operations in the state and could make the state potentially vulnerable to other events that may be occurring simultaneously.
Property, Facilities and Infrastructure	Cyber attacks may have the effect of disrupting life sustaining equipment or systems in hospitals or medical facilities by causing technological disruptions. These attacks may also sabotage information networks and communications equipment that could disrupt services within medical facilities. Normal operations in communications equipment such as telephones, cell phones, and internet could all be severely impacted by a cyber attack which would impact large numbers of people including critical facilities operators.
Environment	Because cyber attacks occur in cyberspace and would not truly have any impacts outside of the physical sphere, there are no expected environmental impacts from this type of event.
Economic Condition of the Jurisdiction	Freezing, redirecting, or stealing financial assets can have drastic impacts on a business. Banking and credit institutions are commonly affected or

	targeted by fraudulent activities and often store a great deal of information on businesses, so large-scale intrusions can have significant impacts on the local economy. Large employers are more likely to be targeted by cyber attacks than individuals or small businesses. Larger businesses generally have greater assets to exploit and store more personal information on private individuals or employees.
Public Confidence in the Jurisdiction's Governance	Cyber attacks certainly have the ability to negatively impact public confidence in the government.

Electromagnetic Pulse

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.

Table 3.60 below provides summary information about which Western UNC campuses are potentially impacted by electromagnetic pulses. **Table 3.61** provides the PRI summary information for electromagnetic pulses for each Western UNC campus.

TABLE 3.60: CAMPUSES AT RISK TO ELECTROMAGNETIC PULSE

ASU	NCAT	UNCA	UNCC	UNCG	UNCSA	WCU	WSSU
●	●	●	●	●	●	●	●

TABLE 3.61: PRI SUMMARY FOR THE ELECTROMAGNETIC PULSE HAZARD

Campus	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
ASU	Unlikely	Minor	Large	12 to 24 hours	Less than 6 hours	1.9
NCAT	Unlikely	Minor	Large	12 to 24 hours	Less than 6 hours	1.9
UNCA	Unlikely	Minor	Large	12 to 24 hours	Less than 6 hours	1.9
UNCC	Unlikely	Minor	Large	12 to 24 hours	Less than 6 hours	1.9
UNCG	Unlikely	Minor	Large	12 to 24 hours	Less than 6 hours	1.9
UNCSA	Unlikely	Minor	Large	12 to 24 hours	Less than 6 hours	1.9
WCU	Unlikely	Minor	Large	12 to 24 hours	Less than 6 hours	1.9
WSSU	Unlikely	Minor	Large	12 to 24 hours	Less than 6 hours	1.9

Climate Change

One of the most problematic threats of EMPs is the little common understanding of consequences between local, State, and Federal authorities. However, as technology increases globally, more can be learned about the effects of an EMP occurrence.

TABLE 3.62: ELECTROMAGNETIC PULSE CONSEQUENCE ANALYSIS

Category	Consequences
Public	The entire State of North Carolina's population is vulnerable to the impacts of an EMP/geomagnetic storm, regardless of the measured magnitude, although most low-classification events will not have any noticeable impact on the daily lives of people. If a large event were to occur and cause widespread power outages or communications systems disruptions, there may be a panic and people may temporarily be unable to undertake normal activities such as cooking or using mobile devices. Consumer electronics may also be damaged, including HVAC systems, newer model appliances, radios, and televisions. EMP/geomagnetic storms have some likelihood of affecting public confidence due to their highly visible impacts and the fact that most members of the public are unaware of the hazard and may be confused about the cause of loss of power/communications systems.
Responders	Responders could be critically affected by an EMP/geomagnetic storm event as response personnel rely heavily on communications equipment to carry out their normal operations. If a large event were to occur that knocked out communications equipment for several hours or possibly more than a day, this would significantly hinder responders' abilities to perform their duties. Additionally, other electronic equipment or devices used by responders may be damaged by an EMP/geomagnetic storm further impacting their ability to respond to emergencies following an event.
Continuity of Operations (including Continued Delivery of Services)	Continuity of operations would potentially be impacted in many ways by a major EMP/geomagnetic storm. As mentioned above, if communications equipment is disrupted, it would be challenging for government officials to coordinate with one another and respond to citizen needs such as emergency medical care. It is also possible that some satellites will be damaged, affecting satellite-based communications. Additionally, if power is lost, there would be a disruption to normal operations, though there are generally plans in place to maintain continuity of operations in this case as several operations centers have backup power systems.
Property, Facilities and Infrastructure	Critical Infrastructure The primary impact on the built environment from an EMP/geomagnetic storm would be on communications and power infrastructure. Most of the built environment (e.g. homes, buildings, roadways) would not be impacted in any way by this type of event. However, if power or communications systems are damaged or temporarily shut down, some aspects of the built environment will be impacted such as traffic lights, street lights, and cell phone towers. Additionally, electronic equipment and control systems could also be damaged and water and wastewater systems, gas stations, and pipelines may be shut down throughout the state.
Environment	There will likely be relatively minimal impacts on the environment from an EMP/geomagnetic storm. These types of events do not directly impact plants or animals and typically do not have any effect on water

	systems or other natural areas. There may be indirect impacts if, for example, power systems are damaged at facilities that house hazardous materials, causing releases into the environment. However, the likelihood of this occurring is relatively low.
Economic Condition of the Jurisdiction	An EMP/geomagnetic storm can impact any area of the State of North Carolina at any time and may bring with it an interruption of service for local businesses as well as governments that lose power or cannot utilize communications systems. As a result, there will be significant disruption of the local economy as long as the effects (such as power or communications loss) of the EMP/geomagnetic storm remain in place. ATMs, credit card processing, and other electronic financial transactions may also be disrupted, further impacting the economy.
Public Confidence in the Jurisdiction's Governance	If a large event were to occur and cause widespread power outages or communications systems disruptions, there may be a panic and people may temporarily be unable to undertake normal activities such as cooking or using mobile devices.

3.5 Conclusions on Hazard Risk

As described and detailed above, the UNC Western Campuses are at risk to a range of natural and technological/manmade hazards. Specific risks and vulnerabilities to each of campuses are further addressed in the campus-specific annexes.

SECTION 4
MITIGATION STRATEGY

This section of the Plan provides the blueprint for the participating universities in UNC Western Campuses region to follow in order to become less vulnerable to their identified hazards. It is based on general consensus of the Multi-Campus Hazard Mitigation Steering Committee and the Campus Hazard Mitigation Planning Teams and the findings and conclusions of the *Capability Assessment* and *Risk Assessment*. It consists of the following five subsections:

- 4.1 Introduction
- 4.2 Mitigation Goals
- 4.3 Identification and Analysis of Mitigation Techniques
- 4.4 Selection of Mitigation Techniques for the UNC Western Campuses
- 4.5 Plan Update Requirement

4.1 INTRODUCTION

The intent of the Mitigation Strategy is to provide the universities in the UNC Western Campus 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 UNC Western Campus Region (provided separately in the plan Annexes under the Mitigation Action Plans). Each university has its own Mitigation Action Plan (MAP) that reflects the needs and concerns of that university. 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 UNC Western Campuses 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 decision makers who want to quickly review the recommendations and proposed actions of the Hazard Mitigation Plan.

In preparing each Mitigation Action Plan for the UNC Western Campuses, officials considered the overall hazard risk and capability of the university 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 university.

4.1.1 Mitigation Action Prioritization

In the previous versions of the campus hazard mitigation plans, not all actions were prioritized. In addition, there needed to be consistency among the universities regarding how they prioritized their actions. Therefore, for the 2021 UNC Western Campuses Hazard Mitigation Plan, the Multi-Campus Hazard Mitigation Steering Committee and the Campus Hazard Mitigation Planning Teams 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 university support
- A general economic cost/benefit review[1]

[1] Only a general economic cost/benefit review was considered by the Campus Hazard Mitigation Planning Teams through the process of selecting and prioritizing mitigation actions. Mitigation actions with “high” priority were determined to be the most cost effective, most compatible with the participating universities’ unique needs and having the most significant impacts on loss reduction. “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 and more limited impacts on loss reduction. A more detailed cost/benefit analysis will be applied to particular projects prior to the application for or obligation of funding, as appropriate.

- Funding availability
- Continued compliance with the NFIP if applicable

The point of contact for each campus helped coordinate the prioritization process by reviewing each action and working with the Campus Hazard Mitigation Planning Teams 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 university officials.

4.2 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.

One of the primary goals of all universities is to promote the public health, safety, and welfare of its staff, faculty and students. In keeping with this standard, the UNC Western Campuses have developed goal statements and associated objectives for local hazard mitigation planning in the UNC System.

The intent of goal setting is to guide the review of possible mitigation actions. This Hazard Mitigation Plan needs to make sure that recommended actions are consistent with what is appropriate for the campuses. Mitigation goals should reflect campus priorities and should be consistent with other campus, local, and regional plans.

Goals provide the general guidelines that explain what is to be achieved. They are usually broad-based, long-term policy type statements that represent global visions. Goals help define the benefits that the plan is trying to achieve.

Objectives are short term aims which, when combined, form a strategy or course of action to meet a goal. Objectives provide more specific methods for achieving goals.

When formulating the goals for this update, the existing goals from the previous plan were reviewed, and it was determined that those goals were no longer relevant for this plan. As such, new goals were developed, voted upon, and accepted by the Campus Hazard Mitigation Planning Teams. Each goal, purposefully broad in nature, serves to establish parameters that were used in developing more mitigation actions. The UNC Western Campuses Hazard Mitigation Goals are presented in **Table 4.1**. Consistent implementation of actions over time will ensure that community goals are achieved. It should be noted that these goals and objectives also align with those found in the UNC Eastern Campuses Hazard Mitigation Plan.

TABLE 4.1: UNC WESTERN CAMPUS REGIONAL MITIGATION GOALS AND OBJECTIVES

	Goal
Goal #1	**Reduce the impact of hazards on campus buildings, critical facilities, and critical infrastructure.**
Objective 1.1	Retrofit or otherwise protect critical facilities and infrastructure.
Objective 1.2	Protect critical research and campus operations.
Objective 1.3	Preserve and protect natural systems and resources that provide hazard mitigation benefits.
Goal #2	**Protect the public health, safety, and welfare of people on campus from hazard risk.**
Objective 2.1	Preserve and protect natural systems and resources that provide hazard mitigation benefits.
Objective 2.2	Improve hazard monitoring and warning systems to enable earlier response actions.
Objective 2.3	Create or update existing campus evacuation and shelter in place procedures.
Goal #3	**Build campus resilience to minimize interruption and ensure speedy recovery from hazard events.**
Objective 3.1	Develop or revise plans, policies, and regulations to reduce vulnerability of new construction on campus.
Objective 3.2	Improve campus mitigation and response capabilities.

4.3 IDENTIFICATION AND ANALYSIS OF MITIGATION TECHNIQUES

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

In formulating the Mitigation Strategy for the UNC Western Campuses, 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 Campus Hazard Mitigation Planning Teams meetings. In general, all activities considered by the Campus Hazard Mitigation Planning Teams 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.

4.3.1 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

4.3.2 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., wind proofing, floodproofing, seismic design techniques, etc.)
- Safe rooms, shutters, shatter-resistant glass
- Insurance

4.3.3 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

4.3.4 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

4.3.5 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

4.3.6 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

4.4 SELECTION OF MITIGATION TECHNIQUES FOR THE UNC WESTERN CAMPUSES

In order to determine the most appropriate mitigation techniques for the communities in the UNC Western Campuses, the Campus Hazard Mitigation Planning Team members thoroughly reviewed and considered the findings of the *Capability Assessment* and *Risk Assessment* to determine the best activities for their respective universities. 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).

4.5 PLAN UPDATE REQUIREMENT

In keeping with FEMA requirements for plan updates, the Mitigation Actions identified in the previous University plans were evaluated to determine their 2021 implementation status. Updates on the implementation status of each action is provided. The mitigation actions provided in the plan Annexes *Mitigation Action Plans* include the mitigation actions from the previous plans as well as any new mitigation actions proposed through the 2021 planning process.

SECTION 5
PLAN MAINTENANCE PROCEDURES

44 CFR Requirement

44 CFR Part201.6(c)(4)(i):
The plan shall include a plan maintenance process that includes a section describing the method and schedule of monitoring, evaluating and updating the mitigation plan within a five-year cycle.

44 CFR Part 201.6(c)(4)(ii):
The plan maintenance process shall include a process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

This section discusses how the University of North Carolina Western Campuses Mitigation Strategies and Mitigation Action Plans will be implemented and how the Hazard Mitigation Plan will be evaluated and enhanced over time. This section also discusses how the public will continue to be involved in a sustained hazard mitigation planning process. It consists of the following four subsections:

- 5.1 Implementation and Integration
- 5.2 Monitoring, Evaluation and Enhancement
- 5.3 Continued Public Involvement
- 5.4 Evaluation of Monitoring, Evaluation and Update Process

5.1 IMPLEMENTATION AND INTEGRATION

Each university department or other partner participating under the UNC Western Campuses Hazard Mitigation Plan is responsible for implementing specific mitigation actions as prescribed in the Mitigation Action Plans found in the Annexes. Every proposed action listed in the Mitigation Action Plans is assigned to a specific "lead" university department in order to assign responsibility and accountability and increase the likelihood of subsequent implementation.

In addition to the assignment of a lead university department, 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. In most cases, the participating universities in the UNC Western Campuses 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 campuses will attempt to integrate this Hazard Mitigation Plan into relevant University decision-making processes or mechanisms, where feasible. This includes integrating the requirements of the Hazard Mitigation Plan into other campus planning documents, processes or mechanisms, such as comprehensive campus development plans or capital improvement plans, when appropriate. The members of the Camps Hazard Mitigation Planning Teams 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 on the campuses.

Since the initial plan was adopted in 2010 for all eight campuses in the Western Campuses region, each campus 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 each campus-specific annex. Specific examples of how integration has occurred include:

- Integrating the mitigation plan into reviews and updates of campus policies as applicable
- Integrating the mitigation plan into reviews and updates of campus emergency operations plans
- Integrating the mitigation plan into the campus planning and/or capital improvements plans through identification of mitigation actions that require university funding.

Opportunities to further integrate the requirements of this Plan into other campus planning mechanisms shall continue to be identified through future meetings of the Campus Hazard Mitigation Planning Teams, individual campus leadership, and the annual review process described herein.

5.2 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 Plans.

When determined necessary, each individual Campus Hazard Mitigation Planning Team shall meet every year to evaluate and monitor the progress attained and to revise, where needed, the hazard identification and risk assessment and capabilities assessment in the Plan. The findings and recommendations of the Hazard Mitigation Planning Teams shall be documented in the form of a report that can be shared with interested university staff or leadership. The Campus Hazard Mitigation Planning Teams 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 at each campus. For future updates of the plan, North Carolina Emergency Management’s Hazard Mitigation Planning Section will help coordinate the reconvening of the Campus Hazard Mitigation Planning Teams for these reviews through coordination with each Campus’ Emergency Management Departments. The Emergency Management Director from each university will maintain ultimate responsibility for their respective university’s plan implementation and monitoring, evaluation and update.

Five (5) Year Plan Review

The Plan will be thoroughly reviewed by the Campus Hazard Mitigation Planning Teams every five years to determine whether there have been any significant changes for the UNC Western Campuses 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 campus 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 Campus Hazard Mitigation Planning Teams and conducting the five-year review through coordination with each university'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 university 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 UNC Western Campuses 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 UNC Western Campuses 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 North Carolina Emergency Management's Hazard Mitigation Planning section to coordinate the reconvening of the Campus Hazard Mitigation Planning Teams, through coordination with each university's Emergency Management Department, 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 Campus Hazard Mitigation Planning Teams 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 each university will forward information on the proposed change(s) to all interested parties including, but not limited to, all directly affected university departments, faculty and staff. 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 Campus Hazard Mitigation Planning Teams for final consideration. The Planning Teams 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 Campus Hazard Mitigation Planning Teams:

- 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 Campus Hazard Mitigation Planning Teams and prior to adoption of the Plan, the participating universities will seek public comment, if deemed necessary. The governing bodies of each participating university will review the recommendation from the Campus Hazard Mitigation Planning Teams (including the factors listed above) and any oral or written comments received from the public. 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 Campus Hazard Mitigation Planning Teams for further revision, or
- Defer the amendment request back to the Campus Regional Hazard Mitigation Planning Committee for further consideration and/or additional hearings

5.3 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 comment 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 Campus Hazard Mitigation Planning Teams in campus newspapers, public bulletin boards, online resources/social media and/or university buildings.
- Designating willing and voluntary faculty, staff or students and private sector representatives as official members of the Campus Hazard Mitigation Planning Teams.
- Utilizing local media to update the public on any maintenance and/or periodic review activities taking place.
- Utilizing the university websites to advertise any maintenance and/or periodic review activities taking place, and
- Keeping copies of the Plan in university libraries.

5.4 EVALUATION OF PREVIOUS MONITORING, EVALUATION AND UPDATE PROCESS

Over the past ten years, the participating universities have been independently implementing, monitoring and evaluating their own mitigation action plans. Progress made in implementing actions has been documented in the Mitigation Action Plans where each action contains a narrative about the implementation status of the action as of 2021. That said, the universities did waiver slightly from 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 2021 update of this plan, the Campus Hazard Mitigation Planning Teams determined to follow the processes prescribe in this section for monitoring and evaluation, and that those procedures 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 apply for a PDM grant for funding to update the campus hazard mitigation plans. To facilitate this effort, NCEM assigned the plan update to their pre-qualified hazard mitigation planning consultants, ESP Associates, Inc. Representatives from ESP Associates, Inc. first reached out to the Emergency Management Coordinators from each campus in August 2019 to initiate the plan update process. More details about the plan update process are provided in Section 2, Planning Process and in each campus-specific Annex.

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.

SECTION 6
PLAN ADOPTION

This section will include the adoption resolution from each participating university. The universities will work to adopt the plan once it is approved by NCEM and FEMA.

RESOLUTION TO ADOPT THE UNIVERSITY OF NORTH CAROLINA WESTERN CAMPUSES REGIONAL HAZARD MITIGATION PLAN

WHEREAS, the University of North Carolina Asheville is vulnerable to an array of hazards that can cause loss of life and damages to university property; and

WHEREAS, the University of North Carolina Asheville desires to seek ways to mitigate situations that may aggravate such circumstances; and

WHEREAS, the development and implementation of a hazard mitigation plan can result in actions that reduce the long-term risk to life and property from hazards; and

WHEREAS, it is the intent of the University of North Carolina Asheville to protect its faculty, staff, students and property from the effects of hazards by preparing and maintaining a hazard mitigation plan; and

WHEREAS, it is also the intent of the University of North Carolina Asheville to fulfill its obligation under North Carolina General Statutes, Chapter 166A: North Carolina Emergency Management Act and Section 322: Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act to remain eligible to receive state and federal assistance in the event of a declared disaster affecting the University of North Carolina Asheville; and

WHEREAS, University of North Carolina Asheville, in coordination with the other participating University of North Carolina System institutions within the Western Campuses region has prepared a multi-university hazard mitigation plan with input from the appropriate university and state officials;

WHEREAS, North Carolina Emergency Management and the Federal Emergency Management Agency have reviewed the UNC Western Campuses Regional Hazard Mitigation Plan for legislative compliance and has approved the plan pending the completion of university adoption procedures;

NOW, THEREFORE, BE IT RESOLVED that the University of North Carolina Asheville hereby:

1. Adopts the UNC Western Campuses Regional Hazard Mitigation Plan; and
2. Agrees to take such other official action as may be reasonably necessary to carry out the proposed actions of the Plan.

Adopted on Sept 14, 2021.

Nancy J. Cable

Nancy J. Cable, Chancellor
University of North Carolina Asheville

UNC WESTERN CAMPUSESHAZARD MITIGATION PLAN
Summary

The purposes of the Western University Campuses Hazard Mitigation Plan, as reflected through the plan goals are as follows:

•Reduce the impact of natural hazards on each campus1;

•Develop a natural hazards mitigation plan that meets planning criteria outlined in 44 CFR, Part 201;

•Develop a model PDM planning process for a multi-campus university system;

Develop an innovative approach based on ASCE/ Building Security Council national standards; and

•Provide a mechanism to obtain FEMA Mitigation Project Grant funding for facility improvements.

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. University-specific planning processes are described in the plan Annexes.

The Hazard Identification and Hazard Profiles presented in Section 3 serve to identify, analyze, and assess hazards that pose a threat to the campuses. This section begins by identifying hazards that threaten the campuses. 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 UNC System universities seek to determine the most appropriate mitigation actions to pursue and implement—enabling university officials to prioritize and focus their efforts on those hazards of greatest concern and those structures or planning areas facing the greatest risk(s). Campus-specific risk and vulnerabilities are addressed in the plan Annexes.

The Mitigation Strategy, found in Section 4, consists of broad goal statements as well as an analysis of hazard mitigation techniques for the participating campuses to consider in reducing hazard vulnerabilities. The strategy provides the foundation for a detailed Mitigation Action Plan, found in the plan Annexes, which links specific mitigation actions for each campus 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 campus less vulnerable to the damaging forces of hazards. 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, recreation, transportation improvements, environmental quality, land development, and public health and safety.

Plan Maintenance, found in Section 5, includes the measures that the university 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.

Campus-specific information is contained in the plan's Annexes. Each Annex contains the following information for each of the participating campus in the Western Region.

♦Planning Process Details specific to each campus to include information about the Campus Hazard Mitigation Planning Teams and the meetings that were held as part of the plan update process.

♦A Campus Profile that provides a general overview of each campus, 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 university officials recognize those structural and environmental factors that ultimately play a role in determining the campus's vulnerability to hazards.

♦The Asset inventory includes the types, numbers and values of the buildings on each campus. This section also includes a ranking of the most critical buildings on the campuses as determined by the Campus Hazard Mitigation Planning Teams.

♦Hazard Profiles – campus specific (location, extent, historical occurrences, probability of future occurrences. The profiles also include information about the specific vulnerabilities that each campus faces. (methodology, loss estimates, future development)♦The Capability Assessment provides a comprehensive examination of each University's capacity to implement meaningful mitigation strategies and identifies opportunities to increase and enhance that capacity. Specific capabilities addressed include planning and regulatory capability, staff and organizational (administrative) capability, technical capability, fiscal capability, and political capability. 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.

♦Campus-specific Mitigation Action Plans that provide the specific plan action that the campuses have identified for decreasing vulnerability and increase resiliency. Each action serves as an effective measure (project or policy) to reduce hazard risk on the campus.

The purposes of the Western University Campuses Hazard Mitigation Plan, as reflected through the plan goals are as follows:

•Reduce the impact of natural hazards on each campus1;

•Develop a natural hazards mitigation plan that meets planning criteria outlined in 44 CFR, Part 201;

•Develop a model PDM planning process for a multi-campus university system;

Develop an innovative approach based on ASCE/ Building Security Council national standards; and

•Provide a mechanism to obtain FEMA Mitigation Project Grant funding for facility improvements.

RESOLUTION TO ADOPT THE
UNIVERSITY OF NORTH CAROLINA WESTERN CAMPUSES
REGIONAL HAZARD MITIGATION PLAN

WHEREAS, University of North Carolina School of the Arts is vulnerable to an array of hazards that can cause loss of life and damages to university property; and

WHEREAS, the University of North Carolina School of the Arts desires to seek ways to mitigate situations that may aggravate such circumstances; and

WHEREAS, the development and implementation of a hazard mitigation plan can result in actions that reduce the long-term risk to life and property from hazards; and

WHEREAS, it is the intent of the University of North Carolina School of the Arts to protect its faculty, staff, students and property from the effects of hazards by preparing and maintaining a hazard mitigation plan; and

WHEREAS, it is also the intent of the University of North Carolina School of the Arts to fulfill its obligation under North Carolina General Statutes, Chapter 166A: North Carolina Emergency Management Act and Section 322: Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act to remain eligible to receive state and federal assistance in the event of a declared disaster affecting the University of North Carolina School of the Arts; and

WHEREAS, University of North Carolina School of the Arts, in coordination with the other participating universities within the Western Campuses region has prepared a multi-university hazard mitigation plan with input from the appropriate university and state officials;

WHEREAS, North Carolina Emergency Management and the Federal Emergency Management Agency have reviewed the UNC Western Campuses Regional Hazard Mitigation Plan for legislative compliance and has approved the plan pending the completion of university adoption procedures;

NOW, THEREFORE, BE IT RESOLVED that the Cabinet of University of North Carolina School of the Arts hereby:

1. Adopts the UNC Western Campuses Regional Hazard Mitigation Plan; and
2. Agrees to take such other official action as may be reasonably necessary to carry out the proposed actions of the Plan.

Adopted on September 1, 2021, 2021.

Britton J. Smith
Name, Vice Chancellor for Finance and Administration
UNC School of the Arts Cabinet

Attest:

Amber Russell
Name, Clerk

Certified by: Amber Russell (SEAL)
Date: 6/27/2025

Amber Russell
Notary Public
Forsyth County
North Carolina
My Commission Expires 6/27/2025

STATEMENT TO ADOPT THE
UNIVERSITY OF NORTH CAROLINA WESTERN CAMPUSES
REGIONAL HAZARD MITIGATION PLAN

WHEREAS, Western Carolina University is vulnerable to an array of hazards that can cause loss of life and damages to university property; and

WHEREAS, the Western Carolina University desires to seek ways to mitigate situations that may aggravate such circumstances; and

WHEREAS, the development and implementation of a hazard mitigation plan can result in actions that reduce the long-term risk to life and property from hazards; and

WHEREAS, it is the intent of Western Carolina University to protect its faculty, staff, students and property from the effects of hazards by preparing and maintaining a hazard mitigation plan; and

WHEREAS, it is also the intent of the Western Carolina University to fulfill its obligation under North Carolina General Statutes, Chapter 166A: North Carolina Emergency Management Act and Section 322: Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act to remain eligible to receive state and federal assistance in the event of a declared disaster affecting the Western Carolina University; and

WHEREAS, Western Carolina University, in coordination with the other participating universities within the Western Campuses region has prepared a multi-university hazard mitigation plan with input from the appropriate university and state officials;

WHEREAS, North Carolina Emergency Management and the Federal Emergency Management Agency have reviewed the UNC Western Campuses Regional Hazard Mitigation Plan for legislative compliance and has approved the plan pending the completion of university adoption procedures;

NOW, THEREFORE, Western Carolina University hereby:

1. Adopts the UNC Western Campuses Regional Hazard Mitigation Plan; and
2. Agrees to take such other official action as may be reasonably necessary to carry out the proposed actions of the Plan.

August 23, 2021.

Kelli R. Brown

Kelli R. Brown
Chancellor

Approved as to form.
SRB
Attorney

Annex A: Appalachian State University

This section provides planning process, campus profile, hazard risk, vulnerability, capability, and mitigation action information specific to Appalachian State University (ASU). This section contains the following subsections:

- A.1 Planning Process Details
- A.2 Campus Profile
- A.3 Asset Inventory
- A.4 Hazard Identification
- A.5 Hazard Profiles, Analysis, and Vulnerability
- A.6 Capability Assessment
- A.7 Mitigation Strategy

A.1 Planning Process Details

The update of the campus hazard mitigation plan was conducted by a Campus Hazard Mitigation Planning Team comprised of university staff and faculty. The committee followed a planning process prescribed by FEMA and participated in a series of meetings to update the plan. Details about the meetings held by the committee are provided below.

TABLE A.1: APPALACHIAN STATE UNIVERSITY CAMPUS HAZARD MITIGATION PLANNING TEAM

LAST NAME	FIRST NAME	TITLE	ATTENDED FIRST MEETING	ATTENDED SECOND MEETING
Anderson	Lauren	Geography Instructor and GIS Lab Supervisor	X	
Bausch	Emily	Critical and Crisis Communications Specialist	X	X
Behrent	Michael	Chair of Faculty Senate, Associate Professor	X	
Bell	Sharon	AVC Finance	X	X
Bosley	Carolyn	Leave Management Administrator	X	
Brown	Johnny	Campus Police Captain	X	
Dellinger Page	Amy	Professor of Sociology	X	
Dull	Matt	AVC Student Affairs	X	X
Earp	David	ITS Director		X
Eckman	John	AVC Campus Services	X	X

LAST NAME	FIRST NAME	TITLE	ATTENDED FIRST MEETING	ATTENDED SECOND MEETING
Farley	Ronnie	University Housing		X
Godwin	Denise	Risk Manager	X	X
Hughes	Craig	ITS		X
Kane	Tom	Director of University Housing	X	X
Katers	Nick	AVC Facilities	X	X
Love	Anthony	Research Operations Manager	X	
Marsh	Taylor	Watauga County Emergency Management		X
Marshburn*	Jason	EHS and EM Director	X	X
Miller	Angie	HR Manager		X
Rex	Art	Director of Space Management and Planning	X	
Sadler	Mallory	Chair of Staff Senate	X	
Trivette	Deb	Emergency Planner	X	X
Wilson	Heather			X

* Primary Point of Contact

January 22, 2020 – Project Kickoff Meeting

ESP Associates' Project Manager, Nathan Slaughter, 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 Campus Hazard Mitigation Planning Team and began by having attendees introduce themselves. The 17 attendees included faculty and staff from various departments at the University. 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 was managing the planning effort and had assigned ESP Associates, Inc. to manage the update.

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 on campus (buildings, infrastructure 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 a discussion about various mitigation techniques. He briefly explained the six different categories of mitigation techniques: emergency services, prevention, natural resource protection, structural projects, public education and awareness, and property protection. The attendees were then asked what types of mitigation projects would be needed the most at ASU if FEMA funding was available. Most attendees felt that emergency services activities would be most needed on the campus. This helped demonstrate how priorities in mitigation actions should be considered for the plan.

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

- Coordinate between the eight participating campuses to update the existing plan,
- Update the plan to demonstrate progress and reflect current conditions,
- Complete the update in a timely manner because the existing plan expired in October of 2017,
- Increase public awareness and education,
- Maintain grant eligibility for participating campuses, and
- Maintain compliance with State and Federal requirements.

Mr. Slaughter reviewed the list of participating campuses with the group. He also explained the project tasks to be accomplished. These included the planning process, risk assessment, capability assessment, mitigation strategy, mitigation action plan, and plain maintenance procedures.

He explained that the project as being managed by a Campus Hazard Mitigation Steering Committee that had one representative from each of the eight campuses. For Appalachian State University, that representative was Jason Marshburn, EM Director. He explained that the group currently in the room would be known as the Campus Hazard Mitigation Planning Team.

Mr. Slaughter explained that this update would expand the scope of the plan to not only address natural hazards, as was previously done for the existing plan, but that it would also address manmade/technological hazards as well. This was done to ensure alignment with the State of North Carolina's Hazard Mitigation Plan.

Mr. Slaughter explained that the plan would address campus vulnerability, where feasible, to identify specific types and numbers of campus assets that are at risk to the identified hazards. He said that an attempt would be made to address other types of vulnerability as well to include social, economic and environmental vulnerabilities.

He then discussed the capability assessment and how the plan would include a discussion on the University's capability to address their hazard vulnerability through mitigation. Next, he discussed the mitigation strategy and explained how that section of the plan would be reviewed and updated as required by FEMA.

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

Mr. Slaughter then reviewed the roles and responsibilities of ESP Associates, Inc, the campus leads and stakeholders. The presentation concluded with a discussion of the next steps to be taken in the project development. He explained that a Hazard Mitigation Public Survey was being developed and that it would be distributed soon. The next campus HMPT meeting was discussed and would be held sometime in the Spring or Summer of 2020. The purpose of the second meeting would be to discuss the findings of the risk and capability assessments and to begin updating existing mitigation actions and identify new goals.

January 14, 2021 – Mitigation Strategy Meeting – Online Meeting (Zoom)

Following a hiatus in the planning process caused by the onset, response and initial recovery from the COVID 19 pandemic, the ASU Campus Hazard Mitigation Planning Team held an online Mitigation Strategy Meeting on January 14, 2021.

Mr. Slaughter began the meeting with brief introductions and an overview of the agenda for the day. He provided a brief refresher on the definition of mitigation and a recap of the Disaster Mitigation Act of 2000, the key objectives of the project and the project schedule (which remained somewhat delayed because of the COVID-19 pandemic, but still on track for completion of the final plan).

He then began providing more detailed information about the hazards that impact the University. He started by recapping the number of hazard events experienced since the previous plan and discussed the presidential disaster declarations that have been experienced since the previous update. These included two declarations for severe storms, flooding, landslides and mudslides and the COVID-19 pandemic. He provided summary stats and slides for the following hazards: drought, hail, hurricanes and tropical storms, lightning, severe thunderstorms, tornadoes, flood, wildfire, winter storms and freeze, dam failure, earthquake, landslides, excessive heat, hazardous materials incident, public health hazards/infectious disease, cyber nuclear power plants, electromagnetic pulse and terrorism.

Mr. Slaughter provided an overview of the Priority Risk Index. The PRI is a quantitative scoring of hazards which is used to focus in on the hazards of greatest concern for the University. Using the PRI, the following hazards were considered the be highest risk for the University: severe winter weather, infectious disease and flooding.

There was some discussion about how the recent earthquake in Sparta had required some electrical systems to be reset. Also, there was mention of areas of potential localized land sliding around the stadium, the old high school and the new track. The Campus Hazard Mitigation Planning Team as a whole endorsed the elevation of cyber attacks as a high risk hazard for the University.

Following the hazard identification and PRI review, Mr. Slaughter reviewed the listing of key assets from the prior plan and discussed the need to update that ranking. He also mentioned that social vulnerability would be included in the plan to some extent and he presented slides on social vulnerability for Watauga County.

There was also a brief discussion about the capability assessment that would be included in the plan for the University. He mentioned how that assessment would be conducted and what it would try to capture (administrative, technical, fiscal, and political capabilities of the University).

University staff indicated that several million dollars of work has been done on campus to mitigate flooding. Examples include removal of obstructions and daylighting the creek. New buildings in the floodplain have foundations that are above the BFE

The remainder of the meeting was spent discussing the Mitigation Strategy. Mr. Slaughter gave an overview of the process for updating the Mitigation Strategy and presented the existing mitigation goals for the UNC Western Campuses regional plan. He asked the ASU Campus 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 goals were no longer relevant and new goals and associated objectives were developed, voted upon and accepted. It should be noted that these goals and objectives also align with those found in the UNC Eastern Campuses Hazard Mitigation Plan.

Mr. Slaughter then indicated that Campus Hazard Mitigation Planning Team would need to provide a status update for their existing mitigation actions (completed, deleted, or deferred) and a brief discussion of how that determination was made. Mr. Slaughter also discussed the Mitigation Action Worksheets to be completed for any new mitigation actions. Mr. Slaughter then presented sample mitigation actions for the committee members to consider to include in their plan update.

Mr. Slaughter mentioned the need to conduct public outreach measures to meet FEMA requirements and indicated that a public survey would be sent out soon and an online public meeting for the entire UNC Western Campuses region would be conducted before the plan was finalized.

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

Involving the Public

Because this plan update was developed during the COVID-19 pandemic, the planning teams had to get creative in order to solicit feedback from the public about the plan and their thoughts on hazard mitigation. A public survey instrument was developed to provide an opportunity for the public to provide comment on their concerns about hazard impacts on the campuses and their thoughts on how mitigation could help reduce vulnerability. The public survey was distributed by each campus through different means to outreach to faculty, staff and students.

For Appalachian State University, 84 public survey responses were received and the results from those surveys were shared with the Campus Hazard Mitigation Planning Team. Feedback from the surveys was reviewed and considered for inclusion in this plan, as applicable, where determined to be relevant. A summary of the responses can be found in **Appendix B** and detailed survey responses can be obtained through North Carolina Emergency Management, Hazard Mitigation Planning staff.

A.2 Campus Profile

This section of the plan provides a general overview of the Appalachian State University Campus and surrounding area.

A.2.1 Geography and the Environment

Appalachian State University is located in northwestern North Carolina in the city of Boone. The campus has an elevation of 3,333 feet. Appalachian's campus covers almost 1,300 acres which includes the 411-acre main campus and several outlying properties such as Camp Broadstone. The main campus consists of residence halls, academic buildings, athletic and recreational facilities, libraries, a conference center, student apartments, auditoriums, and research centers. Located off campus are the physical plant, the Dark Sky Observatory, and other recreational areas. An orientation map of Appalachian State University can be seen in **Figure A.1** and a map of the main-campus can be seen in **Figure A.2.**

FIGURE A.1: APPALACHIAN UNIVERSITY LOCATOR MAP

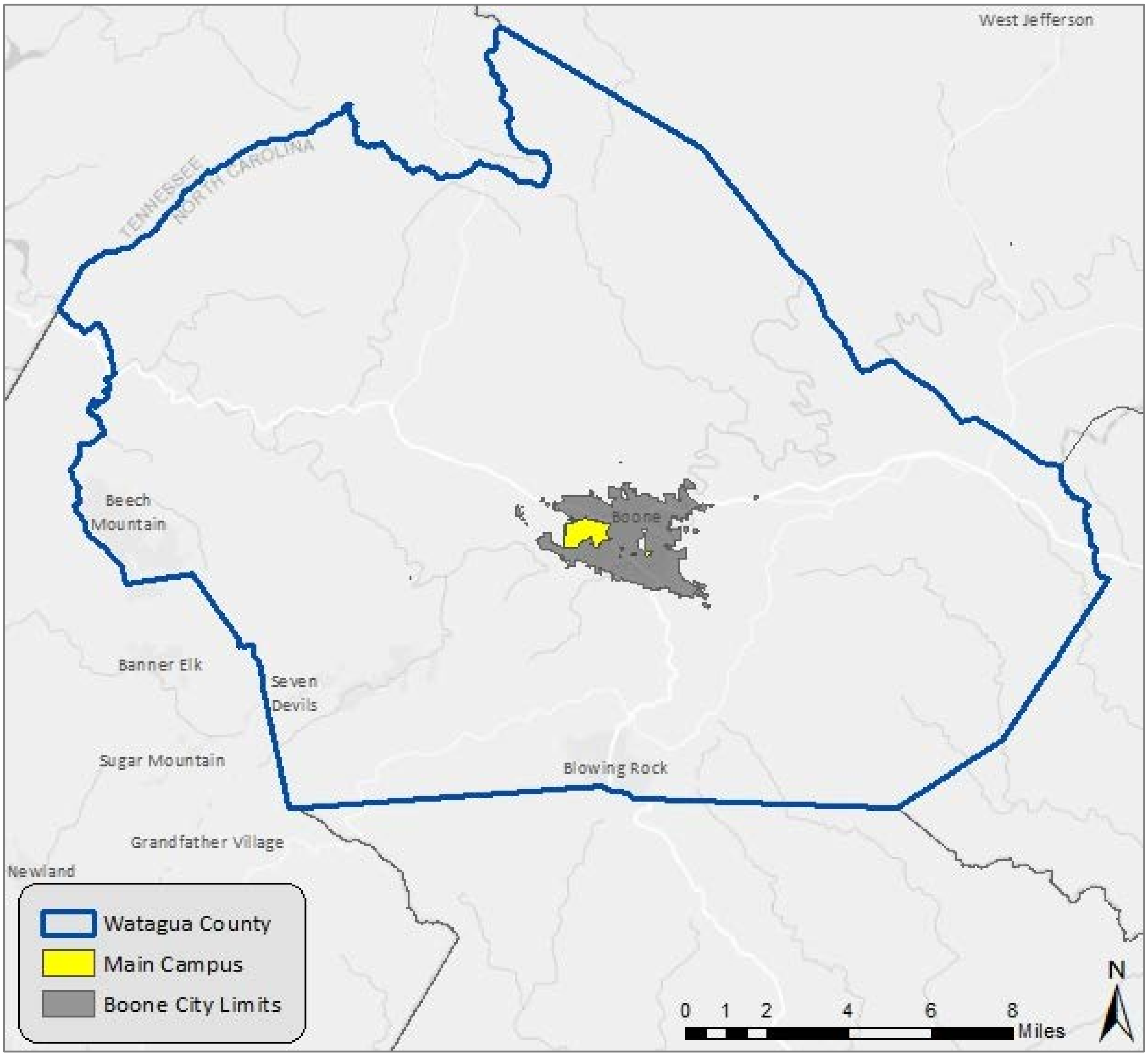
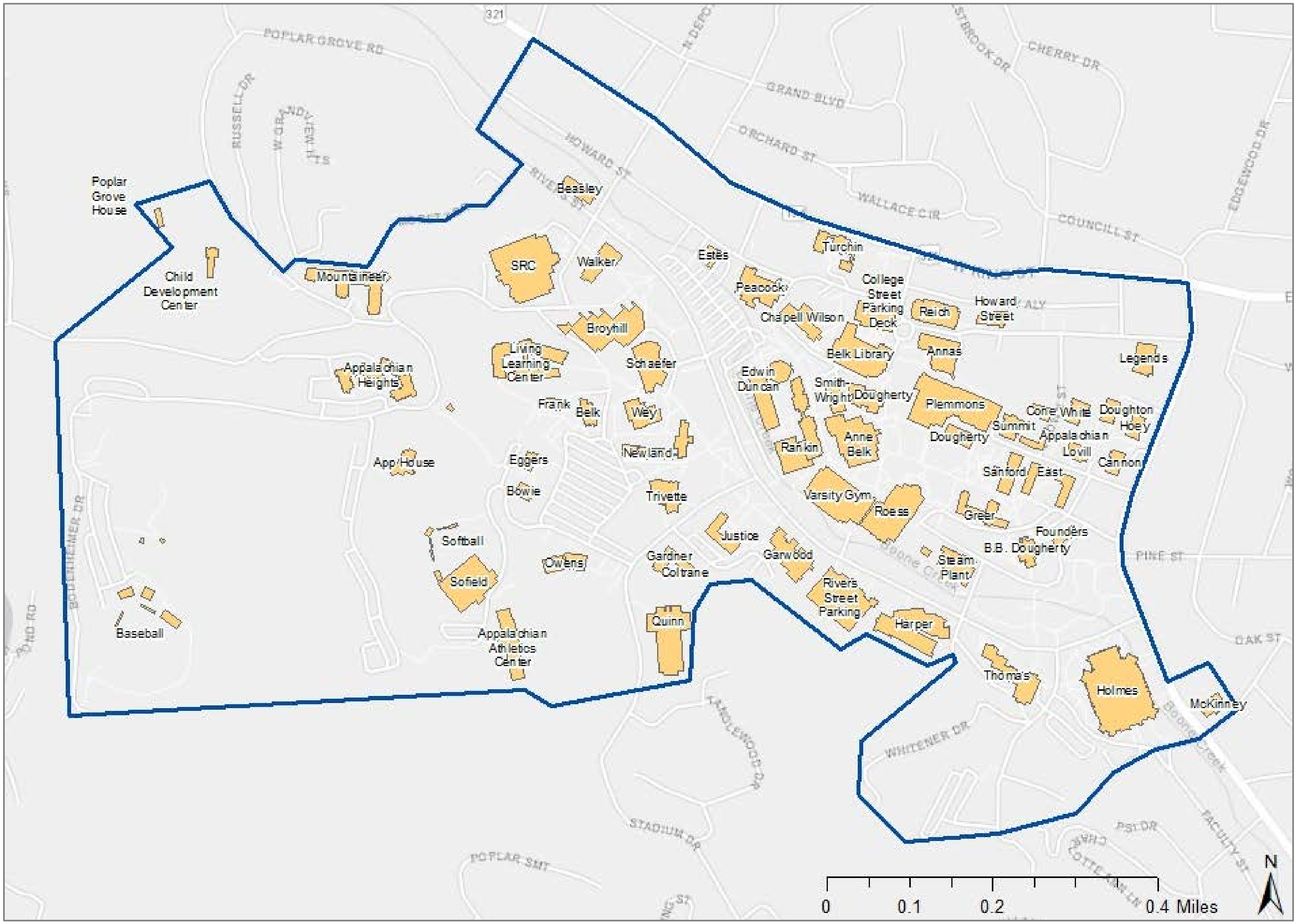


FIGURE A.2 MAIN CAMPUS MAP



Being located in the Blue Ridge Mountains, the climate of Boone is a relatively cooler than the rest of North Carolina. During the summer months, the average high temperature in Boone is 74.8 °F and conditions are considerably less humid than in other parts of North Carolina. Winters are typically longer, harsher, and colder, with frequent sleet and snowfall, and occasional blizzard-like conditions. The average low temperature in winter is 23.6 °F. Boone on average receives 39.8 inches of snowfall annually, which is far higher than the average in the rest of the North Carolina. The annual average of rainfall in Boone is 56 inches. However, approximately 200 days out of the year are sunny. The monthly averages for Boone are presented in **Table A.2**.

TABLE A.2 MONTHLY AVERAGES FOR BOONE, NORTH CAROLINA

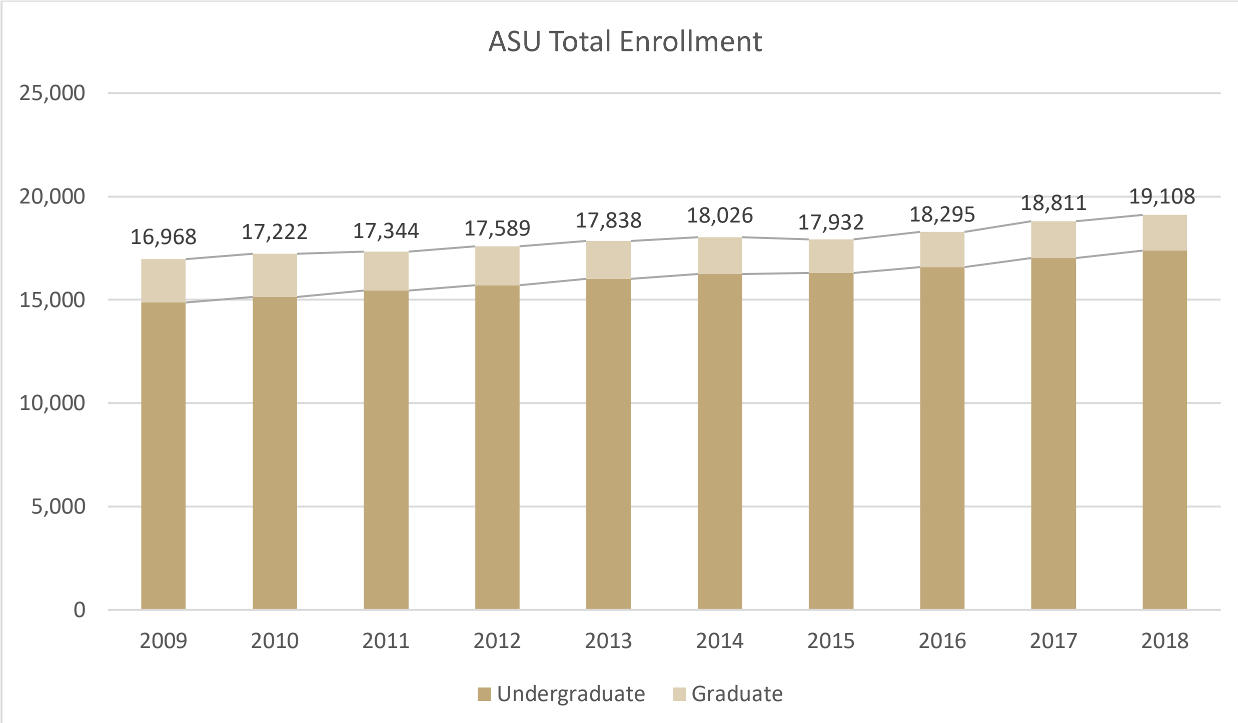
Month	Average High	Average Low	Average Precipitation
January	39 °F	20 °F	3.97 in.
February	43 °F	22 °F	4.14 in.
March	50 °F	29 °F	5.18 in.
April	59 °F	38 °F	4.70 in.
May	67 °F	47 °F	4.87 in.
June	73 °F	55 °F	4.58 in
July	76 °F	59 °F	4.69 in.
August	75 °F	57 °F	4.83 in.
September	70 °F	50 °F	3.81 in.
October	62 °F	38 °F	3.17 in.
November	52 °F	30 °F	4.38 in.
December	44 °F	22 °F	3.21 in.

Source: National Weather Service

A.2.2 Population and Demographics

As of fall 2019, Appalachian State University has a total enrollment of 19,280 students. This includes 17,518 undergraduate students and 1,762 graduate students. Enrollment has increased by 13% since 2009, demonstrating the university's growth since the last hazard mitigation plan was created. The enrollment trends over the past ten years can be seen in **Figure A.3.**

FIGURE A.3 ENROLLMENT TOTALS



Source: UNC System – Interactive Data Dashboards

For a breakdown of enrollment demographics please see **Table A.4** below.

TABLE A.4 ENROLLMENT DEMOGRAPHICS (2018)

Race/Ethnicity	Enrollment (Fall 2018)	Percentage
White	15,839	82.9%
Hispanic or Latino	1,160	6.1%
Black or African American	696	3.6%
Two or More Races	683	3.6%
Asian	309	1.6%
Nonresident Alien	153	0.8%
American Indian or Alaska Native	52	0.3%
Native Hawaiian or Other Pacific Islander	14	0.1%
Unknown	202	1.1%

Source: UNC System – Interactive Data Dashboards

A.3 Asset Inventory

An inventory of assets was compiled to identify the total count and value of property exposure on the ASU campus. This asset inventory serves as the basis for evaluating exposure and vulnerability by hazard. Assets for analysis include buildings, critical facilities, and critical infrastructure.

A.3.1 Building Inventory

This section provides total building exposure for the campus, which was estimated by summarizing building footprints provided by North Carolina Emergency Management and property values derived from 2020 insurance assessment data. According to that data, there are 139 buildings associated with Appalachian State University totaling a value of $2,148,608,424 (building and contents).

A.3.2 Critical Buildings and Infrastructure Exposure

Of significant concern with respect to any disaster event is the location of critical facilities and infrastructure in the planning area. Critical facilities are those essential services and lifelines that, if damaged during and emergency event, would disrupt campus continuity of operations or result in severe consequences to public health, safety, and welfare.

Critical buildings are a subset of the total building exposure and were identified by ASU's HMPC representatives. The ASU HMPC updated the list of critical facilities from the previous DRU plan and ranked each facility on a set of standardized criteria designed to evaluate all critical buildings in the UNC System DRU plans. Factors considered for this ranking included:

- the building's use for emergency response,
- the building's use for essential campus operations
- the building's use as an emergency shelter or for essential sheltering services,
- the presence of a generator or generator hook-ups,
- the building's use for provision of energy, chilled water or HVAC for sensitive or essential systems,
- the storage of hazardous materials,
- the building's use for sensitive research functions,
- the building's cultural or historical significance, and
- building-specific hazard vulnerabilities

Figure A.4 below shows the scoring sheet that the ASU Campus Mitigation Planning Team used to rate critical buildings on campus. All of the campuses in the UNC system used to same scoring methodology for consistency.

FIGURE A.4: CRITICAL BUILDING SCORING WORKSHEET

Critical Building Scoring Worksheet

Campus:
Facility Name:

		Score
1	Does the facility serve as the campus Emergency Operations Center (EOC)? Yes, Primary EOC = 6 pts Yes, Secondary EOC = 3 pts No = 0 pts	0
2	Does the facility house functions essential to campus operations? Main Telecommunication Center = 3 pts; Maintenance = 1 pt Computer Network Hub = 3 pts; Public Safety = 1 pt Adminstrative Operations = 1 pts	0
3	Is the facility equiped with a generator or hook-ups? Generator = 3 pts Hook-ups = 1 pt Neither = 0 pts	0
4	Does the facility serve as a pre or post disaster shelter? Both pre and post disaster shelter = 6 pts Either pre or post disaster shelter = 3 pts Neither = 0 pts	0
5	Does the facility provide services essential to sheltering? Resident Housing = 1 pt; Food Preperation Facility = 1 pt Assesmbly Space = 1 pt; Shower Facilities = 1 pt	0
6	Does the facility provide chilled water distribution or contain HVAC systems necessary to sensitive or essential systems? Yes = 3 pts No = 0 pts	0
7	Are there hazardous materials on-site? (greater than 25 gallons) Yes = 3 pts No = 0 pts	0
8	Does the facility house research functions that have a low level of tolerance for disruption? Yes = 2 pts No = 0 pts	0
9	Does the facility serve as storage for rare or unique collections (art, artifacts, letters, etc) or is it a historically or culturally significant building? Yes = 2 pts No = 0 pts	0
10	Does the facility have hazard specific vulnerabilities (basement susceptible to flood, etc.) Yes = 3 pts No = 0 pts	0
Notes/ Comments		

Total Score:	0
Total Possible Score:	**42**

The identified critical facilities for ASU, as scored by the ASU Campus Hazard Mitigation Planning Team are listed below:

- Carol Grotnes Belk Library
- George M. Holmes Convocation Center
- Mary S. Shook Health Services Center
- Water Treatment Plant
- New River Light & Power
- Steam Plant
- Plemmons Student Union
- Roess Dining Hall
- Data Centers (State Farm and Peacock Hall)

A.4 Hazard Identification

This section describes how the regional planning committee identified the hazards to be included this plan

A.4.1 Hazard Identification

Upon a review of the full range of natural hazards suggested under FEMA planning guidance, the Campus Hazard Mitigation Planning Team identified a number of hazards that are to be addressed in its Hazard Mitigation Plan. These hazards were identified through a process that utilized input from the Campus Hazard Mitigation Planning Team, research of past disaster declarations in the surrounding county, and review of the previous ASU Pre-Disaster Mitigation Plan. To maintain consistency, the Multi-Campus Hazard Mitigation Steering Committee and the Campus Hazard Mitigation Planning Teams voted to assess the same hazards that were identified in the most recent update of the North Carolina State Hazard Mitigation Plan. Therefore, since the development of the previous plan, the hazard identified and included in the plan have changed. A list of all previous hazards covered in the previous Appalachian State University Pre-Disaster Mitigation Plans are viewable in **Table A.5**, 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.

TABLE A.5: 2021 APPALACHIAN STATE UNIVERSITY HAZARDS UPDATE

2010 Appalachian State University Identified Hazards		**2021 Appalachian State University Identified Hazards**		**Description of hazards covered in 2021 Plan and Explanations**
Atmospheric Hazards	Drought	**Natural Hazards**	Drought	Agricultural Drought, Hydrological Drought
	Driving Rain			
	Other High Wind events			
	Hurricane		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

2010 Appalachian State University Identified Hazards		2021 Appalachian State University Identified Hazards		Description of hazards covered in 2021 Plan and Explanations
	Tornado		Tornadoes/Thunderstorms	Hailstorm, Torrential Rain associated with Severe Thunderstorms, Thunderstorm Wind, Lightning, Waterspout, High Wind
	Electrical Storm			
	Severe Winter Weather, including ice or snow events		Severe Winter Weather	Freezing Rain, Snowstorms, Blizzards, Wind Chill, Extreme Cold
Hydrologic Hazards			Dam Failures	
	Flood		Flooding	
Geologic Hazards	Earthquake		Earthquakes	
	Landslide, Rockslide, and other Geologic		Geological	Landslides, Sinkholes, Erosion
Other Hazards	Wildfire or Building Fire	**Other Hazards**	Wildfires	
	Animal borne and other Infectious Diseases		Infectious Disease	
	Accidental Explosion	**Technological Hazards**		
			Hazardous Substances	Hazardous Materials, Hazardous Chemicals, Oil Spill
			Terrorism	Chemical, Biological, Radiological, Nuclear, Explosive
			Cyber	
			Electromagnetic Pulse	

A.4.2 Disaster Declarations

Disaster declarations provide insight into the hazards that may impact Appalachian State University. **Table A.6** shows every declared presidential disaster to impact Watauga County since 1973. There have been thirteen total disaster declarations in Watauga County since 1973.

TABLE A.6: WATAUGA COUNTY DISASTER DECLARATIONS

Year	Disaster Number	Description	Watauga County
1973	394	SEVERE STORMS & FLOODING	X
1977	542	SEVERE STORMS & FLOODING	X
1989	844	HURRICANE HUGO	X
1995	1073	SEVERE STORMS, FLOODING, HIGH WINDS	X
1996	1087	BLIZZARD OF '96	X
1996	1103	WINTER STORM	X
1998	1200	SEVERE STORMS AND FLOODING	X
2004	1553	HURRICANE IVAN	X
2004	1546	TROPICAL STORM FRANCES	X

2010	1871	SEVERE WINTER STORMS & FLOODING	X
2013	4146	SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES	X
2013	4153	SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES	X
2020	4487	COVID-19 PANDEMIC	X

A.4.3 Summary of Hazard Impacts Since Previous Plan

Since the approval of the previous Appalachian State University Pre-Hazard Mitigation Plan (June 30th, 2010), there have been 197 hazard events recorded for the planning area in the National Centers for Environmental Storm Event Database. It is important to take note of those hazard events and consider them in the *Hazard Identification* section to help ensure that the appropriate hazards are being considered in the risk assessment sections in the Mitigation Strategy. **Table A.7** documents the hazard events recorded.

TABLE A.7: SUMMARY OF HAZARD EVENTS SINCE PREVIOUS PLAN

Hazard Type*	Number of Reported Events in Watauga County
Cold/Wind Chill	1
Flash Flood	45
Flood	25
Hail	28
Heavy Snow	10
High Wind	42
Lightning	1
Strong Wind	6
Thunderstorm Wind	19
Tornado	0
Tropical Storm	0
Winter Storm	16
Winter Weather	4
TOTAL NUMBER OF REPORTED EVENTS	197

* The hazard type names that NCEI uses are different than the names of hazards used in this plan; however, one can still get an understanding of the types of hazards that impact the region as the hazard types are similar in name.

A.4.4 Hazard Evaluation

Table A.8 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 furthered 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 further evaluations and updates of the risk assessment if deemed necessary by the University Core Planning Team and the University Campus Core Committee during the plan update process.

TABLE A.8: 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?
NATURAL HAZARDS			
Avalanche	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of the NC State Hazard Mitigation Plan • Review of the previous Appalachian State University Pre-Disaster Mitigation Plan • Review of US Forest Service National Avalanche Center website	• The United States avalanche hazard is limited to mountainous western states including Alaska as well as some areas of low risk in New England. • Avalanche hazard was removed from the North Carolina State Hazard Mitigation Plan after determining the mountain elevation in Western North Carolina did have enough snow not to produce this hazard. • Avalanche is not included in the previous Appalachian State University Pre-Disaster Mitigation Plan.
Drought	**YES**	• Review of the NC State Hazard Mitigation Plan • Review of the North Carolina Drought Monitor website • Review of the previous Appalachian State University Pre-Disaster Mitigation Plan	• There are reports of drought conditions in nineteen out of the last nineteen years in Watauga County, according to the North Carolina Drought Monitor. • Droughts are discussed in NC State Hazard Mitigation Plan as a lesser hazard. • The NC State Hazard Mitigation Plan lists drought as a top hazard for the Mountain 2

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?
			Region which includes Watauga County.
Hailstorm	**YES (Assessed under Tornadoes/ Thunderstorms)**	• Review of NC State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NOAA NCEI Storm Events Database • Review of the previous Appalachian State University Pre-Disaster Mitigation Plan	• Hailstorm events are discussed in the state plan under the Severe Thunderstorm hazard. • NCEI reports 283 hailstorm events (0.75 inch size hail to 4.5 inches) for Watauga County between 1959 and 2018. For these events there was over $274,000 (2018 dollars) in property damages. • 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.
Excessive Heat	**No**	• Review of NOAA NCEI Storm Events Database • Review of the North Carolina State Hazard Mitigation Plan • Review of the previous Appalachian State University Pre-Disaster Mitigation Plan	• NCEI did not report any excessive heat event for Watauga county. • The NC State Hazard Mitigation Plan does identify excessive heat as a hazard that impacts the state but mentions that it does not significantly impact the NC mountains. • Extreme Heat was not addressed in the previous Appalachian State University Pre-Disaster Mitigation Plan.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Hurricane and Coastal Hazards	**YES**	• Review of NC State Hazard Mitigation Plan • Analysis of NOAA historical tropical cyclone tracks and National Hurricane Center Website • Review of NOAA • NCEI Storm Events Database • Review of historical presidential disaster declarations • Review of the previous Appalachian State University Pre-Disaster Mitigation Plan	• Hurricane and coastal hazard events are discussed in the state plan and are listed as a top hazard in the Mountain 2 Region which includes Watauga County. • NOAA historical records indicate 7 hurricane/coastal hazards have come within 25 miles of Appalachian State University since 1850. • Three out of thirteen disaster declarations in Watauga County are directly related to hurricane and costal hazard events. • The 50-year return period peak gust for hurricane and tropical storm events in Watauga County is between 63-68 mph. • Hurricane hazards were addressed in the previous Appalachian State University Pre-Disaster Mitigation Plan.
Lightning	**YES (Assessed under Tornadoes/Thunderstorms)**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of NOAA NCEI Storm Events Database, NOAA lightning statistics • Review of the previous Appalachian State University Pre-Disaster Mitigation Plan	• Lightning events are discussed in the state plan as part of the severe thunderstorm hazard. • NCEI reports 31 lightning events for Watauga County since 1996. These events have resulted in a recorded 8 injuries and nearly $2.2 million (2018 dollars) in property damage. • Given the damage and reported death and injuries, individual analysis is warranted.

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?
Nor'easter	**NO**	• Review of NC State Hazard Mitigation Plan • Review of the previous Appalachian State University Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database	• Nor'easters are discussed in the state plan however the mountains are considered to have low vulnerability to the hazard. • NCEI does not report any nor'easter activity for Watauga County. However, nor'easters may have affected the campus as severe winter storms. In this case, the activity would be reported under winter storm events. • Nor'easters were not addressed in the previous Appalachian State University Pre-Disaster Mitigation Plan.
Tornadoes/ Thunderstorm	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Appalachian State University Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations.	• Tornado events are discussed in the NC State Hazard Mitigation Plan. • NCEI reports 2 tornado events in Watauga County since 1996. These events have resulted in no recorded deaths and have caused 2 injuries and over $70,000 in property damage with the most severe being an F1. • Tornado events were addressed in the previous Appalachian State University Pre-Disaster Mitigation Plan.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Severe Thunderstorm	**YES (Assessed under Tornadoes/ Thunderstorms)**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Appalachian State University Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations.	• Severe thunderstorm events are discussed in the NC State Hazard Mitigation Plan. • NCEI reports 48 thunderstorm wind events in Watauga County since 1993. These events have resulted in 1 injury and $276,000 in property damage. • Severe thunderstorm events were addressed in the previous Appalachian State University Pre-Disaster Mitigation Plan.
Severe Winter Weather	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Appalachian State University Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations.	• Severe winter weather events, including snow storms and ice storms, are discussed in the state plan. • NCEI reports that Watauga County has been affected by 43 snow and ice events since 1993. • Three of the county's thirteen disaster declarations were directly related to winter storm events. • Winter storm events were addressed in the previous Appalachian State University Pre-Disaster Mitigation Plan.
Earthquakes	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan	• Earthquake events are discussed in the state plan. • Earthquakes were addressed in the previous Appalachian State

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?
		• Review of the previous Appalachian State University Pre-Disaster Mitigation Plan • Review of the National Geophysical Data Center USGS Earthquake Hazards Program website	University Pre-Disaster Mitigation Plan. • 12 events are known to have occurred in the region according to the National Geophysical Data Center. The greatest magnitude reported was a 4.3. In 2020, a strong earthquake in Sparta, NC was felt on campus. • According to USGS seismic hazard maps, the peak ground acceleration (PGA) with a 10% probability of exceedance in 50 years for the area is approximately 4%g. FEMA recommends that earthquakes be further evaluated for mitigation purposes in areas with a PGA of 3%g or more.
Expansive Soils	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Appalachian State University Pre-Disaster Mitigation Plan • Review of USDA Soil Conservation Service's Soil Survey	• Expansive soils are not included as a hazard in the State Plan. • According to FEMA and USDA sources, Appalachian State University is located in an area that has a "little to no" clay swelling potential. • The previous Appalachian State University Pre-Disaster Mitigation Plan did not identify expansive soils as a potential hazard.
Geological (Landslides, Sinkholes, Erosion)	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment	• Landslide/debris flow events are discussed in the state plan. • USGS landslide hazard maps indicate "high landslide

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?
		• Review of NC State Hazard Mitigation Plan • Review of the previous Appalachian State University Pre-Disaster Mitigation Plan • Review of USGS Landslide Incidence and Susceptibility Hazard Map • Review of the North Carolina Geological Survey database of historic landslides	incidence" (more than 15% of the area is involved in landsliding) is found in Watauga County. • Data provided by NCGS indicates that there have been many landslides in Watauga County. the • Geological hazards were addressed in the previous Appalachian State University Pre-Disaster Mitigation Plan.
Land Subsidence	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Appalachian State University Pre-Disaster Mitigation Plan	• The state plan delineates certain areas that are susceptible to land subsidence hazards in North Carolina; however, none of these areas are located in Watauga County. • Land Subsidence was not addressed in the previous Appalachian State University Pre-Disaster Mitigation Plan.
Tsunami	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Appalachian State University Pre-Disaster Mitigation Plan • Review of FEMA "How-to" mitigation planning guidance (Publication 386-2, "Understanding Your Risks –	• Tsunamis are discussed in the state plan but the mountains have no vulnerability to tsunamis. • Tsunamis were not addressed in the previous Appalachian State University Pre-Disaster Mitigation Plan. • No record exists of a catastrophic Atlantic basin tsunami impacting the mid-Atlantic coast of the United States.

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?
		Identifying Hazards and Estimating Losses).	• Tsunami inundation zone maps are not available for communities located along the U.S. East Coast. • 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.
Volcano	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of USGS Volcano Hazards Program website	• There are no active volcanoes in North Carolina. • There has not been a volcanic eruption in North Carolina in over 1 million years. • No volcanoes are located near Appalachian State University.
Dam Failure	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Appalachian State University Pre-Disaster Mitigation Plan • Review of North Carolina Division of Land Management website	• Dam failure is discussed in the state plan as a hazard of concern for Watauga County. • Of the 30 dams reported for Watauga County in the National Inventory of Dams, 18 are high hazard. (High hazard is defined as "where failure or mis operation will probably cause loss of human life.") • Dam failure was not addressed in the previous Appalachian State University Pre-Disaster Mitigation Plan.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Erosion	**YES (Referenced in Geological Hazards)**	• Review of NC State Hazard Mitigation Plan • Review of the previous Appalachian State University Pre-Disaster Mitigation Plan	• Riverine erosion is addressed in the previous Appalachian State University Pre-Disaster Mitigation Plan.
Flooding	**YES**	• Review of NC State Hazard Mitigation Plan • Review of historical disaster declarations • Review of NOAA NCEI Storm Events Database • Review of the previous Appalachian State University Pre-Disaster Mitigation Plan	• The flood hazard is thoroughly discussed in the state plan. • Ten of the County's thirteen Presidential Disaster Declarations were directly associated with flooding. • NCEI reports that Watauga County have been affected by 111 flood events since 1993. • Flooding was addressed in the previous Appalachian State University Pre-Disaster Mitigation Plan.
Storm Surge	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Appalachian State University Pre-Disaster Mitigation Plan • Review of NOAA • NCEI Storm Events Database	• Storm surge is discussed in the state plan under the hurricane hazard, however, the mountains are not vulnerable to storm surge. • Storm surge was not addressed in the previous Appalachian State University Pre-Disaster Mitigation Plan. • No historical events were reported by NCEI • Given the inland location of Appalachian State University,

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
			storm surge would not affect the area.
OTHER HAZARDS			
Wildfires	**YES**	• Review of NC State Hazard Mitigation Plan • Review of the previous Appalachian State University Pre-Disaster Mitigation Plan • Review of Southern Wildfire Risk Assessment (SWRA) Data • Review of the NC Division of Forest Resources website	• Wildfires occur in virtually all parts of the United States. Wildfire hazard risk will increase as low-density development along the urban/wildland interface increases. • Wildfires were not addressed in the previous Appalachian State University Pre-Disaster Mitigation Plan. • According to the North Carolina Division of Forest Resources, Watauga County experiences an average of 9 fires each year which burn a combined 140.44 acres.
Hazardous Substances	**YES**	• Review of the previous Appalachian State University Pre-Disaster Mitigation Plan	• Review of Pipeline and Hazardous Materials Safety Administration data indicates 16 HAZMAT incidents, which resulted in approximately $100,000 in property damage, in Watauga County. • EPA Toxic Release Inventory indicates that there are no Toxic Release Inventory (TRI) facilities in Watauga County. • This update assesses hazardous materials, hazardous chemicals, and oil spills under this hazard.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Infectious Disease	**YES**	• Review of the NC State Hazard Mitigation Plan.	• Infectious Disease is identified as a hazard in the state plan. • Although the previous ASU Pre-Disaster Mitigation Plan did not include infectious disease as a hazard, it is assessed in this update to maintain consistency with the NC State Hazard Mitigation Plan • Infectious Disease has caused one of the thirteen disaster declarations in Watauga County
TECHNOLOGICAL HAZARDS			
Terrorism	**YES**	• Review of previous mitigation plans in Appalachian State University • Review of local official knowledge	• Although the previous Appalachian State University Pre-Disaster Mitigation Plan did not include terrorism threat as a hazard, it is assessed in this update to maintain consistency with the NC State Hazard Mitigation Plan. • This hazard will assess chemical, biological, radiological, nuclear, and explosive terrorism events.
Radiological Emergency – Fixed Nuclear Facilities	**NO**	• Review of the previous Appalachian State University Pre-Disaster Mitigation Plan • Review of IAEA list of fixed nuclear power stations in the United States • Discussion with local officials about location of nuclear power stations	• Although radiological emergencies are not identified in any previous plans, local officials expressed a desire to address them in this plan • There are no nuclear facilities located within 50 miles of the Appalachian State University or Watauga County.

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?
Cyber	**YES**	• Review of NC State Hazard Mitigation Plan	• Changing future conditions encourage the assessment of the possibility of a cyber-attack with the increase in global technology
Electromagnetic Pulse	**YES**	• Review of NC State Hazard Mitigation Plan	• Changing future conditions encourage the assessment of the possibility of an electromagnetic pulse with the increase in global technology

A.5 Hazard Profiles, Analysis, and Vulnerability

This section includes detailed hazard profiles for each of the hazards identified in the Hazard Identification section as significant enough for further evaluation in the Appalachian State University Hazard Mitigation Plan. It contains the following subsections:

- A.5.1 Overview
- A.5.2 Drought
- A.5.3 Hurricane and Coastal Hazards
- A.5.4 Tornadoes/Thunderstorms
- A.5.5 Severe Winter Weather
- A.5.6 Earthquakes
- A.5.7 Geological
- A.5.8 Dam Failure
- A.5.9 Flooding
- A.5.10 Wildfires
- A.5.11 Infectious Disease
- A.5.12 Hazardous Substances
- A.5.13 Terrorism
- A.5.14 Cyber
- A.5.15 Electromagnetic Pulse
- A.5.16 Conclusions on Hazard Risk
- A.5.17 Final Determinations

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

A.5.1 OVERVIEW

This section includes detailed hazard profiles for each of the hazards identified in the Hazard Identification section as significant enough for further evaluation in the Appalachian State University 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 Campus Hazard Mitigation Planning Team as it relates to unique historical or anecdotal hazard information as it applies specifically for Appalachian State University.

After reviewing the list of assessed hazards from the previous plan, the Appalachian State University Campus Hazard Mitigation 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
  - 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
  - Terrorism
  - Cyber
  - Electromagnetic Pulse

Much of the information in this section begins with a review of how the hazards impact Watauga County because that is the level at which the most readily-available and best-available information is provided. Where feasible, County-level information is supplemented with campus-specific details.

Natural Hazards

A.5.2 DROUGHT

A.5.2.1 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, 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. It is also notable that drought conditions typically do not cause significant damage to the built environment.

A.5.2.2 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 A.9.**

TABLE A.9: 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 NOAA, Watauga County has had drought occurrences in six of the last twenty-five years (1995-2019) (**Table A.10**). It should be noted that the North Carolina Drought Monitor also estimates what percentage of the county is in each classification of drought severity. For example, the most severe classification reported may be exceptional, but a majority of the county may actually be in a less severe condition.

TABLE A.10: SUMMARY OF DROUGHT OCCURRENCES IN WATAUGA COUNTY (1995-2019)

Year	Months of Recorded Drought	Event Details
1998	4	Dry conditions started in July, subsided in August, started again in September, and continued through most of November. In most areas, crops were damaged or destroyed. Water levels in creeks, streams, rivers, and lakes were fairly low. Water levels in some shallow wells were low.
1999	3	Dry conditions that began in July of 1998, subsided for several months during the later part of 1998 and the first part of 1999, returned in June of 1999 and continued in many areas through early September. In many areas, crops were damaged or destroyed. Water levels in creeks, streams, and rivers were very low. The drought

		ended in most areas with the arrival of heavy rain from the remnants of hurricane Dennis on the 4th and 5th of September.
2007	6	Significant rainfall deficits led to drought conditions across the northwest mountains of NC, peaking at an extreme D4 drought level in October. Crop and livestock losses were significant, and the governor urged citizens to conserve water.
2008	12	The drought conditions seen in 2007 continued into 2008. Rainfall in April along with rain from Tropical Storm Fay in August helped to mitigate drought conditions, though the drought conditions continued in Watauga County through the year.
2016	2	It was extremely dry for most of November and only a late month rainfall event prevented a record or near-record dry month. Drought conditions into December until rainfall early in the month ended the drought.
2019	1	Parts of northwest North Carolina began to experience dry conditions during the mid-summer month. These dry conditions were aggravated by an early October heat wave with numerous records or near-record highs occurred from October 1st through 4th which propelled the county into drought conditions.

Source: NOAA, Storm and Weather Events Database

A.5.2.3 Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of Watauga County, including the Appalachian State University campus, 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[1].

[1] *U.S. Seasonal Drought Outlook. National Weather Service Climate Prediction Center. http://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php*

A.5.3 HURRICANE AND COASTAL HAZARDS

A.5.3.1 Location and Spatial Extent

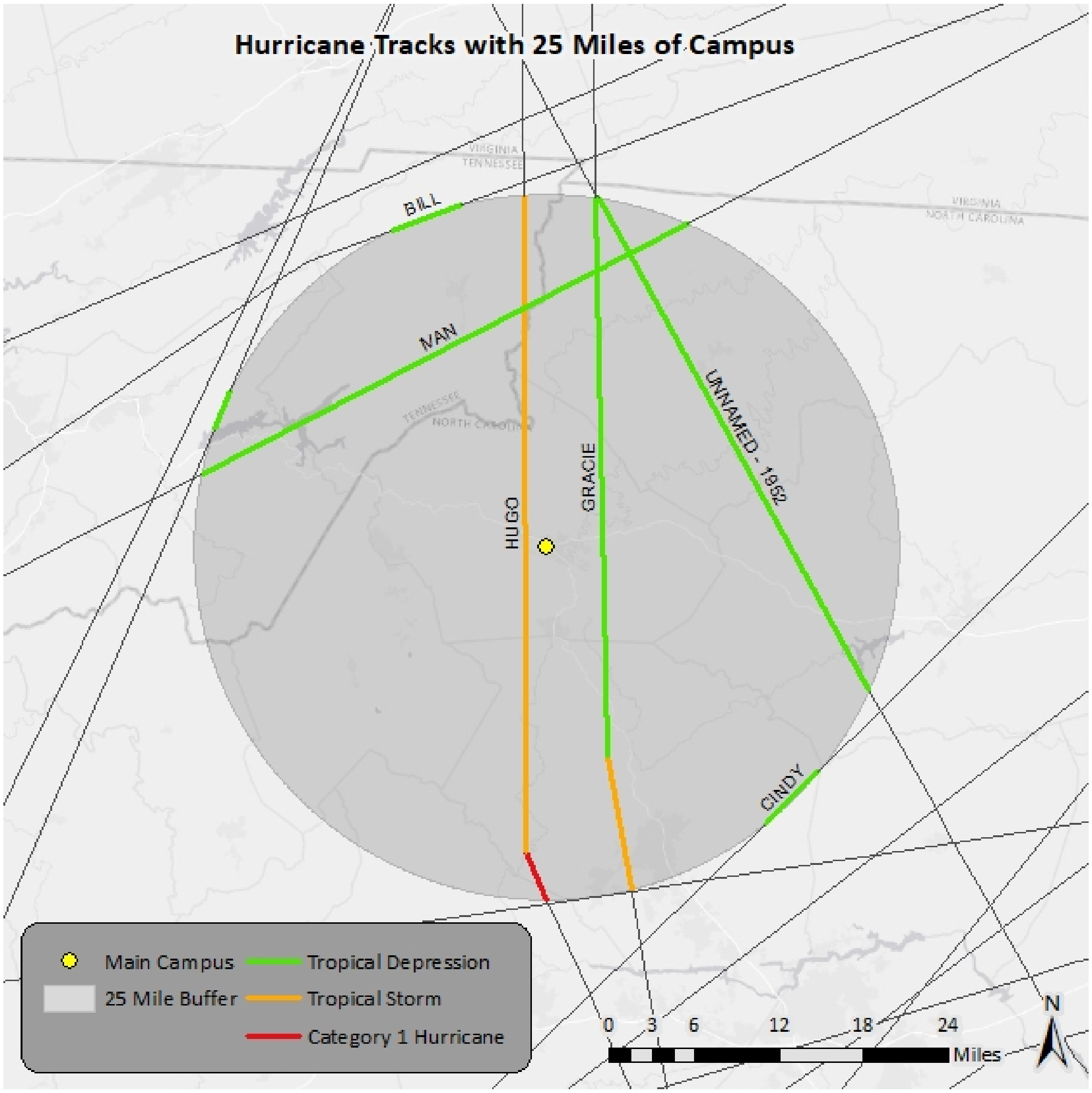
Hurricanes, coastal hazards, and tropical storms threaten the entire Atlantic and Gulf seaboard of the United States. While coastal areas are most directly exposed to the brunt of landfalling storms, their impact is often felt hundreds of miles inland and they can affect the Appalachian State University Campus.

A.5.3.2 Historical Occurrences

According to the National Hurricane Center's historical storm track records, 7 hurricane or tropical storm tracks have passed within 25 miles of ASU's campus since 1850[2]. This includes 5 tropical depressions, 1 tropical storm, and 1 category 1 hurricane. These storm events are shown in **Figure A.11.** Furthermore, **Table A.11** provides for each event the date of occurrence, name (if applicable), maximum wind speed (as recorded within 25 miles of Watauga County) and Category of the storm based on the Saffir-Simpson Scale.

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

FIGURE A.17: HISTORICAL HURRICANE STORM TRACKS WITHIN 25 MILES OF APPALACHIAN STATE UNIVERSITY



Source: National Oceanic and Atmospheric Administration; National Hurricane Center

TABLE A.11: HISTORICAL STORM TRACKS WITHIN 25 MILES OF APPALACHIAN STATE UNIVERSITY (1901–2018)

Year	Storm Name	Maximum Wind Speed (knots)	Storm Category
1901	UNNAMED	35	Tropical Depression
1952	UNNAMED	30	Tropical Depression
1959	GRACIE	45	Tropical Storm
1989	HUGO	85	Cat 1 Hurricane
2003	BILL	20	Tropical Depression
2004	IVAN	20	Tropical Depression
2005	CINDY	20	Tropical Depression

Source: National Hurricane Center

The National Centers for Environmental Information did not record any hurricane or tropical storm events in Watauga County between 1950 and 2018. Hurricane and tropical storm events have caused 5 presidential disaster declarations in Watauga County. While these were not recorded in the database, effects from these types of storms were likely still felt in other hazards, including thunderstorms and flooding. Flooding is generally the greatest hazard of concern with hurricane and tropical storm events in the area near Appalachian State University. 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.

A.5.3.3 Probability of Future Occurrences

Given the inland location of the campus, it is more likely to be affected by remnants of hurricane and tropical storm systems (as opposed to a major hurricane) which may result in flooding or high winds. The probability of being impacted is less than coastal areas, but still remains a real threat to Appalachian State University due to induced events like flooding and land sliding. Based on historical evidence, the probability level of future occurrence is possible (between 1 and 10 percent annual probability). However, when the area is impacted, the damage could be severe, threatening lives and property on campus.

A.5.4 TORNADOES/THUNDERSTORMS

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

A.5.4.1 Location and Spatial Extent

Tornadoes

Tornadoes occur throughout the state of North Carolina, and thus in the area surrounding Appalachian State University. 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 area surrounding the Appalachian State University campus 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 Appalachian State University typically experiences several straight-line wind events each year. These wind events can and have caused significant damage. It is assumed that the area surrounding the Appalachian State University campus 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 all of the area surrounding the Appalachian State University campus is uniformly exposed to severe thunderstorms; therefore, the campus itself is also 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 area surrounding the Appalachian State University campus is uniformly exposed to lightning.

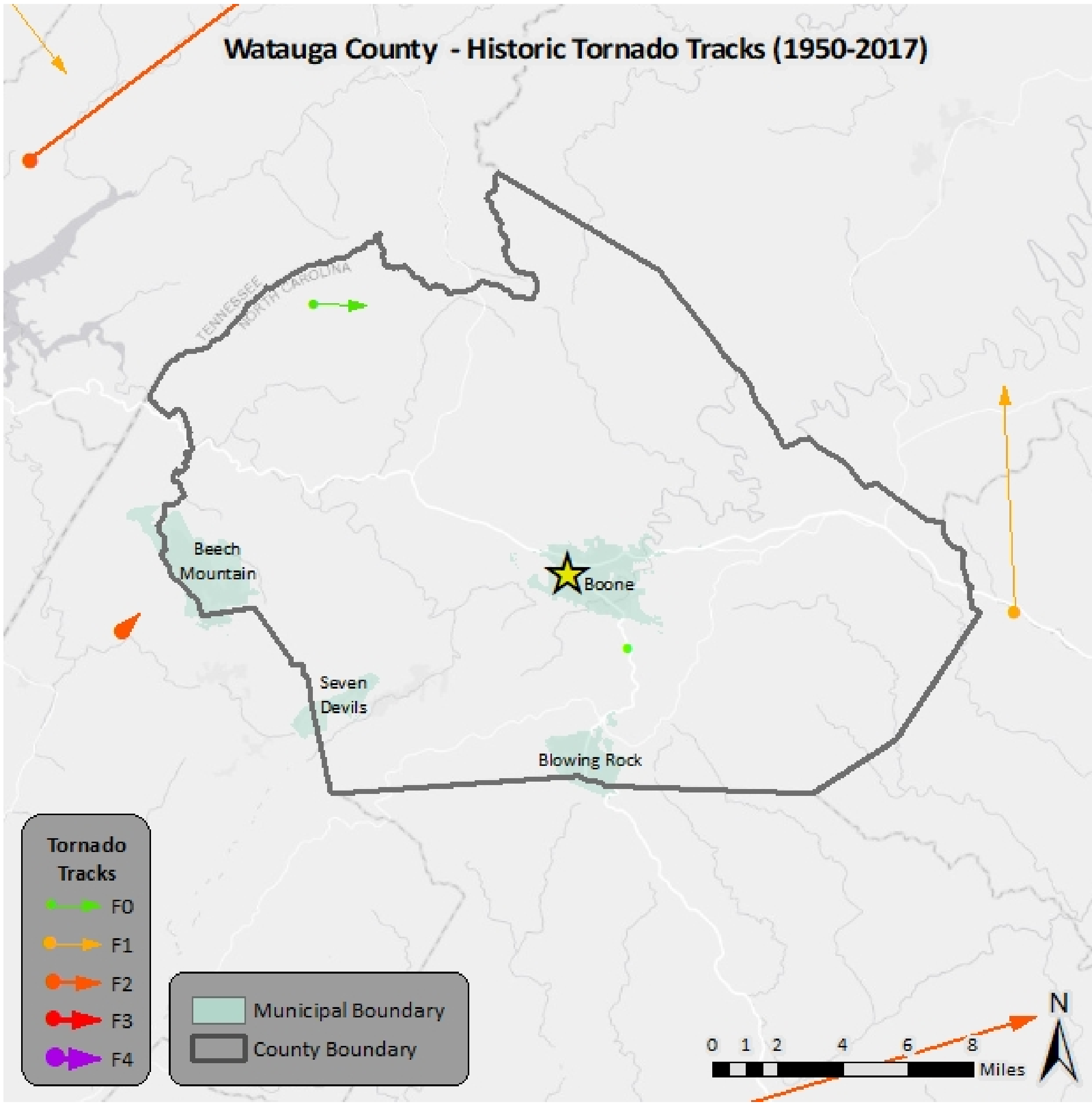
A.5.4.2 Historical Occurrences

Tornadoes

Tornadoes are a somewhat rare occurrence; however, they have and do occur in the area. According to the National Centers for Environmental Information, there have been 2 recorded tornado events in Watauga County since 1950 (**Table A.12**), resulting in over $70 thousand in property damages[3]. In addition, 1 death and 30 injuries were reported. The magnitude of these tornadoes ranges from F0 to F1 in intensity, although an F5 event is possible but not likely. 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. **Figure A.18** shows a map of tornado impact in Watauga County.

[3] 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 Watauga County. As additional local data becomes available, this hazard profile will be amended.

FIGURE A.18: TORNADO TRACKS IN WATAUGA COUNTY (1950 – 2017)



Source: National Centers for Environmental Information

TABLE A.12: HISTORICAL TORNADO IMPACTS IN WATAUGA COUNTY

Location	Date	Magni-tude	Deaths/ Injuries	Property Damage*	Details
Boone	04/20/1996	F1	0/2	$50,000	A tornado briefly touched down at 1300 EST approximately 3 miles southeast of Boone at an amusement park. The tornado damaged 16 vehicles and injured two people. The tornado ripped the car door off of one vehicle. In addition, a man broke a rib after being lifted into the air by the tornado and then dropped. Several vehicles were turned around by the tornado.
Zionville	6/03/1998	F0	0/0	$20,000	A tornado from five and a half miles west to three and a half miles west Zionville in the western part of Watauga County destroyed a few barns and toppled trees and tree limbs causing power outages.

Thunderstorms

According to NCEI, there have been 48 reported thunderstorm and high wind events since 1957 in Watauga County[4]. These events caused over $276 thousand (2019 dollars) in damages. There were reports of one injury. **Table A.13** summarizes this information.

TABLE A.13: HISTORICAL THUNDERSTORM IMPACTS IN WATAUGA COUNTY

Location	Date	Deaths/Injuries	Property Damage
Boone	4/15/1993	0/0	$9,010
Blowing Rock	8/18/1995	0/0	$0
Boone	3/5/1997	0/0	$0
Boone	3/5/1997	0/0	$32,303
Boone	6/13/1997	0/0	$3,230
Zionville	6/13/1997	0/0	$0
Matney	8/17/1997	0/0	$0
Zionville	6/3/1998	0/0	$0
Meat Camp	6/3/1998	0/0	$0
Boone	11/25/1998	0/0	$0
Boone	7/8/2001	0/0	$0
Boone	5/26/2004	0/0	$0
Boone	5/26/2004	0/0	$0
Bethel	5/26/2004	0/0	$0
Triplett	5/26/2004	0/0	$0
Boone	5/31/2004	0/0	$0
Blowing Rock	5/31/2004	0/0	$0
Boone	5/31/2004	0/0	$0
Sands	4/2/2006	0/0	$3,888
Boone	4/25/2006	0/0	$19,438

[4] 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 Watauga County. As additional local data becomes available, this hazard profile will be amended.

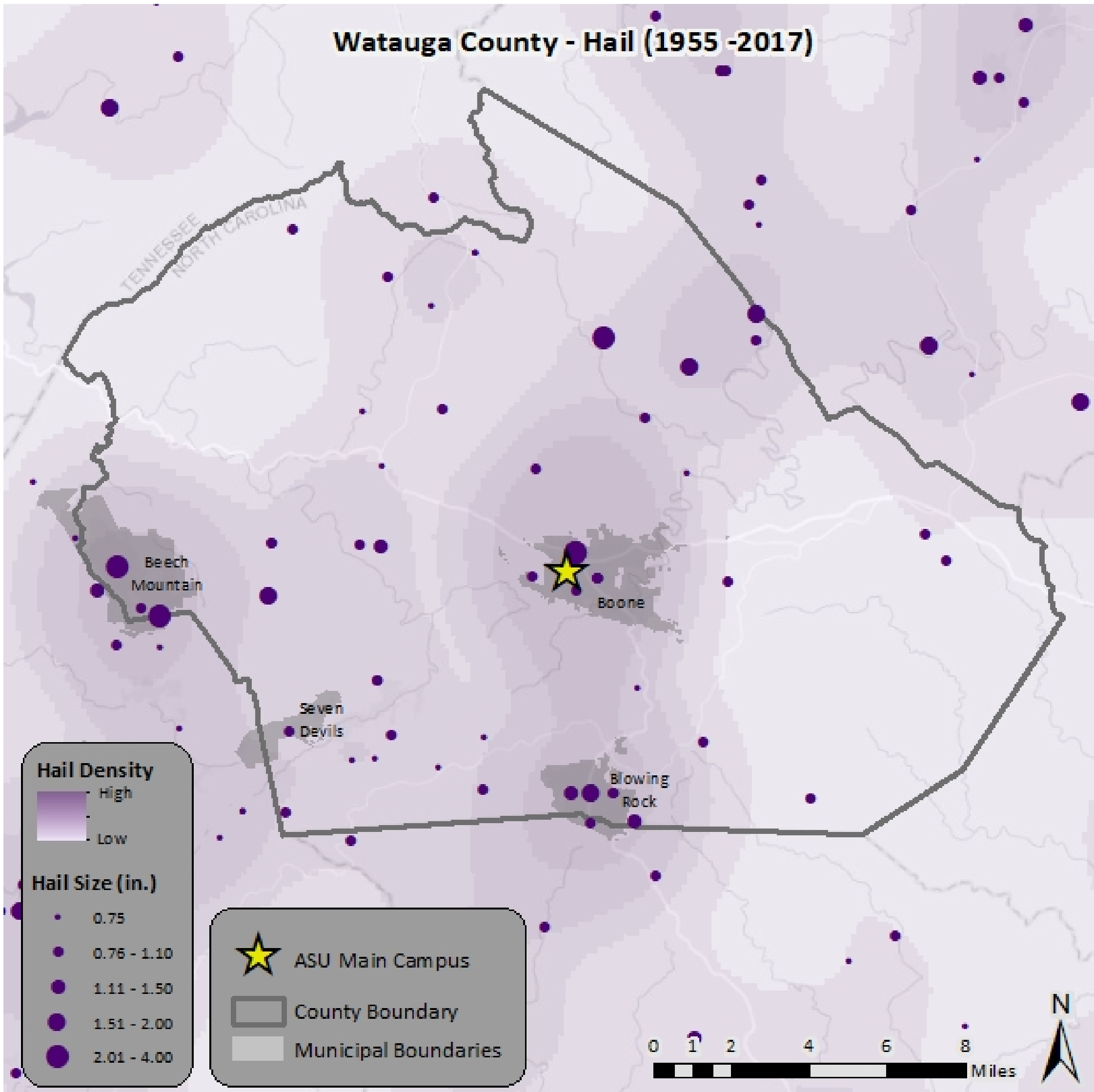
Location	Date	Deaths/Injuries	Property Damage
Boone	6/10/2008	0/0	$3,652
Boone	6/10/2008	0/0	$3,652
Foscoe	6/26/2008	0/0	$3,652
Sugar Grove	6/16/2009	0/0	$304
Sugar Grove	6/16/2009	0/0	$304
Blowing Rock	6/17/2009	0/0	$0
Boone	6/17/2009	0/0	$608
Zionville	6/14/2010	0/0	$3,202
Vilas	6/21/2010	0/0	$2,372
Foscoe	2/28/2011	0/0	$1,779
Kellersville	5/10/2011	0/0	$0
Vilas	6/12/2011	0/0	$3,501
Peoria	7/1/2012	0/0	$3,401
Boone	8/1/2012	0/0	$34,015
Boone	6/13/2013	0/0	$3,348
Rutherwood	7/17/2013	0/0	$670
Rutherwood	7/17/2013	0/0	$0
Shulls Mills	7/17/2013	0/0	$3,348
Bethel	7/8/2014	0/0	$549
Perkinsville	7/8/2014	0/0	$549
Zionville	10/14/2014	0/0	$10,986
Triplett	7/13/2015	0/0	$1,649
Valle Crucis	8/5/2015	0/0	$550
Valle Crucis	8/5/2015	0/0	$1,100
Hodges Gap	8/5/2015	0/0	$550
Reese	7/8/2016	0/1	$108,466
Zionville	7/6/2018	0/0	$15,551
Todd	10/31/2019	0/0	$510
			$276,137.00

Hailstorms

According to the National Centers for Environmental Information, 70 recorded hailstorm events have affected Watauga County since 1984 summarized in **Table A.14.** [5] In all, hail occurrences resulted in over $611,894 (2020 dollars) in property damages. 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. **Figure A.19** shows a map of hailstorm occurrences in Watauga County.

[5] 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 Watauga County. 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.

FIGURE A.19: HAIL OCCURANCES IN WATAUGA COUNTY



Source: National Centers for Environmental Information

TABLE A.14: HISTORICAL HAIL OCCURANCES IN WATAUGA COUNTY

Location	Date	Magnitude	Deaths/Injuries	Property Damage*
Watauga County	5/6/1984	1.75 in.	0/0	$0
Watauga County	5/6/1984	1.75 in.	0/0	$0
Sugar Grove	5/13/1995	0.75 in.	0/0	$0
Boone	5/13/1995	0.88 in.	0/0	$0
Blowing Rock	5/13/1995	1.10 in.	0/0	$0
Blowing Rock	5/13/1995	0.88 in.	0/0	$0
Boone	6/9/1995	0.88 in.	0/0	$0
Blowing Rock	6/16/1995	0.75 in.	0/0	$0
Beech Mountain	6/17/1995	0.88 in.	0/0	$0
Seven Devils	6/17/1995	0.75 in.	0/0	$0
Boone	5/5/1996	1.00 in.	0/0	$0
Deep Gap	3/5/1997	0.75 in.	0/0	$0
Blowing Rock	5/3/1998	0.75 in.	0/0	$0
Blowing Rock	5/7/1998	1.00 in.	0/0	$0
Boone	6/2/1998	4.00 in.	0/0	$526,322
Boone	6/3/1998	3.00 in.	0/0	$0
Meat Camp	6/3/1998	3.00 in.	0/0	$0
Boone	6/3/1998	1.75 in.	0/0	$0
Zionville	4/28/2002	0.75 in.	0/0	$0
Valle Crucis	6/4/2002	0.75 in.	0/0	$0
Deep Gap	7/3/2002	0.88 in.	0/0	$0
Boone	4/30/2003	0.75 in.	0/0	$0
Zionville	5/2/2003	0.75 in.	0/0	$0
Blowing Rock	5/15/2003	1.25 in.	0/0	$0
Blowing Rock	6/30/2003	0.88 in.	0/0	$0
Valle Crucis	8/3/2005	1.75 in.	0/0	$0
Zionville	5/14/2006	0.75 in.	0/0	$0
Boone	5/14/2006	1.00 in.	0/0	$0
Todd	7/19/2006	1.00 in.	0/0	$0
Sands	7/19/2006	0.75 in.	0/0	$0
Lovill	7/21/2006	0.75 in.	0/0	$0
Silverstone	6/24/2007	0.75 in.	0/0	$1,159
Matney	7/27/2007	1.00 in.	0/0	$0
Boone	5/11/2008	0.88 in.	0/0	$0
Valle Crucis	6/9/2008	1.00 in.	0/0	$0
Rominger	6/9/2008	0.88 in.	0/0	$0

Location	Date	Magnitude	Deaths/Injuries	Property Damage*
Kellersville	6/9/2008	1.00 in.	0/0	$0
Kellersville	6/9/2008	2.75 in.	0/0	$84,413
Boone	6/2/2009	0.88 in.	0/0	$0
Foscoe	6/3/2009	0.75 in.	0/0	$0
Foscoe	6/18/2009	0.75 in.	0/0	$0
Perkinsville	5/14/2010	1.00 in.	0/0	$0
Boone	3/23/2011	1.00 in.	0/0	$0
Kellersville	5/13/2011	0.88 in.	0/0	$0
Kellersville	5/13/2011	1.00 in.	0/0	$0
Soda Hill	5/22/2011	1.75 in.	0/0	$0
Boone	5/24/2011	1.00 in.	0/0	$0
Perkinsville	5/24/2011	1.00 in.	0/0	$0
Blowing Rock	5/26/2011	1.75 in.	0/0	$0
Bamboo	5/26/2011	0.88 in.	0/0	$0
Blowing Rock	6/9/2011	1.00 in.	0/0	$0
Blowing Rock	6/12/2011	0.88 in.	0/0	$0
Deep Gap	6/21/2011	1.00 in.	0/0	$0
Perkinsville	6/21/2011	1.00 in.	0/0	$0
Perkinsville	6/28/2011	1.00 in.	0/0	$0
Valle Crucis	7/3/2011	1.25 in.	0/0	$0
Foscoe	3/15/2012	0.88 in.	0/0	$0
Foscoe	3/15/2012	0.75 in.	0/0	$0
Foscoe	3/15/2012	0.88 in.	0/0	$0
Sugar Grove	4/30/2012	1.00 in	0/0	$0
Blowing Rock	6/30/2012	1.5 0in	0/0	$0
Blowing Rock	5/21/2013	1.00 in	0/0	$0
Foscoe	5/21/2013	1.00 in	0/0	$0
Todd	4/9/2015	0.75 in.	0/0	$0
Mabel	4/9/2015	1.00 in.	0/0	$0
Matney	4/20/2015	0.88 in.	0/0	$0
Bowers Gap	5/11/2015	1.00 in.	0/0	$0
Rominger	5/2/2016	1.00 in.	0/0	$0
Aho	9/29/2016	1.00 in.	0/0	$0
Blowing Rock	5/19/2017	1.00 in.	0/0	$0

Lightning

According to the National Centers for Environmental Information, there have been a total of 7 recorded lightning events in Watauga County since 1994[6]. These events resulted in nearly $1.1 million (2018 dollars) in damages, as listed in summary **Table A.15**. Furthermore, lightning caused one injury in the County. It is certain that more than 7 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 A.15: HISTORICAL LIGHTNING IMPACTS IN WATAUGA COUNTY

Location	Date	Deaths/ Injuries	Property Damage*	Details
Beech Mountain	6/17/1995	0/0	$1,609	
Boone	7/28/1996	0/0	$796,744	Lightning started a fire in a large downtown business in Boone that destroyed an 8,200 square foot building. Damage was estimated at $440,000. Nearby buildings sustained fire and smoke damage estimated near $70,000.
Blowing Rock	7/16/1997	0/1	$0	
Boone	3/20/1998	0/0	$7,519	
Boone	5/13/1999	0/0	$88,112	Lightning during the afternoon of the 13th struck a barn, causing a fire which destroyed the barn, a tractor and other farm equipment.
Blowing Rock	5/18/1999	0/0	$29,371	Lightning during the afternoon of the 18th struck a house in Blowing Rock, blowing a hole in the roof, breaking water pipes, and causing damage to the rafters.
Boone	6/14/2001	0/0	$173,029	Thunderstorms during the evening produced damaging lightning and flash flooding. Lightning struck two houses during the late afternoon of the 14th starting fires. One house was completely destroyed while the second house suffered considerable damage. Heavy thunderstorm rains flooded a small part of Boone, requiring several rescues.
			$1,096,384.00	

Source: National Centers for Environmental Information

A.5.4.3 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,

[6] 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 Watauga County. The State Fire Marshall's office was also contacted for additional information but none could be provided. As additional local data becomes available, this hazard profile will be amended.

intensity, and duration, they do pose a significant threat should Appalachian State University experience a direct tornado strike. The probability of future tornado occurrences affecting Appalachian State University 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 Appalachian State University 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 Watauga County 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), Appalachian State University 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.

A.5.5 SEVERE WINTER WEATHER

A.5.5.1 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. Appalachian State University 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.

A.5.5.2 Historical Occurrences

Winter weather has resulted in three disaster declarations Watauga County. This includes the Blizzard of 1996, one subsequent 2000 winter storm, and an ice storm in 2002. According to the National Centers for Environmental Information, there have been a total of 43 recorded winter storm events Watauga County since 1996 (**Table A.16**)[7]. These events resulted in $2,000 (2020 dollars) in damages.

[7] These ice and winter storm events are only inclusive of those reported by the National Centers for Environmental Information (NCEI). It is likely that additional winter storm conditions have affected Watauga County.

TABLE A.16: WINTER STORM EVENTS IN WATAUGA COUNTY

Date	Deaths / Injuries	Property Damage (2020)	Description
1/5/1996	0/0	$0	N/A
1/26/1996	0/0	$0	Freezing rain in the mountains of North Carolina during the late morning and afternoon hours on the 26th resulted in hazardous travel conditions. There were numerous accidents during the afternoon hours with several injuries reported.
2/2/1996	0/0	$0	N/A
2/12/1996	0/0	$0	Snow accumulated from 2 to 4 inches in Ashe and Watauga Counties on the 12th. Slippery roads resulted in several traffic accidents.
4/8/1996	0/0	$0	Snow showers resulted in accumulations of generally 1 to 3 inches across Ashe and Watauga Counties.
1/2/1999	0/0	$0	Sleet mixed at times with freezing rain fell across the northwest mountains of North Carolina from the early afternoon hours on the 2nd to the morning hours on the 3rd. Sleet accumulated from 4 to 6 inches in many areas which resulted in scattered power outages. Hazardous road conditions resulted in numerous traffic accidents.
2/1/1999	0/0	$0	Snow and sleet overspread northwestern North Carolina during the early morning hours of the 1st. Snow accumulations of up to 2 inches occurred before changing to sleet and freezing rain. Freezing rain accumulated 1/4 inch to 1/2 inch, downing some trees and tree limbs, before changing to light rain and drizzle during the afternoon and evening.
2/1/1999	0/0	$0	Snow and sleet overspread northwestern North Carolina during the early morning hours of the 1st. Snow accumulations of up to 2 inches occurred before changing to sleet and freezing rain. Freezing rain accumulated 1/4 inch to 1/2 inch, downing some trees and tree limbs, before changing to light rain and drizzle during the afternoon and evening.
3/3/1999	0/0	$0	Rain early in the morning of the 3rd changed to sleet then quickly to snow by late in the morning. Snow accumulations by mid evening ranged from 6 inches to 12 inches. Strong winds caused blowing and drifting snow with visibility at times reduced to near zero, drifts up to 6 feet deep were reported. Numerous vehicles slid off roads, including one into a mobile home in Watauga County, or were involved in collisions.
1/29/2000	0/0	$0	Light snow, sleet, and freezing rain developed late in the afternoon of the 29th. Snow and sleet accumulations ranged from 1 to 4 inches, then became mainly freezing rain late at night. Glaze accumulated 1/4 inch to 1/2 inch before the freezing rain ended during the afternoon on the 30th.
1/19/2002	0/0	$0	Freezing rain during the 19th resulted in a quarter of an inch of glaze.
12/4/2002	0/0	$0	Snow during the afternoon of the 4th through early morning of the 5th accumulated 4 to 8 inches before changing to freezing rain. In addition, ice accretions of a quarter of an inch or more occurred in Surry, Yadkin, and Rockingham counties. Numerous accidents were reported on snow- and ice-covered roads.

Date	Deaths / Injuries	Property Damage (2020)	Description
2/15/2003	0/0	$0	Freezing rain and sleet fell across the region from late on the 15th through midday on the 17th. Ice accretions ranged from 1/4 to 1/2 inch in the northwestern mountains and foothills to as much as 1 inch east of the foothills. Sleet accumulated from 1 to 4 inches. Up to 50,000 residences were without power for a brief time.
12/4/2003	0/0	$0	Heavy snow developed across northwest North Carolina during the morning of the 4th and continued into the evening. Snow accumulations of 3 to 6 inches fell with locally higher amounts in the mountains.
12/18/2003	0/0	$0	Snow developed during the morning of the 18th and continued into the morning of the 20th. Snow accumulations of 6 to 12 inches occurred with local amounts up to 20 inches.
2/2/2004	0/0	$0	Low pressure moving up the Mid-Atlantic coast brought wintry weather conditions to the mountains and foothills of North Carolina during the evening of the 2nd through the morning of the 3rd. 5 inches of snow fell across most of Watauga County, along with one quarter inch of glaze. In Wilkes County, there was one quarter inch of ice accretion.
1/30/2005	0/0	$0	A low-pressure system tracking along the east coast brought a wintry mix of precipitation to the region. Ice accretion was one quarter of an inch in most locations with a few isolated locations in Rockingham Co. receiving one third inch accretion. Snowfall was a secondary element with 3 to 4 inches being the norm. The exception was Ashe Co. where snowfall amounts ranged from 4 to 5 inches.
1/9/2007	0/0	$0	An area of low pressure moving through the region helped to bring snow showers to the mountains of northwest North Carolina. On average, 4 inches of snow covered the area.
1/17/2008	0/0	$0	As an area of low pressure progressed from the coast of the Gulf of Mexico to along the coast of North Carolina, associated wintry precipitation spread across the area from south to north. The precipitation began as snow and then transitioned to a brief period of sleet before ending as light freezing rain and freezing drizzle.
2/4/2010	0/0	$2,000	A strong low-pressure system moved from the Gulf Coast to off the North Carolina coast. A secondary low moved west of North Carolina over Kentucky, bringing a nose of warm air in aloft. This led to a mixture of snow, sleet, freezing rain, and rain across northwest North Carolina, with many areas seeing significant snow or ice accumulations.
2/9/2010	0/0	$0	An area of low pressure moved from the Mississippi coast to off the Carolina coast. At the same time another low moved through the Ohio Valley, putting northwest North Carolina in the middle of the two. An area of mixed precipitation moved across the area with light to moderate accumulations. The coastal low deepened on Wednesday bringing gusty winds and significant upslope snow showers to the higher elevations.
2/15/2010	0/0	$0	A deep upper level trough centered overhead brought cold northwest winds into the area, bringing significant upslope snows to the normally prone western slopes.

Date	Deaths / Injuries	Property Damage (2020)	Description
2/24/2010	0/0	$0	An upper level low centered overhead, combined with a deepening coastal low brought cold air and strong northwest winds to the area. This resulted in significant upslope snow showers across the west facing slopes of the higher elevations across northwest North Carolina. The strong northwest winds also caused damage across the area.
12/12/2010	0/0	$0	Very strong northwest winds developed in the wake of a departing cold front. The persistent trajectories and duration of the event helped snow accumulate to over one foot in some locations.
12/16/2010	0/0	$0	A low-pressure system moved east from the Tennessee valley across northwest North Carolina. Wintry precipitation occurred with the passage of the low across southeast West Virginia. Snow amounts across the region ranged from 1 to 3 inches while sleet and freezing rain were mixed with the snow at the conclusion of the event.
1/26/2011	0/0	$0	A complex weather system moved through the region on Wednesday the 26th. An area of low pressure developed off the North Carolina coast, while an upper level low passed overhead. Temperatures were initially warm enough for some rain, sleet and freezing rain, however the precipitation quickly changed to snow over the northwest North Carolina mountains. Enough instability was present under the upper level low for the snow to take on a banded form for much of the event.
10/28/2012	0/0	$0	Hurricane Sandy moved north off the Atlantic Coast and combined with a complex low-pressure system and deepening trough over the eastern part of the U.S., and then turned west northwest and into New Jersey into Pennsylvania, slowing down and then drifting north. It produced an expansive area of high impact weather as it approached the coast and moved inland. Strong winds and heavy snowfall were the biggest impacts on southeastern West Virginia, northwestern North Carolina and extreme southwestern Virginia, lasting for 24-48 hours. One to two feet of snow with significant drifting was observed in the higher elevations, with a sharp reduction to little or no accumulation in the valleys. Winds gusted into the 50-60 mph range, with one gust to 70 mph at the Ashe County Airport in Jefferson, North Carolina.
4/4/2013	0/0	$0	As had been typical through much of the latter half of the winter season across the eastern U.S., unseasonably cold air was in place across the region once again. Morning low temperatures on this day were in the 20s across the northwest North Carolina mountains and in the low to mid 30s across the Piedmont. Meanwhile, a strong upper-level low pressure area in the southern stream was moving toward the region from the Mid-South. A cold front was stalled along the Georgia and South Carolina Coast with a wave of surface low pressure tracking northeastward along the front near the Georgia Coast. Precipitation spread into the area from the south during the mid-afternoon. Dynamic cooling associated with the strong upper low caused rain at the onset of the event to quickly change to sleet and snow in the mountains and to a rain, sleet, snow mixture across the Piedmont. The precipitation was quite heavy during the evening rush hour. Thus, even though surface temperatures were right at the freezing mark, sleet began to accumulate on roads enough to cause travel problems in the hours around sunset. Here are the

Date	Deaths / Injuries	Property Damage (2020)	Description
			winter precipitation accumulations reported across northwest and north central North Carolina during this event
3/6/2014	0/0	$0	A complex storm with low pressure tracking out of the Gulf of Mexico to the Carolina coast along with an upper level low moving across the mountains brought periods of snow, sleet and freezing rain to both the mountains and piedmont with total snow amounts up to 8 inches. A significant number of power outages were reported.
11/1/2014	0/0	$0	A very high amplitude upper atmospheric pattern featured equally deep troughs in the western and eastern U.S. Within the eastern U.S. trough, was a vigorous Alberta clipper that intensified immensely as it plunged into the southeast states into the base of the upper trough. Meanwhile...a large nearly 1040mb Canadian High was plunging into the central and eastern U.S. on the back side of the developing storm system in the southeast states. The combination of these features brought an early season snowfall principally to the Appalachian Mountains of eastern Tennessee, far southwest Virginia, and northwest North Carolina. Light snow also fell in the mountains of eastern West Virginia, but the storm system tracked too far south for any significant amounts in that region. Snowfall amounts were generally in the 1 to 3-inch range across this region...with some higher totals of 4 to 6 inches in the higher elevations of northwest North Carolina. Strong and gusty northwest winds accompanied the snow in these areas causing scattered power outages. Watauga, Ashe, and Alleghany counties in northwest North Carolina were particularly impacted by the combination of 30 to 40 mph wind gusts and the heavy wet snow, leaving 446, 457, and 347 members of these counties, respectively, without power for several hours. Because of warm temperatures within the preceding days and the early season time of the event, roads and travel conditions were not significantly impacted.

Date	Deaths / Injuries	Property Damage (2020)	Description
11/26/2014	0/0	$0	A deep upper trough, developing through the central U.S. and swinging into the southeast states the Tuesday before Thanksgiving, induced an area of low pressure along the eastern Gulf Coastal region. As the upper trough shifted into the eastern U.S., the surface low underwent explosive development as it moved northward along the southeast and Mid-Atlantic coastal region. The deepening surface low pulled cold air and moisture into the region bringing a period of snow to areas west of the Blue Ridge on one of the busiest travel days of the year. Snowfall amounts were generally in the one to three-inch range, but several locations saw snowfall in the three to four-inch range across southwest Virginia, northwest North Carolina, and southeast West Virginia. The heaviest snowfall in northwest North Carolina was observed at Beech Mountain in Watauga county, with 5.0 inches of snow.
1/23/2015	0/0	$0	Light freezing rain occurred within a scenario where cold air damming was taking place across the area, all while relatively warmer moisture aloft in association with a coastal low was progressing across the region. The result was a light rain that froze upon contact and produced ice accretion mainly between a trace and two-tenths of an inch. Isolated amounts a little over one-quarter of an inch were also noted, but not the norm across any given county. Much of the ice accretion was focused along the crest of the Blue Ridge of Alleghany, Ashe, and Watauga Counties.
2/16/2015	0/0	$0	Immediately on the heels of the intense Arctic outbreak that spread into the region on the 14th and 15th came the most significant snow storm to affect the region since February 12th and 13th of 2014. The snow storm was the result of a strong upper-level disturbance tracking from the central U.S. into the eastern U.S. on top of the bitterly cold Arctic air mass. A surface low pressure area tracked across the southeast states to off the North Carolina coast, a fairly typical scenario for bigger snowfall events within the region. Temperatures had little to no time to recover at all from the bitterly cold temperatures of the 15th. As snow spread into the region during the late morning and early afternoon hours of the 16th, temperatures were only in the upper teens to lower 20s across the region and fell back into the 10 to 20-degree range across much of the region area during the heavier snow. Snowfall amounts were significant in many areas, ranging from 3 to 4 inches across the Piedmont, where some sleet mixed in during the latter part of the event, to 8 to 11 inches across the New River Valley, Greenbrier Valley, and Tazewell county in far southwest Virginia.
2/24/2015	0/0	$0	An area of surface low pressure riding along a frontal boundary located along the southeast Gulf coastal region combined with support from an upstream upper-level disturbance to bring a period of snow primarily to the southern counties of the Blacksburg National Weather Service Forecast area. Snowfall amounts ranged from 3.0 to 5.0 inches in the northwest North Carolina mountains to 1.0 to 3.0 inches across the North Carolina Piedmont, to 1.0 to 2.0 inches in southwest Virginia, generally west of Interstate 77, to less than 1.0 inch across most of the remainder of the forecast area. The early morning snowfall caused problems with the morning commute, with a number of traffic accidents noted across the region.

Date	Deaths / Injuries	Property Damage (2020)	Description
2/25/2015	0/0	$0	A low-pressure area took a fairly classic path from the northeast Gulf to off the North Carolina coast between the afternoon of the 25th and the morning of the 26th. However, the track of the low was a little further south and east than needed to bring optimal snowfall to the region. Snowfall amounts were heaviest across the southern counties of the forecast area and especially across the North Carolina counties. Snowfall amounts ranged from 4.0 to 8.0 inches across northwest and north central North Carolina, to 3.0 to 6.0 inches across southwest Virginia and Southside Virginia, mostly east of the Blue Ridge, to 2.0 to 3.0 inches further north across southeast West Virginia and toward the Shenandoah Valley of Virginia. The heaviest snow was nearly all south of U.S. 460 across the forecast area.
1/22/2016	0/0	$0	A significant winter storm pushed from southwest to northeast, spreading periods of moderate to heavy snowfall across portions of Northwest North Carolina January 22nd through the 23rd. Snowfall continued through the day Friday and into Saturday before coming to an end after sunset. Accumulations from 4 - 8 inches of snow were commonplace, with portions of the higher elevations receiving over a foot of snowfall. Sleet mixed in at times, especially in the northern Piedmont Counties of North Carolina.
2/14/2016	0/0	$0	A strong winter storm moved from the southeast U.S. into New England. This resulted in widespread heavy snow in the North Carolina mountains. In the foothills and Piedmont, up to 6 inches of snow fell, but freezing rain accumulations (up to 0.25 of an inch) were more significant. In the wake of the storm, strong winds were observed across the region. Coupled with the icy conditions, this led to numerous traffic accidents and power outages.
1/6/2017	0/0	$0	A developing Nor'easter began to strengthen across the Gulf Coast of the United States late in the day on January 6th before moving northeast along the Atlantic coastline on January 7th. Precipitation began to spread to into the area along the north and west side of the storm, bringing measurable snowfall into parts of the south-central Virginia. The heaviest snowfall amounts were recorded within southside Virginia, where 5 to 10 inches of snow fell. Travel impacts were felt area-wide during and immediately following the event. Extreme cold conditions overspread the area, resulting in additional impacts, including the death of an elderly man in Surry County.
1/17/2018	0/0	$0	A cold front and subsequent closed low aloft brought measurable snow to the region beginning early in the morning on Wednesday the 17th. The slow speed of the system combined with decent moisture convergence in the low levels, and snow to liquid ratios in excess of 15 to 1 contributed to the high snowfall totals.
3/24/2018	0/0	$0	An area of low pressure tracked eastward from the Tennessee Valley to the coast of the Carolinas, before swinging northward along the U.S. east coast. Initially, temperatures were warm enough for rain to fall, but as colder air worked its way into the area behind the departing low pressure, the precipitation changed over to snow. Late in the event, warmer air just off the surface worked its way into parts of the area resulting in a period of freezing rain across the Northern Mountains. Snowfall amounts generally ranged from 3 to 6 inches. Freezing rain accretion was around one to three-tenths of an inch.

Date	Deaths / Injuries	Property Damage (2020)	Description
12/8/2018	0/0	$0	A low-pressure system tracked eastward along the Gulf Coast and spread moisture northward toward the Mid Atlantic. Meanwhile, high pressure to the north allowed temperatures to fall into the 20s, which caused the moisture to mostly fall as heavy snow. Some sleet and freezing drizzle also fell during this storm. The heavy snow caused numerous vehicle accidents and downed trees that fell on to roads and power lines, and it also caused one indirect fatality in Yadkin County. Average snowfall accumulations ranged from ten to twenty inches over northwest North Carolina.
1/12/2019	0/0	$0	A wedge of cool high pressure was already in place across the mid-Atlantic states when deep low pressure entered the central Appalachians from the Tennessee Valley, bringing deep moisture from the Gulf of Mexico northward along the Appalachian chain. The low also brought with it a layer of warm air aloft where temperatures were above freezing, while surface temperatures held below freezing. This resulted in a complex winter storm scenario where precipitation started as snow, but soon transitioned to sleet and freezing rain.
2/19/2019	0/0	$0	A strong center of high pressure over the northeastern United States wedged cold air along the east side of the Appalachian Mountains. Low pressure in the Gulf of Mexico brought moisture into the region as it tracked northeast over the Carolinas and Virginia. The enhanced moisture combined with the dammed cold air created a complex winter storm that produced snow, sleet and freezing rain in northwest North Carolina.

Source: National Centers for Environmental Information

There have been several severe winter weather events in the Appalachian State University. Severe winter weather events have led to 65 closures of the school since 1974. The text below describes three of the major events. 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.

A.5.5.3 Probability of Future Occurrences

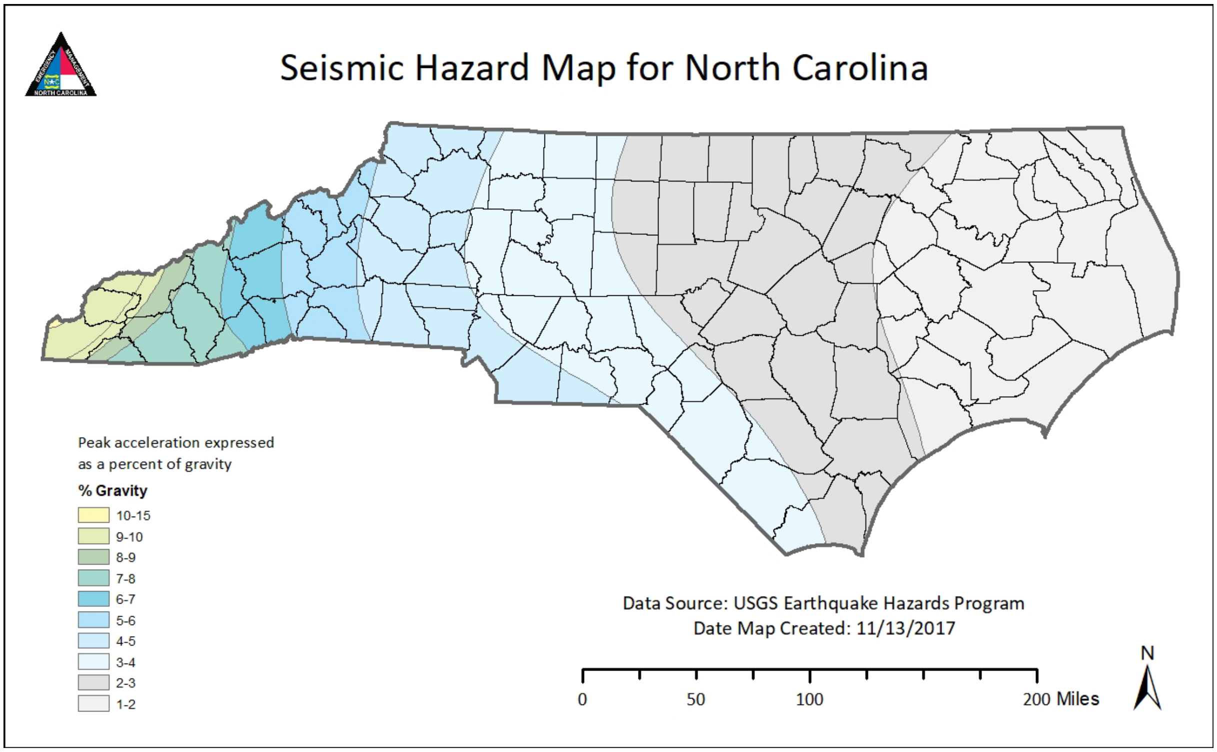
Winter storm events will remain a regular occurrence for Appalachian State University due to its location in the western part of the state. According to historical information the University often experiences several winter storms events each year. Therefore, the annual probability is likely (10 to 100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

A.5.6 EARTHQUAKES

A.5.6.1 Location and Spatial Extent

Approximately two-thirds of North Carolina is subject to earthquakes, with the western and southeast region most vulnerable to a very damaging earthquake. The state is affected by both the Charleston Fault in South Carolina and New Madrid Fault in Tennessee. Both of these faults have generated earthquakes measuring greater than 8 on the Richter Scale during the last 200 years. In addition, there are several smaller fault lines throughout North Carolina. **Figure A.20** is a map showing geological and seismic information for North Carolina.

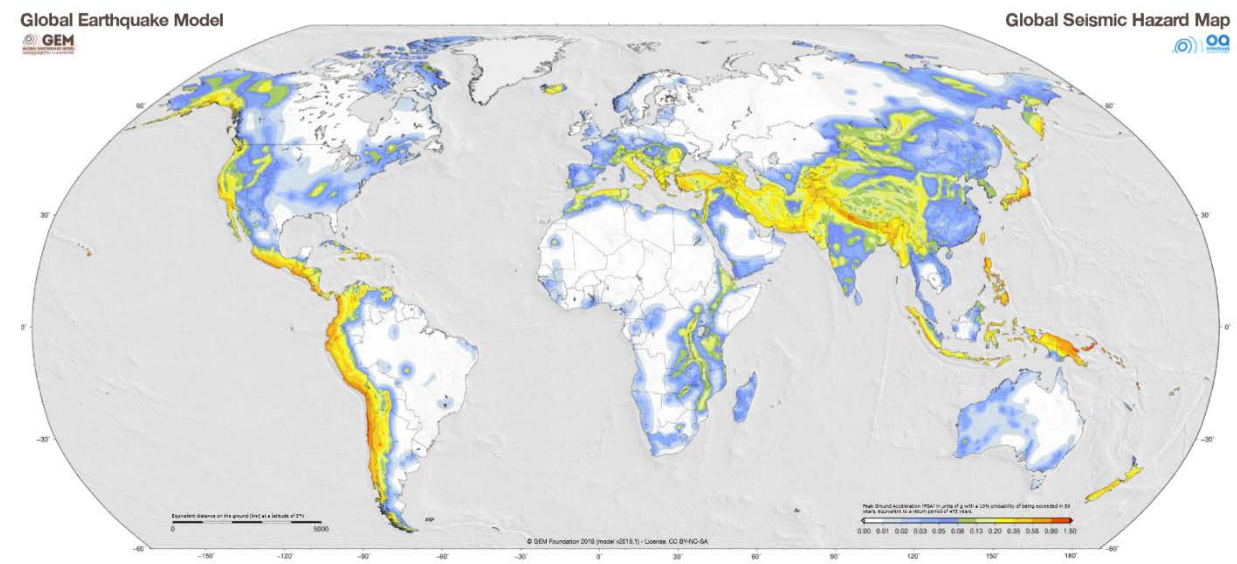
FIGURE A.20: GEOLOGICAL AND SEISMIC INFORMATION FOR NORTH CAROLINA



Source: North Carolina Geological Survey

Figure A.21 shows the intensity level associated with the world 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 campus as a whole exists within an area of moderate seismic risk.

FIGURE A.21: PEAK ACCELERATION WITH 10 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS



Source: Global Earthquake Model, 2018

A.5.6.2 Historical Occurrences

At least 12 earthquakes are known to have affected Watauga County since 1886. The strongest of these measured a V on the Modified Mercalli Intensity (MMI) scale. **Table A.17** provides a summary of earthquake events reported by the National Geophysical Data Center between 1885 and 1985.

TABLE A.17: EARTHQUAKES IMPACTING WATAUGA COUNTY

Location	Date	Magnitude	MMI
Blowing Rock	8/6/1885	*unknown*	V
Boone	8/6/1885	*unknown*	V
Boone	11/3/1928	*unknown*	*unknown*
Boone	3/8/1968	*unknown*	IV
Boone	11/20/1969	4.3	III
Blowing Rock	9/10/1970	*unknown*	V
Boone	9/10/1970	*unknown*	V
Blowing Rock	9/13/1976	3.3	III
Boone	7/27/1980	*unknown*	II
Boone	6/3/1981	2.3	V
Blowing Rock	10/22/1984	3.2	IV
Boone	10/22/1984	3.2	V

A list of earthquakes that have caused damage throughout North Carolina is presented below in **Table A.18.**

TABLE A.18: EARTHQUAKES WHICH HAVE CAUSED DAMAGE IN NC

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

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).

A.5.6.3 Probability of Future Occurrences

The probability of significant, damaging earthquake events affecting the area surrounding Appalachian State University 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 campus. The annual probability level for the campus 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, and for Watauga County the likelihood was 4 - 5%.

A.5.7 GEOLOGICAL

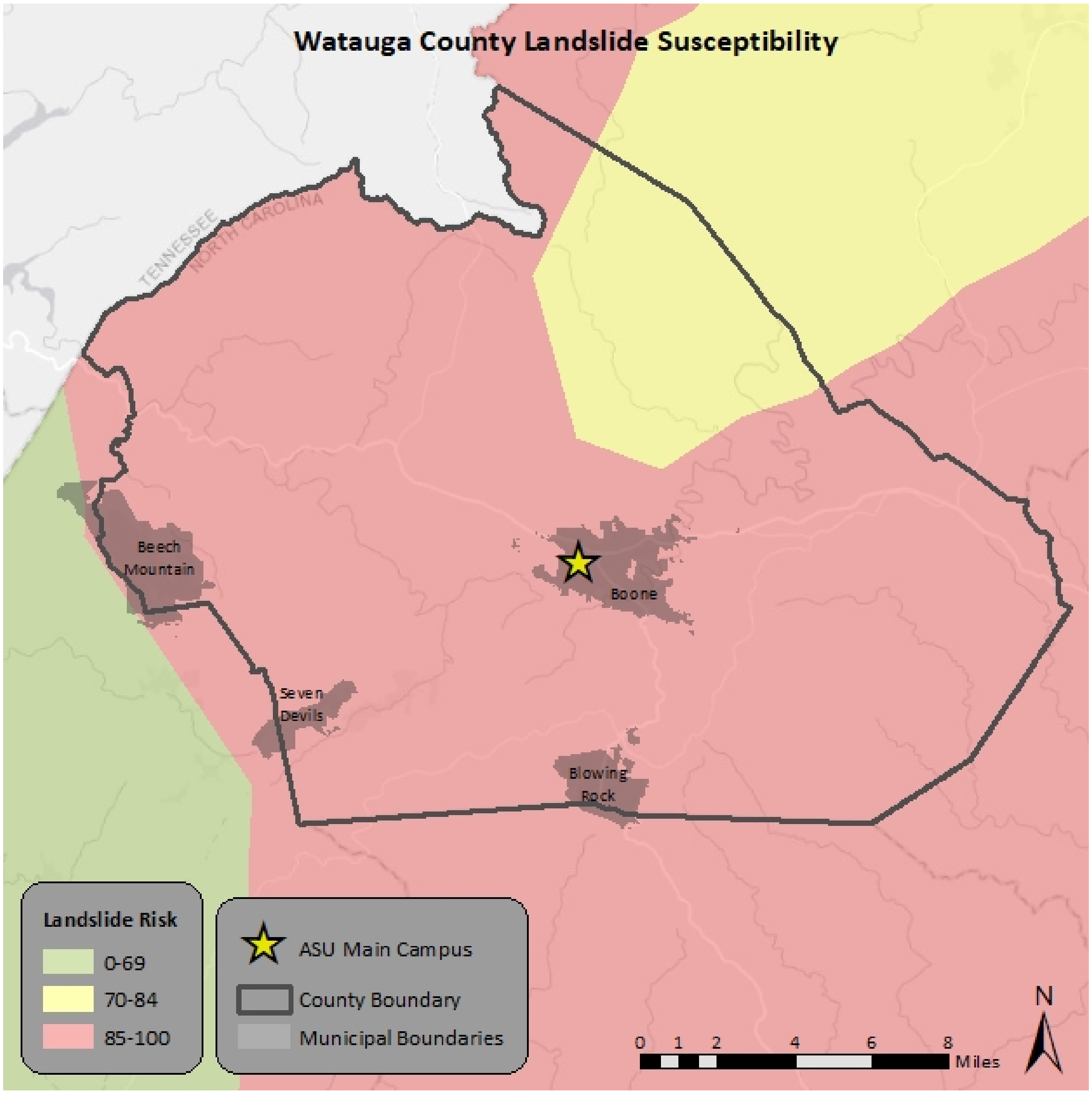
A.5.7.1 Location and Spatial Extent

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 Blue Ridge Mountains, making areas near Appalachian State University susceptible to them as well.

According to **Figure A.22** below, much of Watauga County, has high risk to landslides.

FIGURE A.22: LANDSLIDE SUSCEPTIBILITY AND INCIDENCE MAP OF WATAUGA COUNTY

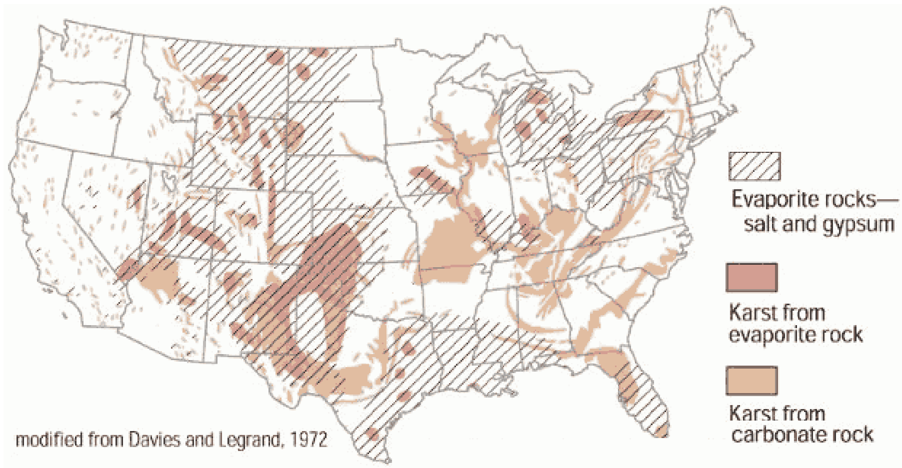


Source: United States Geological Survey

Sinkholes

Figure A.23 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 A.23: UNITED STATES GEOLOGICAL SURVEY OF KARST MODIFIED FROM DAVIES AND LEGRAND, 1972



Erosion

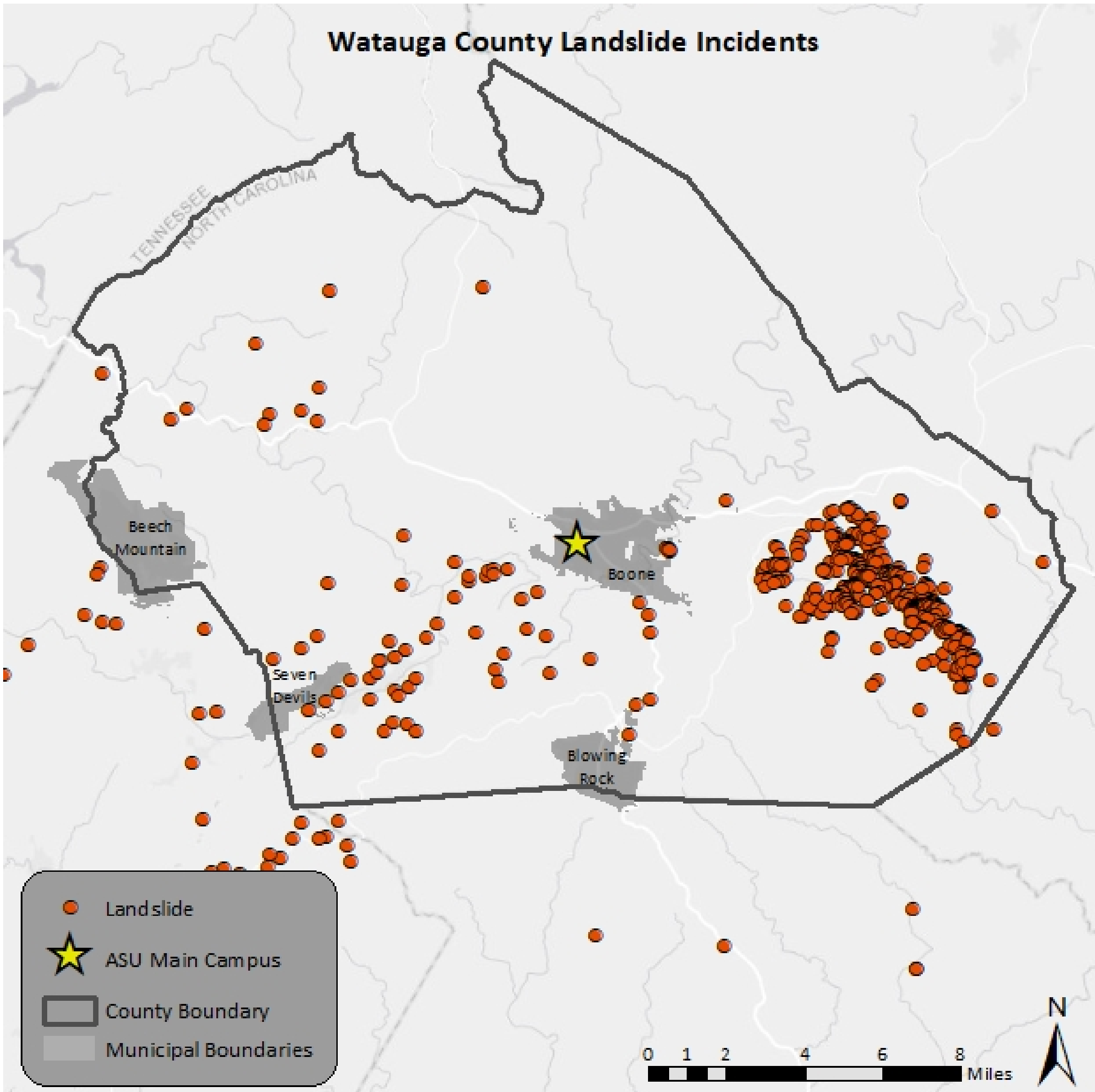
Erosion on the Appalachian State University campus is typically caused by flash flooding events. Unlike coastal areas, where the soil is mainly composed of fine-grained particles such as sand, Watauga County soils have much greater organic matter content. Furthermore, vegetation also helps to prevent erosion in the area. Erosion occurs on the Appalachian State University campus, particularly along the banks of rivers and streams, but it is not an extreme threat to any of the buildings on campus. No areas of concern were reported by the Campus Hazard Mitigation Planning Team.

A.5.7.2 Historical Occurrences

Landslides

Steep topography in the area surrounding Appalachian State University makes the campus 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 around Watauga County as provided by the North Carolina Slope Movement-Slope Movement Deposit Database (NCSM_SMD database) are presented in **Figure A.24.** While some incidence mapping has been completed throughout the western portion of North Carolina, it is not complete; therefore, it should be noted that many more incidents than what is reported are likely to have occurred in the area.

FIGURE A.24: LOCATION OF PREVIOUS LANDSLIDE OCCURRENCES IN WATAUGA COUNTY



Source: North Carolina Geological Survey

Sinkholes

In North Carolina, most sinkholes occur in the southern coastal plain due to the high concentration of limestone. They are fairly uncommon in the western part of the state and in Watauga County.

Erosion
Most historical occurrences of erosion are seen near the coast of North Carolina, but Appalachian State University is still susceptible to the hazard. Several sources were vetted to identify areas of erosion at Appalachian State University. This includes searching local newspapers, interviewing local officials, and reviewing previous hazard mitigation plans. Watauga County have previous mitigation actions that address erosion including bank stabilization and meeting erosion control requirements. Such actions will continue to be implemented as necessary throughout the region. Erosion was referenced in the previous Appalachian State University 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.

A.5.7.3 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 of the Appalachian State University campus 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 in Watauga County. While many sinkholes have been relatively small, it is still unlikely (between 1 and 33.3 percent annual probability) that the campus will continue to be affected in the future.

Erosion
Erosion remains a natural, dynamic, and continuous process for Appalachian State University, and it will continue to occur. The annual probability level assigned for erosion is possible (between 1 and 10 percent).

A.5.8 DAM FAILURE

A.5.8.1 Location and Spatial Extent

The North Carolina Division of Energy, Mineral and 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 A.19** explains these classifications.

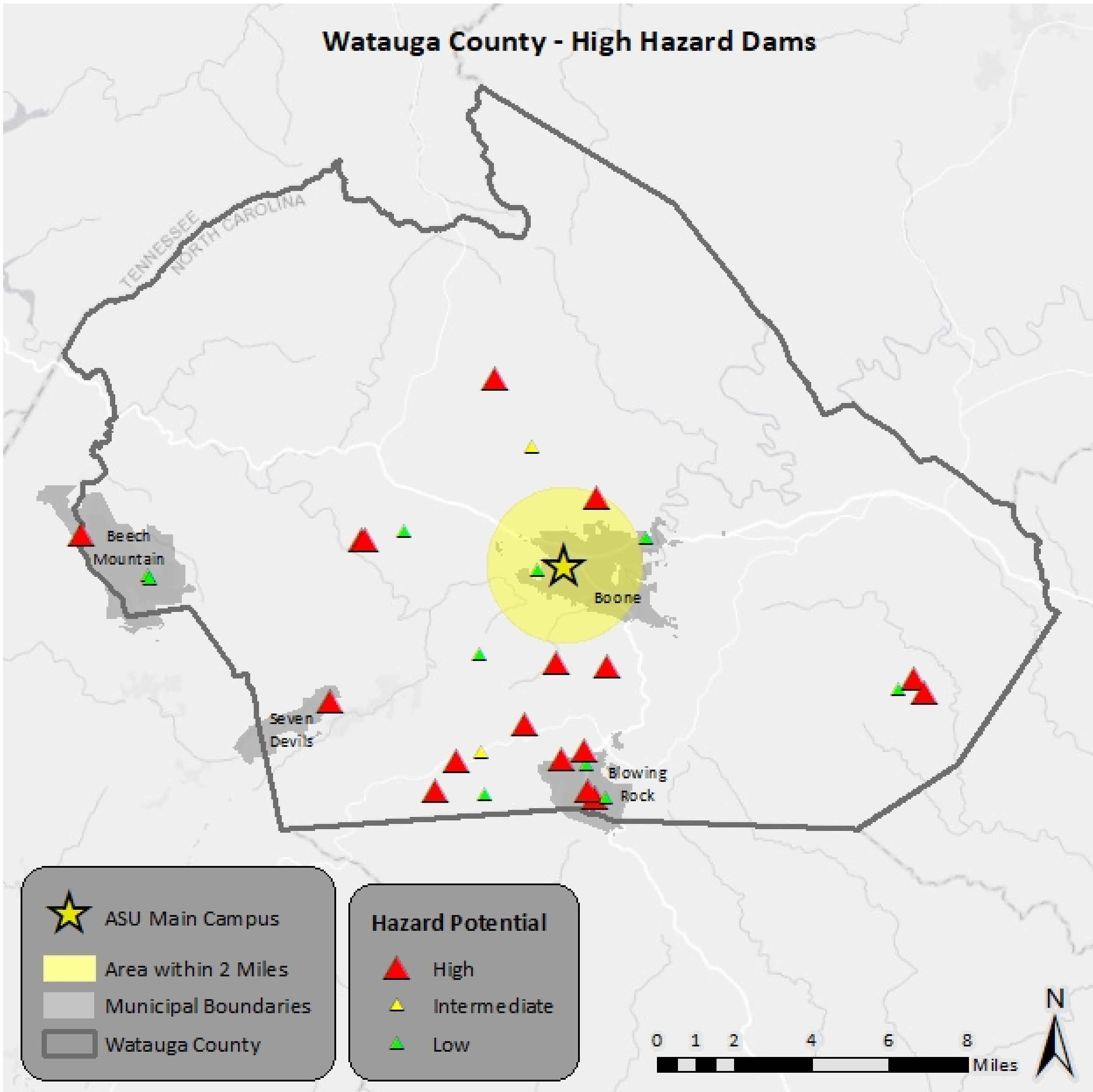
TABLE A.31: NORTH CAROLINA DAM HAZARD CLASSIFICATIONS

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 Management, there are 30 dams in Watauga County. **Figure A.25** shows the dam location and the corresponding hazard ranking for each. Of these dams, 18 are classified as high hazard potential. These high hazard dams are listed in **Table A.20**. According to a consensus of the Campus Hazard Mitigation Planning Team, there is an extremely low possibility that any of these state-recognized dams would cause any damage whatsoever to Appalachian State University should a dam breach or failure occur, despite the hazard classifications assigned to these dams by the state.

FIGURE A.25: WATAUGA COUNTY DAM LOCATION AND HAZARD RANKING



Source: North Carolina Division of Land Resources

TABLE A.20: WATAUGA COUNTY HIGH HAZARD DAMS

Dam Name	Hazard Potential	Surface Area (acres)	Max Capacity (Ac-ft)	State Regulated?
Watauga County				
Bass Lake	High	25.00	306	YES
Town of Boone Water Supply Dam	High	11.00	226	YES
Trout Lake	High	14.00	216	YES
Price Lake	High	50.00	428	YES
Bright Penny Dam	High	3.00	45	YES
Trout Lake	High	3.00	60	NO
Devils Dam Lake	High	4.00	74	YES
Potato Hill Lake	High	9.00	52	NO
Old Blowing Risk Water Supply	High	5.70	76	YES
Appalachian Ski Mountain Lake	High	1.40	24	YES
Snow Lake	High	0.50	6	NO
Asu/Norris Branch Dam	High	22.00	762	YES
Rosasco Dam Lower	High	0.70	11	YES
Rosasco Lake Dam Upper	High	2.00	24	YES
Blowing Rock Country Club Dam	High	1.30	10	YES
New River Lake Dam	High	3.50	35	YES
Sweetgrass Dam	High	20.00	439	YES
Beech Mountain Water Supply Dam	High	6.50	200	YES

Source: North Carolina Division of Land Resources

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

A.5.8.2 Historical Occurrences

According to information from the North Carolina Division of Energy, Mineral and Land Resources, there has only been one dam breached in Watauga County. There are no reports of death, injury, or property damage with any of this event. Further, there are no known levees in Watauga County.

A.5.8.3 Probability of Future Occurrence

Given the current dam inventory and historic data, a dam breech is possible (between 1 and 10 percent annual probability) in the future. However, with regular monitoring, these events can be prevented as has been demonstrated in the past.

Inventories of statewide dam inundation data is an area that NCEM-RM is currently working hard to improve. At this time, there is geospatial data in final quality control review for 19 dams in North Carolina and that number is expected to increase significantly over the next several years. Additionally,

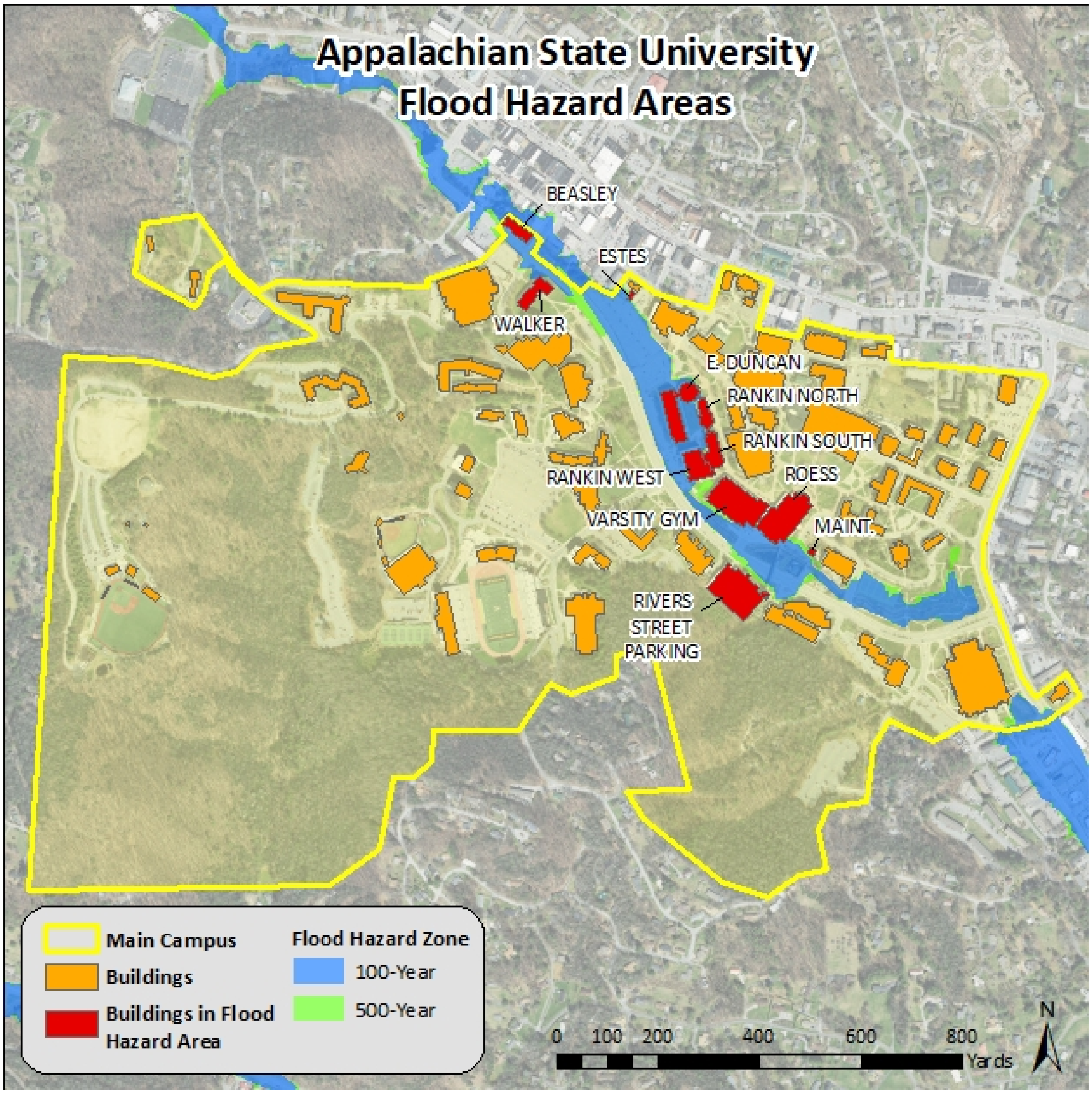
NCEM is currently working with the USACE to acquire inundation data for 9 dams under the Corps' management. As this data becomes available, detailed assessments can be run to better determine vulnerability to dam failures.

A.5.9 FLOODING

A.5.9.1 Location and Spatial Extent

There are areas on the Appalachian State University campus that are susceptible to flooding from Boone Creek. Special flood hazard areas on the Appalachian State University campus were mapped using Geographic Information System (GIS) and FEMA Digital Flood Insurance Rate Maps (DFIRM). This includes the 1-percent annual chance floodplain (100-year), and the 0.2-percent annual chance floodplain (500-year). **Figure A.25** illustrates the location and extent of currently mapped special flood hazard areas for the campus based on best available FEMA DFIRM data from October of 2018. It is important to note that while FEMA digital flood data is recognized as best available data for planning purposes, it does not always reflect the most accurate and up-to-date flood risk. Flooding and flood-related losses often do occur outside of delineated special flood hazard areas.

FIGURE A.25: SPECIAL FLOOD HAZARD AREAS ON THE APPALACHIAN STATE UNIVERSITY CAMPUS



Source: Federal Emergency Management Agency

Of the 98 buildings on the main campus, 13 were found to be located in a special flood hazard area. A list of these buildings can be seen in **Table A.21.**

TABLE A.21: ASU BUILDINGS IN THE FLOODPLAIN

Building Name	Building Type	100-Year	500-Year
Beasley Media Complex	Academic	X	X
Edwin Duncan Hall	Academic	X	X
Estes Apartment	Residential	X	X
Greenhouse	Utility	X	X
Landscape Maintenance	Utility		X
New River Light and Power	Utility	X	X
Rankin Science North	Academic	X	X
Rankin Science South	Academic	X	X
Rankin Science West	Academic	X	X
Rivers Street Parking Deck	Parking		X
Roess Dining Hall	Student Services	X	X
Varsity Gymnasium	Recreation	X	X
Walker Hall	Academic	X	X
Total Number of Buildings:		**11**	**13**

A.5.9.2 Historical Occurrences

Information from the National Centers for Environmental Information was used to ascertain historical flood events. A summary of major flooding events is presented in **Table A.22**. The National Centers for Environmental Information reported a total of 111 events throughout Watauga County since 1996[8]. A summary of these events is presented in **Table A.23**. These events accounted for over $20.4 million (2020 dollars) in property damage throughout the county. **Figure A.26** shows the effects of a flash flood event on ASU campus on October 23, 2017. This event was caused by rainfall of 1 to 2 inches earlier in the day, followed by rainfall rates that increased sharply toward late afternoon reaching 2 to 3 inches per hour for about a one-hour period and this led to flash flooding. Boone Creek, which runs from the Appalachian State University campus southeast through (and under) the town, caused some of the worst damage. At least a dozen water rescues were reported across Boone and numerous cars were flooded and abandoned. A later report said that 13 commercial properties and 53 residential units suffered some flood damage, with 7 commercial and 36 residential sustaining major damage (water

[8] These events are only inclusive of those reported by NCEI. It is likely that additional occurrences have occurred and have gone unreported.

above the electrical outlets). Repairs to damaged roadways, both secondary and primary, were approximately $100,000 according to the NC Department of Transportation.

TABLE A.22: MAJOR FLOOD OCCURRENCES IN WATAUGA COUNTY

Area	Date	Type	Property Damage	Crop Damage	Description
Watauga County	12-Aug-96	Flash Flood	$50,000	$0	N/A
Boone	8-Nov-96	Flash Flood	$20,000	$0	N/A
Boone	20-Mar-98	Flash Flood	$50,000	$0	Thunderstorms during the morning hours on the 20th produced damaging winds, damaging lightning, and flash flooding.
Boone	6-Jun-98	Flash Flood	$600,000	$0	Thunderstorms during the afternoon of the 4th produced flash flooding in the town of Boone. Several main streets were closed within the town and water flooded most buildings. Bridges within Boone were impassable. Some residents were evacuated.
Aho	8-Jun-03	Flash Flood	$10,000	$0	Thunderstorms during the 8th produced flash flooding and damaging winds, heavy thunderstorm rains caused a partial washout of State Route 1514 near Aho and US Route 321 at Aho Road. Heavy rains flooded Dry Creek in Draper with water 6 inches deep running across the road. 5 miles east of Eden, a creek flooded across Wolf Island Road. Thunderstorm winds downed trees in Millers Creek, Roaring River, 10 miles northeast of Wilkesboro, western Yadkin County, Ayersville, 5 miles northwest of Wentworth, across Route 62 in Hamer, and also tore the roof off of a tobacco barn in Hamer.
Watauga County	19-Nov-03	Flash Flood	$1,500,000	$0	Moderate to heavy rain late on the 18th and on the 19th resulted in flash flooding and small stream flooding.
Watauga County	7-Sep-04	Flood	$2,700,000	$0	The remnants of Tropical Depression Frances brought flooding rains to portions of Northwest North Carolina from late in the evening on the 7th through the 8th. Rainfall totals averaged 4 to 6 inches with amounts higher in portions of the mountains. In Watauga County, the Watauga River flooded, leading to evacuations of homes in the Foscoe area. The headwaters of the New River, including the Middle and East Fork also flooded. A mud slide destroyed one home in the Bamboo area.
Watauga County	18-Sep-04	Flood	$5,000,000	$0	Damaging gradient winds in the early morning hours of 18 Nov 2004 behind the exiting remnants of hurricane Ivan downed numerous trees and power lines. 2000 people were without power in Ashe Co. Locally heavy rain around the Foscoe area of Watauga Co. prompted flooding of small streams and mudslides…which caused damage to several homes.
Boone	28-Jun-07	Flash Flood	$20,000	$0	A slow-moving thunderstorm with heavy rains resulted in a flash flood.
Matney	27-Jul-07	Flash Flood	$20,000	$0	An isolated thunderstorm formed over Beech Mountain in Watauga County North Carolina the afternoon of the 26th. Not only did this storm increase to severe levels with quarter size hail reported, it also produced very heavy rainfall (2 to 3 inches) in only a one-hour period. This rainfall caused fifteen

Area	Date	Type	Property Damage	Crop Damage	Description
					gravel roads to wash out, and the main road leading into Beech Mountain was blocked by debris.
Perkinsville	4-Mar-08	Flash Flood	$1,500,000	$0	Low pressure moved across the southern Appalachians producing 2 to 4 inches of rain which resulted in flash flooding.
Shulls Mills	27-Aug-08	Flash Flood	$1,000	$0	The remnants of Tropical Storm Fay moved slowly up the west side of the Appalachian Mountains and interacted with a frontal boundary just to our south. Some upslope enhancement occurred allowing 5-10 inches of rain to fall. The heavier rains caused flash flooding over portions of northwest North Carolina.
Valle Crucis	27-Aug-08	Flash Flood	$1,000	$0	
Valle Crucis	27-Aug-08	Flash Flood	$1,000	$0	
Perkinsville	20-Jul-09	Flash Flood	$100,000	$0	Numerous showers and storms were across the region during the day. A couple of these produced enough heavy rain in a short period of time to prompt flash flooding.
Perkinsville	5-Aug-09	Flash Flood	$2,000	$0	A moist and unstable air mass ahead of a cold front helped with the formation of thunderstorms. Some of the storms had torrential rains which caused flash flooding over portions of the North Carolina mountains during the afternoon and evening of August 5th.
Perkinsville	19-Aug-09	Flash Flood	$2,000	$0	A thunderstorm with torrential rains caused Kraut Creek to overflow its banks and flood the parking area of the Boone Mall, in Boone, NC, August 19th.
Perkinsville	20-Aug-09	Flash Flood	$3,000	$0	Thunderstorms with heavy rain produced another round of isolated flash flooding to portions of northwest North Carolina during the evening of the 20th into early morning on the 21st.
Perkinsville	24-Jan-10	Flash Flood	$10,000	$0	Abundant rain advanced north into the region in advance of an area of low pressure to the west while a frontal boundary remained draped over the region. An average of 2 to 5 inches of rain fell from this system onto an already saturated ground from recent snow melt and rainfall. The heavy rain contributed to widespread flash flooding, mudslides, areal flooding, and river flooding.
Boone	28-Jun-11	Flash Flood	$50,000	$0	A cold front swept through the region on the 28th. Multiple clusters of storms accompanied the front as it progressed. Some of these storms increased to severe levels and produced large hail and damaging winds. Flash flooding also occurred with one of the storms.

Area	Date	Type	Property Damage	Crop Damage	Description
Boone	6-Sep-11	Flash Flood	$750,000	$0	Remnants of Tropical Storm Lee moved northeast through the Tennessee Valley. Strong shear on the east side of the system was responsible for generating numerous rotating thunderstorms. One rotating storm produced a tornado in Wilkes County near Abshers. Other storms produced severe weather in the form of damaging winds. Very heavy rain was also associated with the system. Flooding and flash flooding occurred over parts of the region. The heaviest rainfall was concentrated along the crest of the blue ridge where three to five inches of rain fell. Some bursts of heavy rain had rainfall rates between one and two inches per hour.
Valle Crucis	6-Sep-11	Flash Flood	$10,000	$0	
Perkinsville	25-Sep-11	Flash Flood	$5,000,000	$0	Heavy rain showers, and some isolated thunderstorms in advance of an approaching cold front, produced as much as three to four inches of rain in several hours. The most intense rates were across parts of Watauga County where this amount of rain fell in only two to three hours. Significant flash flooding occurred over both Watauga and Ashe Counties.
Mabel	5-Aug-12	Flash Flood	$10,000	$0	An upper trough and associated cold front were moving from the Ohio Valley toward the Mid-Atlantic region as the strong summer subtropical ridge was squashed southward across the southeast states. Showers and thunderstorms developed during the late afternoon across northwest North Carolina in advance of a near solid line of thunderstorms that tracked across the area during the evening in advance of the cold front. Two to three inches of rain fell across parts of northwest North Carolina during this time frame. One flash flood event was observed in Watauga county just north of Sugar Grove.
Boone	30-Jan-13	Flash Flood	$175,000	$0	Unseasonably warm air, with afternoon temperatures reaching into the 60s and low 70s, and a surge of moisture from the Gulf of Mexico interacted with a slow-moving cold front during the afternoon and evening hours of January 30th, resulting in strong low-topped showers and thunderstorms and widespread heavy rainfall. Despite weak CAPE associated with the frontal passage, low level wind shear was in excess of 60 knots across the region, which made for strong squall lines of shower activity, often with strong winds but little to no lightning. Precipitable water values were observed to be in the 1.0 to 1.5 inch range, which is extremely high for January across the Appalachians and the nearby Piedmont region. To add to the flooding threat, ground conditions were already saturated from recent rain and snow during the days and weeks preceding the event.
Adams	7-Jul-13	Flash Flood	$20,000	$0	Watauga County continued to be the recipient of intense rains. Rainfall in the stronger cells approached 2 to 3 inches in a fairly short duration with flash flooding reported in Boone on the afternoon of the 7th. Rainfall during this period ranged from 2 to 4 inches with some isolated higher amounts.

Area	Date	Type	Property Damage	Crop Damage	Description
Boone	23-Oct-17	Flash Flood	$800,000	$0	A strong cold front associated with a negatively tilted shortwave upper trough approached the region on October 23^{rd}. These are roughly three standard deviations above the late October climatology and near all-time maxima for the date. Enhanced rainfall rates due to decent instability (for late October) were also expected to develop. Moderate rainfall of 1 to 2 inches had already fall ahead of a cold front that approached in the mid-afternoon. Flood impacts began to occur quickly as the higher rate rainfall moved into the area. Flooding was described as 'historic' by some observers ranking close to that seen in Hurricane Hugo in 1989.
Bowers Gap	18-May-18	Flash Flood	$1,250,000	$0	The synoptic pattern remained little changed from the previous day with deep moisture in place. An axis of very heavy rainfall pushed north across the Carolinas in the late afternoon and evening as the weak area of low pressure over the southeast lifted slowly northward. Slow-moving storms with highly efficient rainfall affected number of areas in the mountains and foothills of northern North Carolina. Rainfall amount were generally 2 to 4 inches over a several hour period with isolated higher amounts.
Valle Crucis	8-Jun-19	Flood	$20,000	$0	An unusual long-duration event occurred June 7-11 as a very slow-moving upper trough and surface high across New England combined to produce several days of cool-air damming and persistent rainfall along the frontal boundary and in orographically favored areas of the Blue Ridge with the heaviest rainfall focused over eastern Watauga and Ashe and western Wilkes counties where rain gauges showed 2 to 3 inches in the 24-hour period ending at 0800 EDT on June 8^{th}. The rain continued much of the 8^{th} even heavier amounts with an additional 4 to 8 inches across parts of the area and another 2 to 3 inches ending 0700 on the 10^{th}. Numerous official sites set daily rainfall records on both June 8 and June 9. Four-day totals by the morning of the 10^{th} ranged from 5 to 15 inches, with isolated amounts at unofficial sites approaching 20 inches. The tremendous inflow from various tributaries in the upper Yadkin basin pushed the pool elevation at W. Kerr Scott Reservoir (WLKN7) to its highest level since the dam was completed in 1962, reaching 1062.61 feet on June 10^{th}, eclipsing the previous record of 1061.20 feet in November, 1977.
Foscoe	9-Jun-19	Flood	$615,000	$0	
Matney	11-Jan-20	Flash Flood	$50,000	$0	An unusually warm and humid airmass in advance of a strong spring-like cold front triggered numerous severe thunderstorms that produced damaging winds and flash flooding.

Area	Date	Type	Property Damage	Crop Damage	Description
Boone/Blowing Rock Arpt	6-Feb-20	Flood	$81,000	$0	A deep upper-level trough moved slowly across the central and eastern U.S. bringing abundant moisture northward and combined with a complex frontal boundary with several waves of low pressure to bring repeated rounds of heavy rainfall. Rainfall totals for the 72-hour period ending at 700 AM EST on February 7th ranged from 2 to 6 inches with isolated higher amounts along the Blue Ridge Mountains, but most of the rain fell within a 48-hour period. Numerous NWS Cooperative stations reported record one-day February rainfall amounts ending on the morning of February 6th and/or the 7th and numerous two-day all-time February records were also set. Some flash flooding occurred early during the event as higher rates of rainfall were embedded within the overall rain pattern. Numerous rivers and streams flooded, some reaching crests in the 25- to 50-year flood recurrence interval and many roads were flooded with significant damage to some infrastructure.

Source: National Centers for Environmental Information

TABLE A.23: SUMMARY OF FLOOD OCCURRENCES

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2020)
Beech Mountain	0	0/0	$0
Blowing Rock	4	0/0	$0
Boone	23	0/0	$2,465,000
Seven Devils	0	0/0	$0
Unincorporated Areas	84	0/0	$17,956,000
Watauga County Total	**111**	**0/0**	**$20,421,000**

Source: National Centers for Environmental Information

FIGURE A.26: CAMPUS FLOODING (OCTOBER 23, 2017)

Source: https://business.appstate.edu/news/pictures-october-23-2017-flooding-appalachian-state-universitys-peacock-hall

A.5.9.3 Probability of Future Occurrences

Flood events will remain a threat to Appalachian State University, 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). It can be inferred from the floodplain location maps, previous occurrences, and repetitive loss properties that risk varies throughout the Appalachian State University campus.

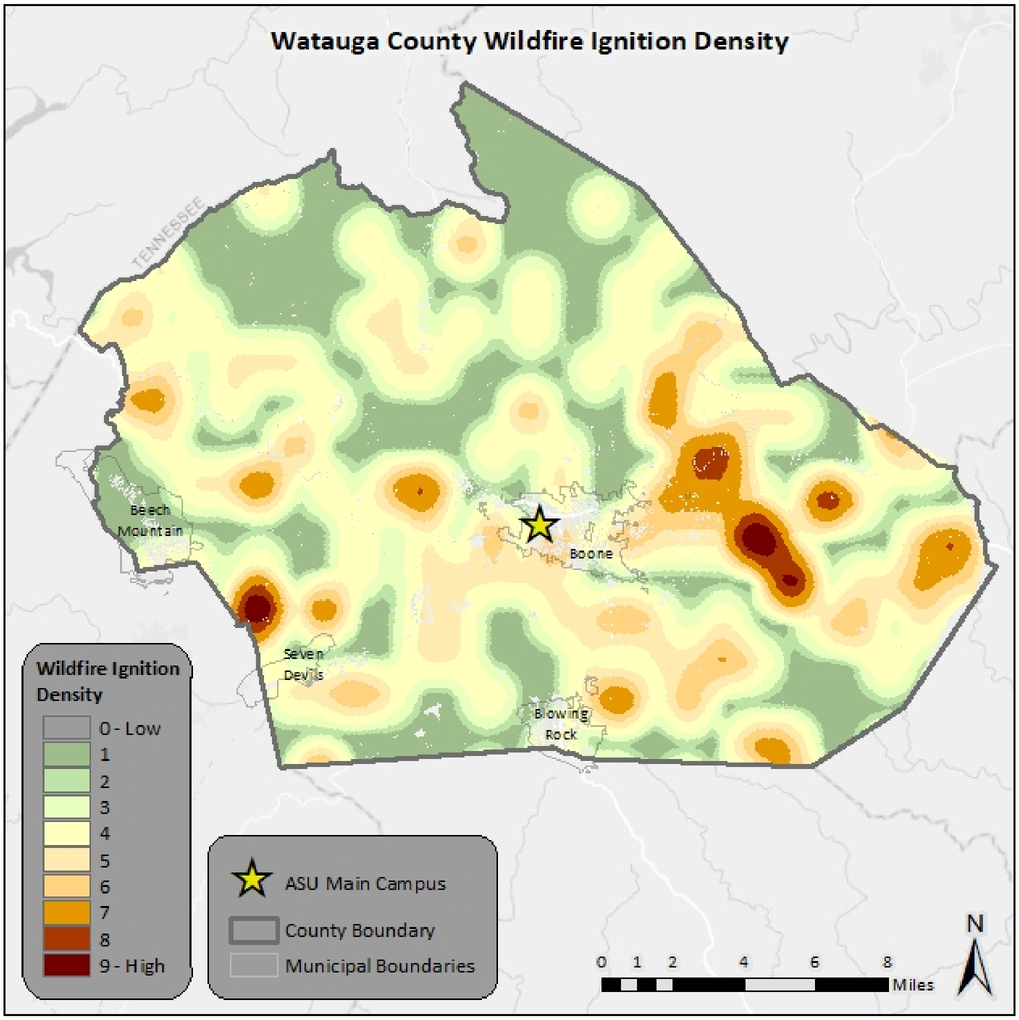
A.5.10 WILDFIRES

A.5.10.1 Location and Spatial Extent

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

Figure A.27 shows the Wildfire Ignition Density in the Watauga County 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.

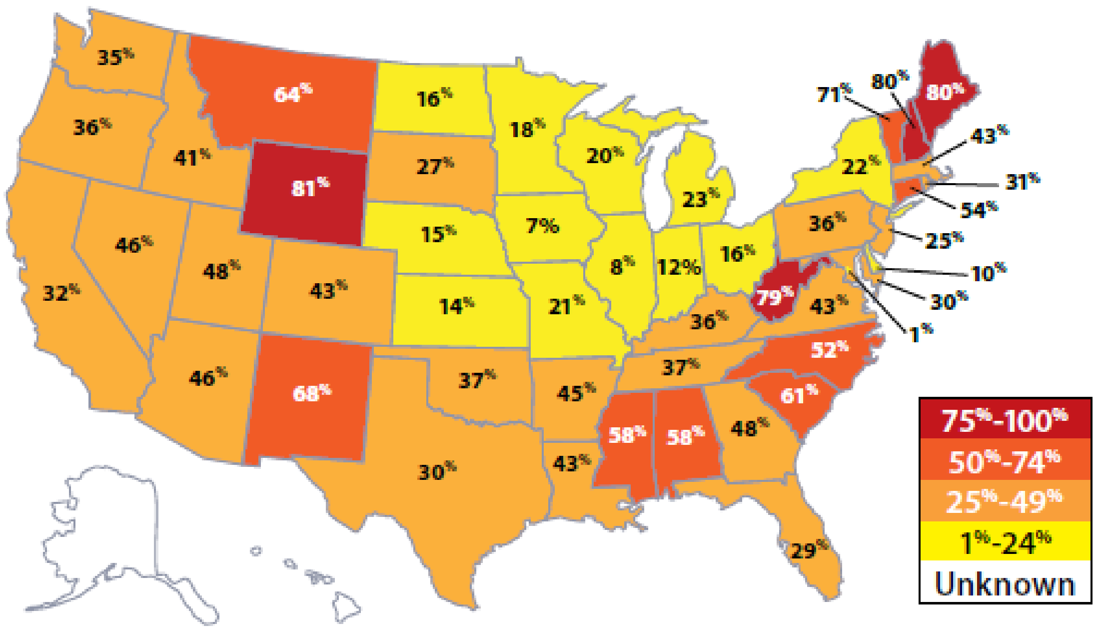
FIGURE A.27: WILDFIRE IGNITION DENSITY IN WATAUGA COUNTY



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 A.28** 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.

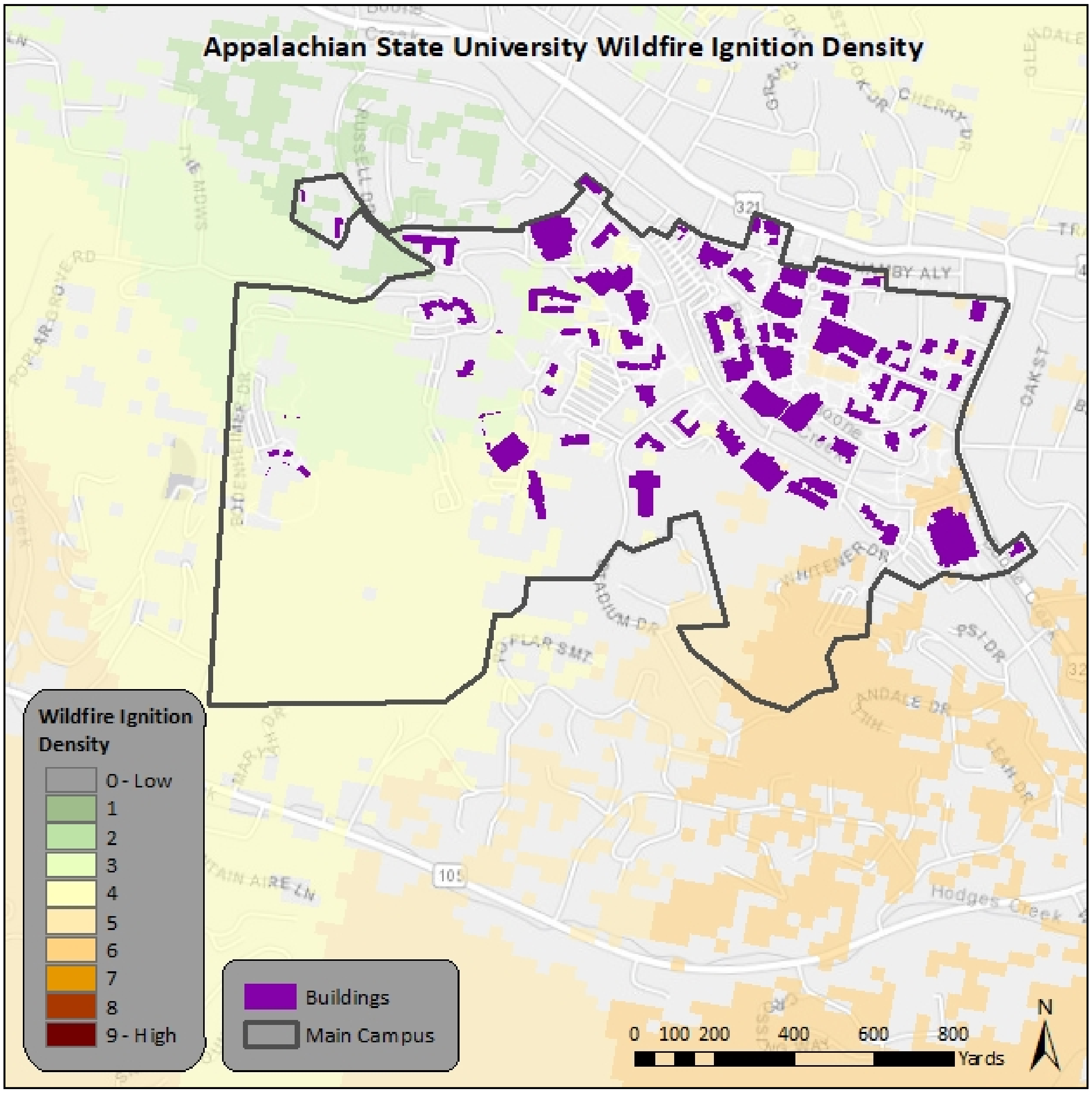
FIGURE A.28: % OF HOMES IN THE WILDLAND URBAN INTERFACE



Source: US Department of Agriculture

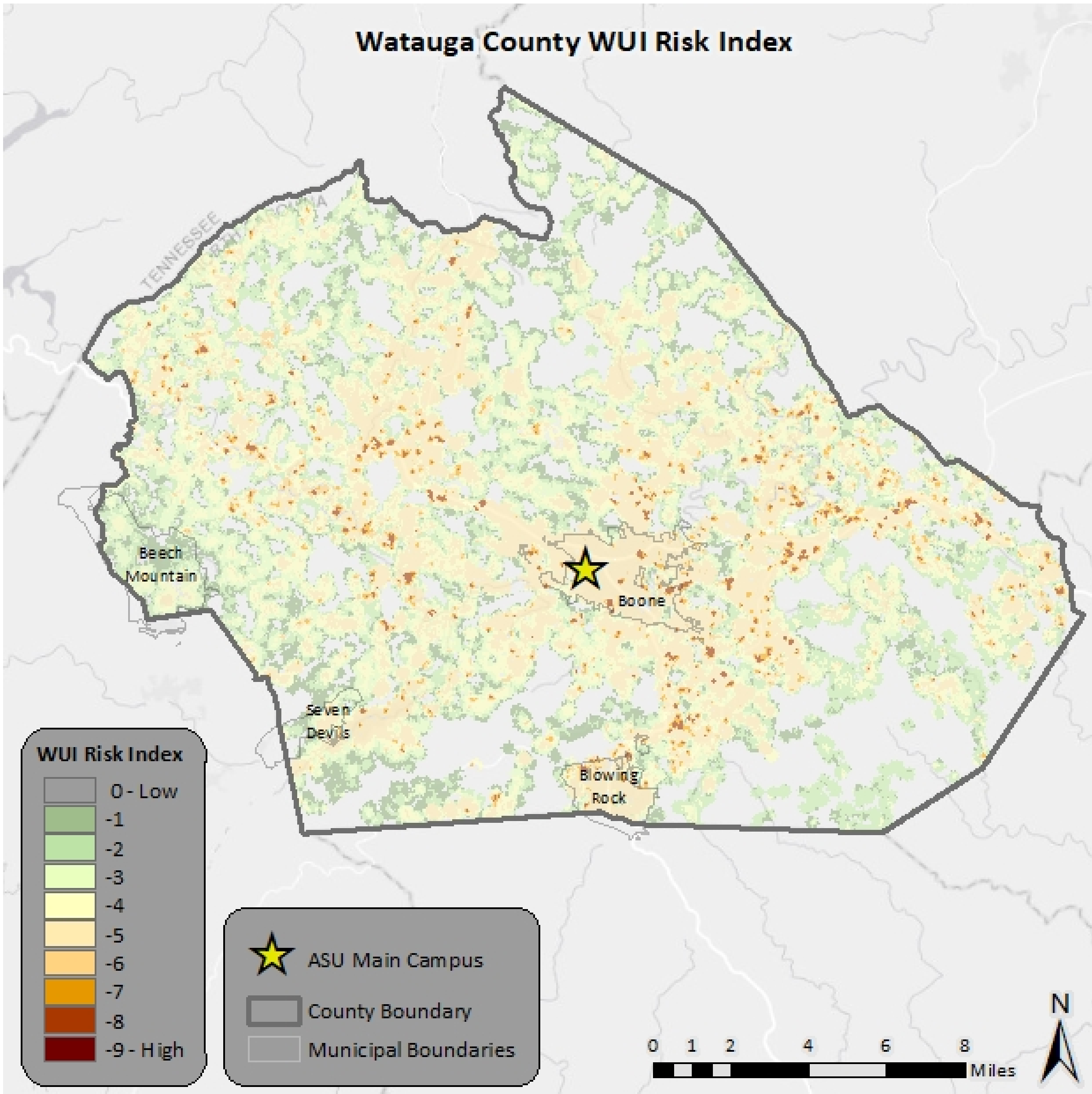
Below, **Figure A.29** displays the Wildfire Ignition Density specifically for the Appalachian State University, and **Figure A.30** shows the WUI Risk Index for Watauga County.

FIGURE A.29: ASU CAMPUS WILDFIRE IGNITION DENSITY



Source: Southern Wildfire Risk Assessment

FIGURE A.30: WATAUGA COUNTY WILDFIRE URBAN INTERFACE RISK INDEX

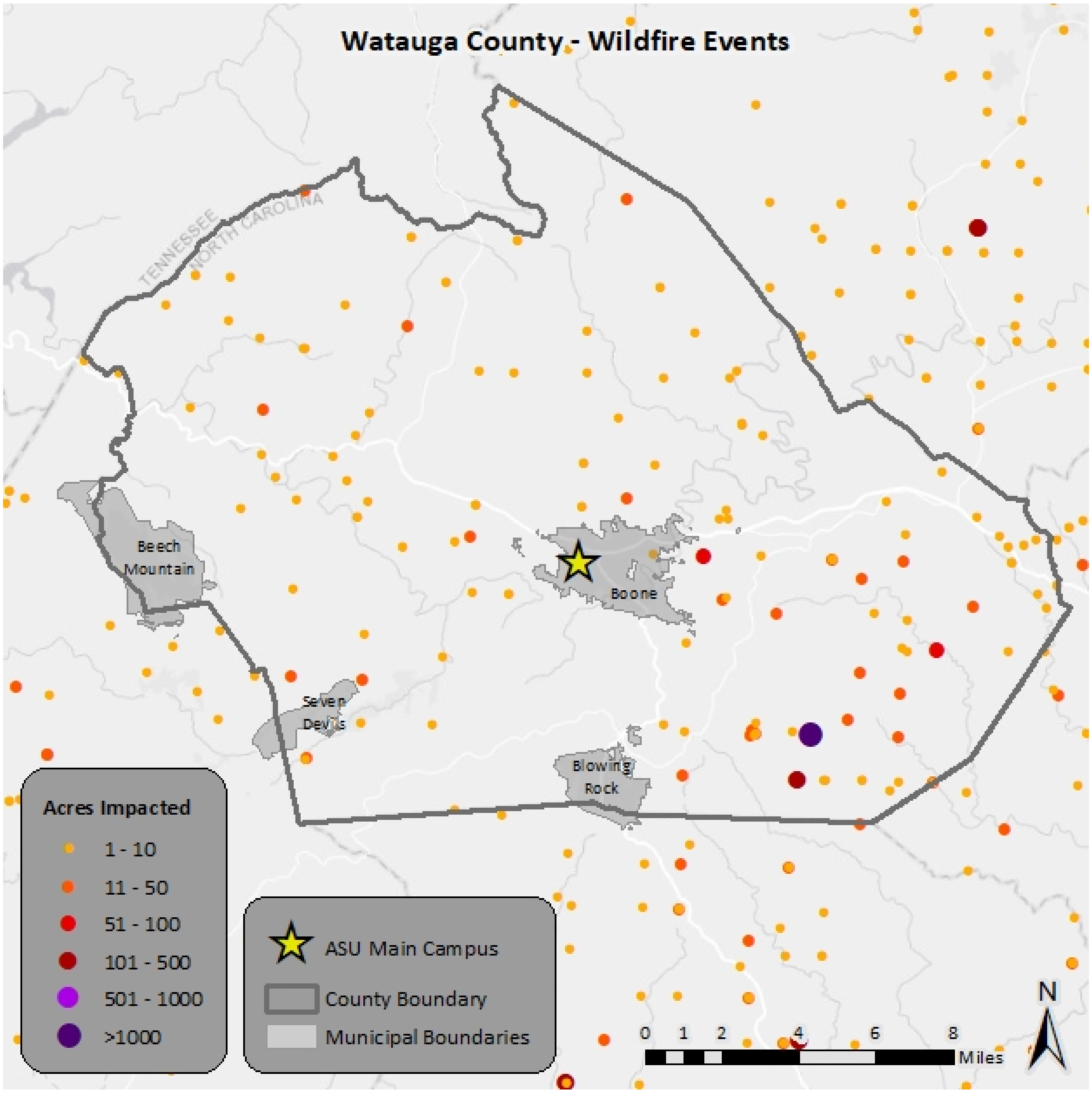


Source: Southern Wildfire Risk Assessment

A.5.10.2 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 172 events that impacted an area greater than 1 acre have occurred throughout the Watauga County since (January 1, 2015)[9]. **Figure A.31** displays wildfire events in Watauga County.

FIGURE A.31: WILDFIRE EVENTS IN WATAUGA COUNTY



Source: NASFI

Based on data from the North Carolina Division of Forest Resources from 2003 to 2018, Watauga County experiences an average of 9 wildfires annually which burn a combined 140.44 acres, on average. The data

[9] These events are only inclusive of those reported by NASFI. It is likely that additional events have occurred and have gone unreported.

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.

There is one incident of wildfire in the National Centers for Environmental Information database for Watauga County. The event occurred on February 14, 2011 and was caused by a fallen tree onto an electrical line which caused a wildfire to break out in the Green Briar/ Rocky Knob area of Watauga County. The winds, gusting as high as 62 mph at the Boone airport (KNTB), combined with low relative humidity to fan the fire. About 60 to 100 acres were burned but no homes were damaged. High winds and falling humidity behind a cold front were blamed for either causing or aggravating wildfires that broke out in several North Carolina counties.

A.5.10.3 Probability of Future Occurrences

Wildfire events will be an ongoing occurrence in Watauga County and for Appalachian State University. 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 Appalachian State University for future wildfire events are likely (10 to 100 percent annual probability).

A.5.11 INFECTIOUS DISEASE

A.5.11.1 Location and Spatial Extent

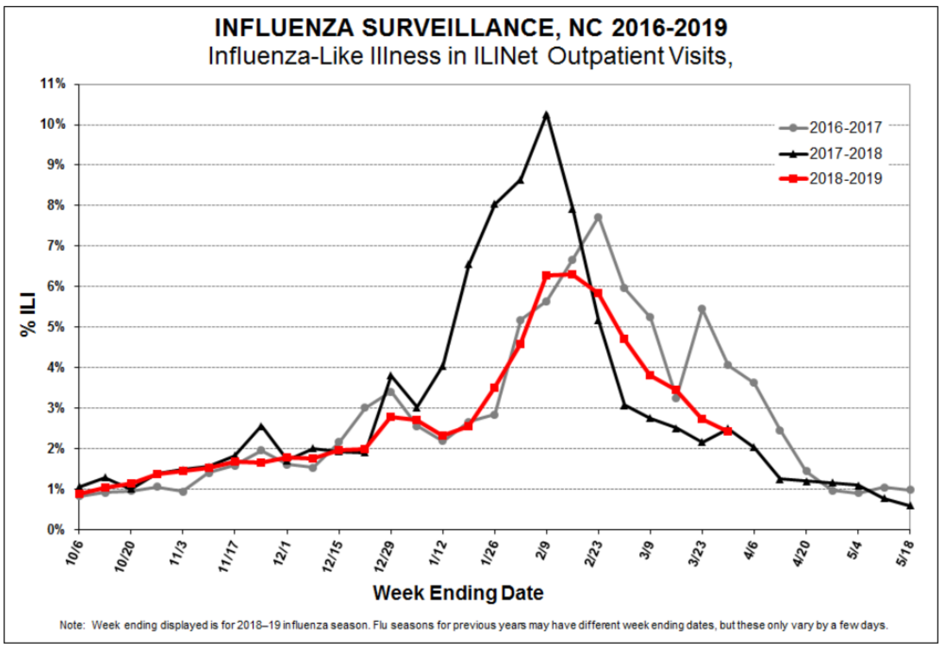
Extent is difficult to measure for an infectious disease event as the extent is largely dependent on the type of disease and on the effect that it has on the population. Extent can be somewhat defined by the number of people impacted, which depending on the type of disease could number in the tens of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

A.5.11.2 Historical Occurrences

Infectious Disease

Influenza is historically the most common infectious disease that has occurred in Watauga County. Cases of the flu tend to occur in the late fall to early winter months. In recent years, cases of the influenza and influenza-like illnesses have been reported in hospitals. As seen in **Figure A.32** below, 172 people throughout North Carolina died from the flu between 2018 and 2019.

FIGURE A.32: 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

Starting in 2020, the COVID-19 infectious disease pandemic began to impact North Carolina and Watauga County. The NC Department of Health and Human Services has been actively monitoring and tracking cases since the first case arrived in the State. A Presidential disaster declaration was declared for North Carolina on March 24, 2020 for the COVID-19 pandemic. **Table A.36** provides a summary of confirmed cases of COVID–19 in Watauga County as of the date of the final version of this plan in 2021. The COVID-19 pandemic is still evolving even though vaccines have been created that are slowing the spread. The pandemic unfolded as this plan was being developed, so the information below presents only a small sample of the pandemic's impacts on Watauga County. On April 27, 2020, the UNC System made the decision to postpone in-person classes for the remainder of the school year. As a result, ASU and all other universities in North Carolina, shifted to online courses. Due to Executive Order 135, which extended the existing statewide stay-at-home order through May 8, 2020; college campuses were asked to vacate any on-campus university housing.

TABLE A.24: SUMMARY OF CONFIRMED COVID-19 CASES IN WATAUGA COUNTY

Location	Number of Cases	Number of Deaths*
Watauga County	**4,628**	**31**

Source: North Carolina Department of Health and Human Services as of 5/13/21

** Deaths reflect deaths in persons with laboratory-confirmed COVID-19 reported by local health departments to the 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[10].

A.5.11.3 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 Appalachian State University will experience an outbreak of infectious diseases in the future.

[10] https://www.ncdhhs.gov/news/press-releases/nc-prepared-zika-virus-risk-local-virus-carrying-mosquitoes-low

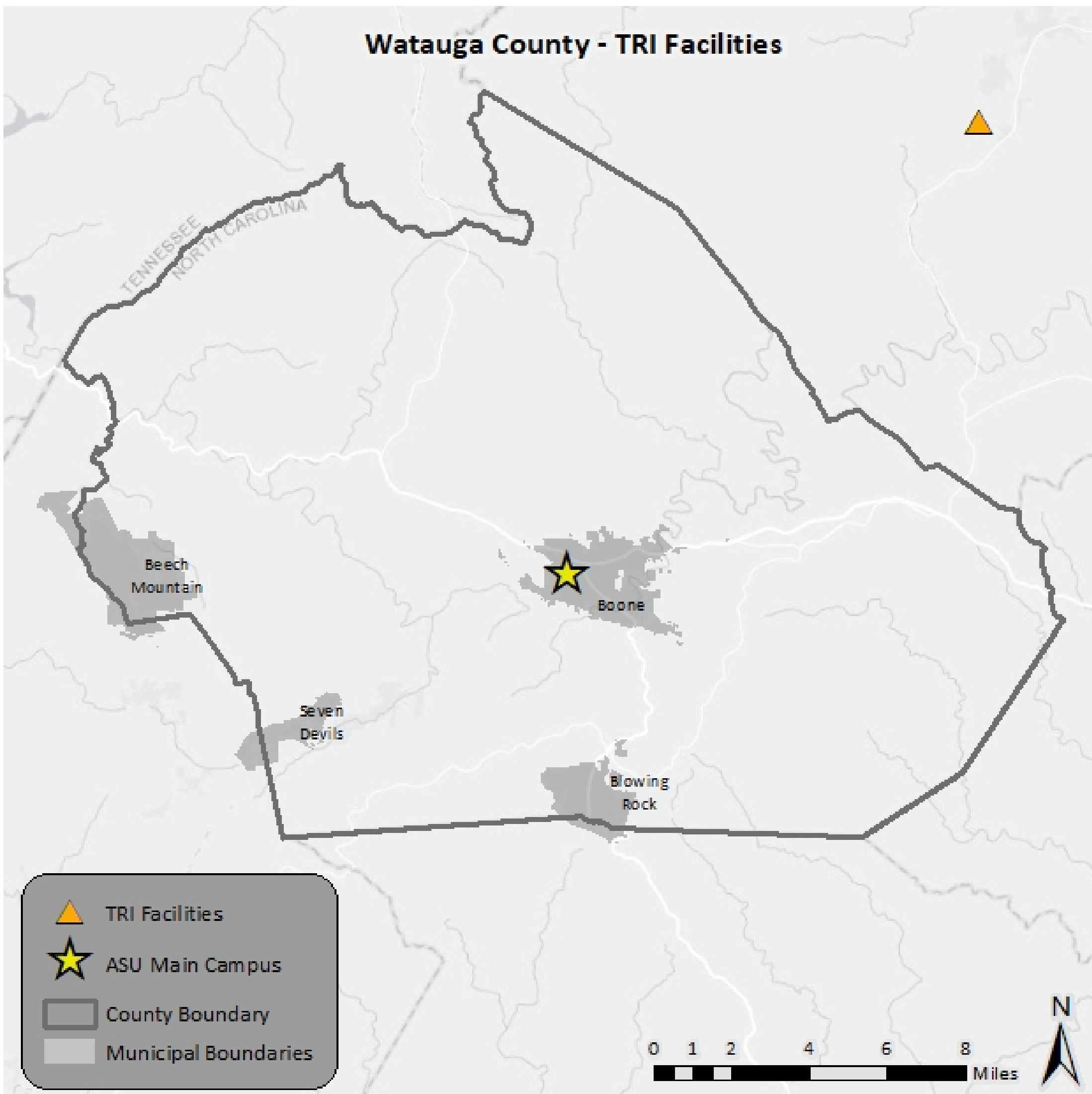
Technological Hazards

A.5.12 HAZARDOUS SUBSTANCES

A.5.12.1 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 collection information from industrial facilities on the releases and transfers of certain toxic agents. This information is then reported in the Toxic Release Inventory (TRI). TRI sites indicate where such activity is occurring. Watauga County has no TRI sites. A map for Watauga County TRI Facilities is shown in **Figure A.34.**

FIGURE A.34: TOXIC RELEASE INVENTORY (TRI) SITES



Source: EPA

A.5.12.2 Historical Occurrences

The U.S. Department of Transportation Pipeline and Hazard 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.

The Pipeline and Hazardous Materials Safety Administration (PHMSA) is an agency of the United States Department of Transportation that was established in 2004. The PHMSA maintains a database of hazardous materials incidents for communities across the United States. Summary results of their data for events that have occurred in Watauga County can be found in **Table A.25.**

TABLE A.25: SUMMARY OF HAZMAT INCIDENTS IN WATAUGA COUNTY

Location	Incidents Reported	Injuries	Fatalities	Type	Costs
Watauga County	**16**	**0**	**0**		**$53,070**
Beech Mountain	0	0	0	N/A	$0
Blowing Rock	2	0	0	Highway	$0
Boone	13	0	0	Highway	$50,515
Seven Devils	0	0	0	N/A	
Unincorporated Area	1	0	0	Highway	$2,555

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

A.5.12.3 Probability of Future Occurrence

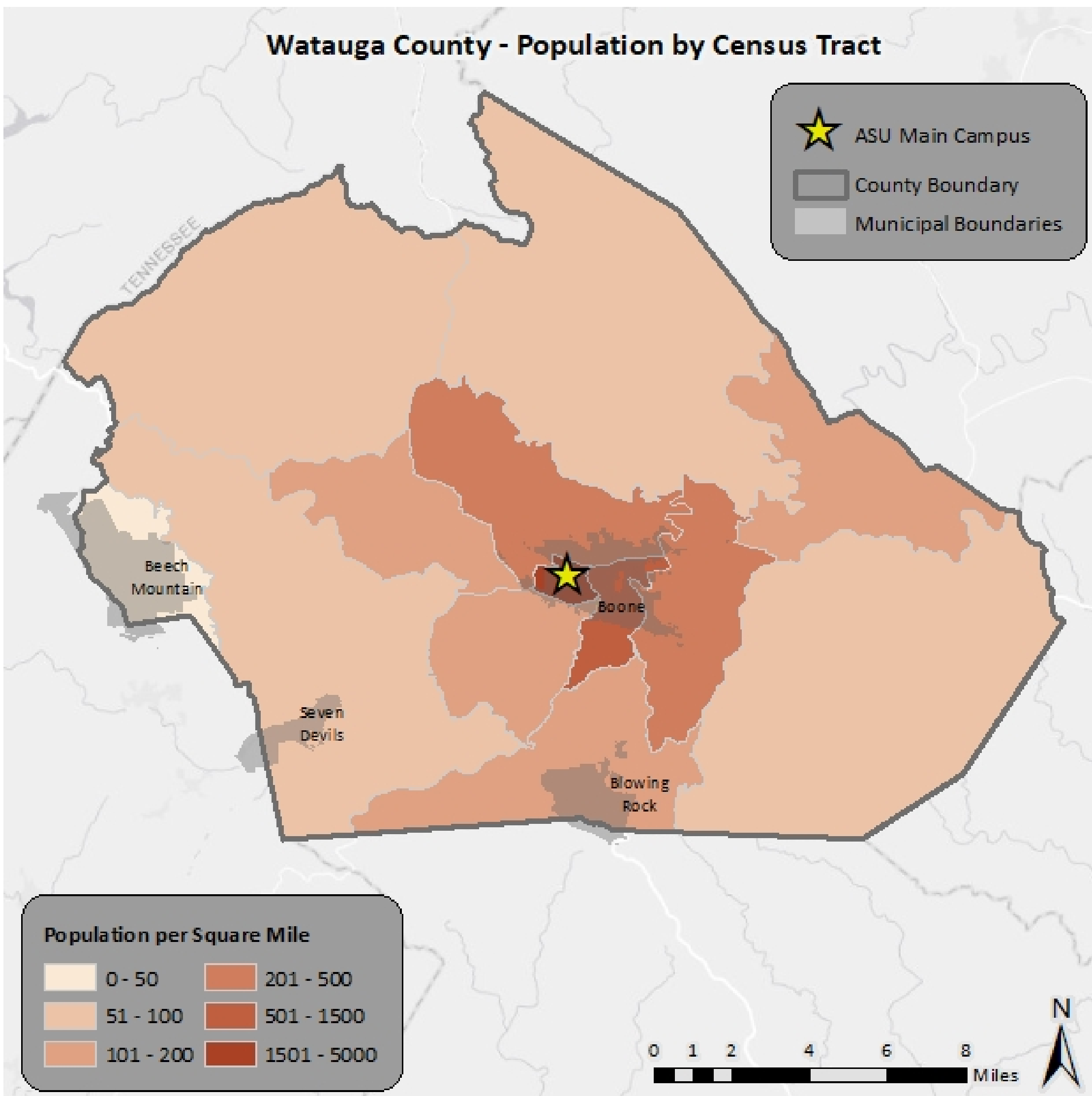
Given the location of toxic release inventory sites in Watauga County, it is possible that a hazardous material incident may occur. University officials are mindful of this possibility and take precautions to prevent such an event from occurring.

A.5.13 TERRORISM

A.5.13.1 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 A.35** displays the population density in Watauga County using census tract levels.

FIGURE A.35: POPULATION DENSITY



Source: US Census Bureau

Furthermore, the most recent population counts of each participating county and jurisdictions can be seen in **Table A.26** below.

TABLE A.26: 2018 POPULATION ESTIMATES FOR WATAUGA COUNTY

Location	2018 Population Estimate
Beech Mountain	321
Blowing Rock	1,307
Boone	19,562
Appalachian State University[11]	17,518
Seven Devils	202
Unincorporated Area	34,553
Watauga County Total	55,945

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

A.5.13.2 Historical Occurrences

No extreme cases of terror attacks have previously affected Watauga County or Appalachian State University. However, as the population in the area continues to increase, so does the chance of an attack. There is an ongoing concern on college campuses about active shooter events. Information from the National Center on Safe and Supportive Learning Environments, a recent study found between the 2001-2002 and 2015-2016 school years, 437 people were shot in 190 college campus shooting incidents.

A.5.13.3 Probability of Future Occurrence

Neither Watauga County nor Appalachian State University have experienced a 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.

A.5.14 CYBER

A.5.14.1 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. Appalachian State University is susceptible to cyber-attacks. The ITS Office of Information Security (ITS-OIS) and the Student Cyber Security Operations Center (SCSOC) are ASU's information security unit.

[11] Undergraduate population statistic for main campus and App State Online.

A.5.14.2 Historical Occurrences

In North Carolina, 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. **Table A.27** displays the North Carolina Cybercrimes and Victim Counts in 2018.

TABLE A.27: NORTH CAROLINA CYBERCRIMES AND VICTIM COUNTS IN 2018

Crime Type by Victim Count			
Crime Type	*Victim Count*	*Crime Type*	*Victim Count*
Advanced Fee	436	Identity Theft	330
BEC/EAC	430	Investment	47
Charity	11	Lottery/Sweepstakes/Inheritance	213
Civil Matter	15	Malware/Scareware/Virus	49
Confidence Fraud/Romance	432	Misrepresentation	148
Corporate Data Breach	39	No Lead Value	246
Credit Card Fraud	306	Non-payment/Non-Delivery	1,647
Crimes Against Children	28	Other	172
Denial of Service/TDos	28	Overpayment	406
Employment	391	Personal Data Breach	1,125
Extortion	1,219	Phishing/Vishing/Smishing/Pharming	947
Gambling	4	Ransomware	29
Government Impersonation	255	Re-shipping	31
Hacktivist	2	Real Estate/Rental	286
Harassment/Threats of Violence	330	Spoofing	430
Health Care Related	9	Tech Support	361
IPR/Copyright and Counterfeit	30	Terrorism	2
Descriptors*			
Social Media	902	Virtual Currency	790

Source: FBI Internet Crime Compliant Center, 2018

Local news media for Watauga County have reported in a 2018 article that ASU, within a two-week period, prevented over 411,000 attempted network attacks against university servers and 33,000 attempted malware attacks[12]. Although Appalachian State University has not reported any major catastrophic cyberattacks, the potential to experience one is unpredictable and can happen at any time.

A.5.14.3 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 at Appalachian State University, and it is considered likely (between 10 and 100 percent annual probability) to experience one in the near future.

[12] https://www.wataugademocrat.com/news/new-state-unit-aims-to-fend-off-cyber-attacks-local/article_d71b6f62-3c3f-53d6-8357-f995b551ec0f.html

A.5.15 ELECTROMAGNETIC PULSE

A.5.15.1 Location and Spatial Extent

An EMP can happen in any location, and they are relatively unpredictable. Due to advancing technologies, densely populated areas may be more prone to damages from an EMP. Therefore, Boone and the Appalachian State University campus may be more susceptible.

A.5.15.2 Historical Occurrences

There have been no reports of EMP occurrences at Appalachian State University.

A.5.15.3 Probability of Future Occurrences

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

A.5.16 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.

A.5.16.1 Hazard Extent

Table A.28 describes the extent of each natural hazard identified for Appalachian State University. The extent of a hazard is defined as its severity or magnitude, as it relates to the planning area.

TABLE A.28 EXTENT OF APPALACHIAN STATE UNIVERSITY 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. Watauga County has received this ranking (three times) over the nineteen-year reporting period. According to the NOAA, Watauga County has had drought occurrences in six of the last twenty-five years (1995-2019).
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 Watauga County was Hurricane Hugo in 1989 which carried tropical force winds of 85 miles per hour upon arrival.
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 Watauga County was an F1 (reported in 1996).

	Thunderstorms: Thunderstorm extent is defined by the number of thunder events and wind speeds reported. According to a 63-year history from the National Centers for Environmental Information, the strongest recorded wind event in Watauga County was reported on June 22, 2001 at 100 knots (approximately 115 mph). It should be noted that future events may exceed these historical occurrences. Lightning: According to the Vaisala flash density map (Figure 5.15), Appalachian State University 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. Hailstorms: Hail extent can be defined by the size of the hail stone. The largest hail stone reported in Watauga County was 4.0 inches (reported on June 2, 1998). It should be noted that future events may exceed this.
Severe Winter Weather	The extent of winter storms can be measured by the amount of snowfall received (in inches). The greatest 24-hour snowfall was reported in Watauga County was 25 inches reported on January 26, 1920.
Earthquakes	Earthquake extent can be measured by the Richter Scale (Table 5.21) and the Modified Mercalli Intensity (MMI) scale and the distance of the epicenter to Watauga County. According to data provided by the National Geophysical Data Center, the greatest MMI to impact Watauga County 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.
Geological	Landslide: As noted above in the landslide profile, the landslide data provided by the North Carolina Geological survey is incomplete. This provides a challenge when trying to determine an accurate extent for the landslide hazard. However, when using the USGS landslide susceptibility index, extent can be measured with incidence, which is high throughout most of Watauga County. There is also at least moderate susceptibility throughout a majority of the region. Sinkhole: The western part of North Carolina and Appalachian State University are susceptible to sinkholes; however, there are no historical records of sinkholes in Watauga County. Erosion: The extent of erosion can be defined by the measurable rate of erosion that occurs. There are no erosion rate records available for Watauga County or Appalachian State University.
Dam Failure	Dam failure extent is defined using the North Carolina Division of Land Resources criteria. Of the 30 dams in Watauga County, 18 are classified as high-hazard.

Flooding

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 7 percent of the total land area for Appalachian State University. Flood depth and velocity are recorded via United States Geological Survey stream gages throughout the region. While a gauge does not exist on Appalachian State University's campus, there is one at or near many areas. The greatest peak discharge recorded for the area was reported in July 1916. Water reached a discharge of 28,000 cubic feet per second and the stream gage height was recorded at 22.1 feet. Peak discharge for the gage on the Watauga River near Sugar Grove, NC is in the table below.

Location/Jurisdiction	Date	Peak Discharge (cfs)	Gage Height (ft)
Watauga County			
Watauga River near Sugar Grove, NC	Jul-16	28,000	22.1

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 Watauga County.

- The greatest number of fires to occur in any year was 25 in 2001.
- The greatest number of acres to burn in a single year occurred in 2016 when 1,394 acres were burned.
- The largest acres burned in a single incidence occurred in 2016 when 1,379 acres were burned.

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

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 Appalachian State University 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 Watauga County is 120 LGA released on the highway on January 14, 2016. It should be noted that larger events are possible.

Terrorism	Although no severe terrorism attacks have been reported at Appalachian State University, the entire campus 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 for Appalachian State University. Technology usage, however, is increasing. A cyber-attack could potentially devastate the campus and could have lasting negative impacts.
Electromagnetic Pulse	Electromagnetic Pulse (EMP) occurrences have not taken place at Appalachian State University, 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.

A.5.16.2 Priority Risk Index

In order to draw some meaningful planning conclusions on hazard risk for Appalachian State University, the results of the hazard profiling process were used to generate hazard classifications according to a "Priority Risk Index" (PRI). The purpose of the PRI is to categorize and prioritize all potential hazards for Appalachian State University as high, moderate, or low risk. Combined with the asset inventory and quantitative capability 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 Appalachian State University to consider as part of their proposed mitigation strategy.

The prioritization and categorization of identified hazards for Appalachian State University 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 Appalachian State University Campus Hazard Mitigation Planning Team in gaining consensus on the determination of those hazards that pose the most significant threat to the campus 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 at Appalachian State University 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[13], as summarized in **Table A.29**. 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:

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

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

According to the weighting scheme and point system applied, the highest possible value for any hazard is 4.0. When the scheme is applied for Appalachian State University, 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 Appalachian State University Campus Hazard Mitigation Planning Team.

TABLE A.29: PRIORITY RISK INDEX FOR THE APPALACHIAN STATE UNIVERSITY

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	

PRI Category	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
Spatial Extent	Negligible	Less than 1% of area affected	1	20%
	Small	Between 1 and 10% of area affected	2	
	Moderate	Between 10 and 50% of area affected	3	
	Large	Between 50 and 100% of area affected	4	
Warning Time	More than 24 hours	Self-explanatory	1	10%
	12 to 24 hours	Self-explanatory	2	
	6 to 12 hours	Self-explanatory	3	
	Less than 6 hours	Self-explanatory	4	
Duration	Less than 6 hours	Self-explanatory	1	10%
	Less than 24 hours	Self-explanatory	2	
	Less than one week	Self-explanatory	3	
	More than one week	Self-explanatory	4	

A.5.16.3 Priority Risk Index Results

Table A.30 summarizes the degree of risk assigned to each category for all initially identified hazards based on the application of the PRI. Assigned risk levels were based on the detailed hazard profiles developed for this section, as well as input from the Campus Hazard Mitigation Planning Team. The results were then used in calculating PRI values and making final determinations for the risk assessment.

TABLE A.30: SUMMARY OF PRI RESULTS FOR THE APPALACHIAN STATE UNIVERSITY

Hazard	Sub hazard(s) Assessed	Category/Degree of Risk					
		Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Natural Hazards							
Drought		Possible	Minor	Large	More than 24 hours	More than 1 week	2.2
Excessive Heat		Unlikely	Minor	Large	More than 24 hours	Less than 1 week	1.8
Hurricane and Coastal Hazards		Possible	Critical	Large	More than 24 hours	Less than 24 hours	2.6
Tornadoes/ Thunderstorms	Hailstorm, Lightning	Likely	Limited	Moderate	6 to 12 hours	Less than 6 hours	2.5
Severe Winter Weather		High Likely	Limited	Large	More than 24 hours	Less than one week	3
Earthquakes		Possible	Minor	Moderate	Less than 6 hours	Less than 6 hours	2.3
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	2.4
Flooding		Likely	Limited	Moderate	6 to 12 hours	Less than one week	2.7
Other Hazards							
Wildfires		Likely	Minor	Small	Less than 6 hours	More than 1 week	2.4
Infectious Disease		Possible	Critical	Large	More than 24 hours	More than 1 week	2.8
Technological Hazards							
Hazardous Substances		Possible	Limited	Small	Less than 6 hours	Less than 24 hours	2.2
Radiological Emergency		Unlikely	Critical	Moderate	6 to 12 hours	More than one week	2.5
Terrorism		Unlikely	Critical	Small	Less than 6 hours	Less than 24 hours	2.2
Cyber		Possible	Minor	Large	Less than 6 hours	Less than 24 hours	2.4
Electromagnetic Pulse		Unlikely	Minor	Large	Less than 6 hours	Less than one week	2.1

A.5.17 FINAL DETERMINATIONS

The conclusions drawn from the hazard profiling process for Appalachian State University, including the PRI results and input from the Campus 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 at Appalachian State University. It should be noted that although some hazards are classified below as posing low risk, their occurrence of varying or unprecedented magnitudes is still possible in some cases and their assigned classification will continue to be evaluated during future plan updates.

Table A.31 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 Appalachian State University Campus Hazard Mitigation Planning Team.

TABLE A.31: 2021 CONCLUSIONS ON HAZARD RISK FOR APPALACHIAN STATE UNIVERSITY

HIGH RISK	Severe Winter Weather Infectious Disease Flooding Cyber
MODERATE RISK	Earthquake Geological Hazards (Landslide, Erosion) Hurricanes and Coastal Hazards Severe Thunderstorms/Tornadoes Hazardous Material Incident Wildfires Terrorism
LOW RISK	Drought Dam Failure Excessive Heat Electromagnetic Pulse

A.6 Capability Assessment

The purpose of conducting a capability assessment for an institution of higher learning is to determine the ability of the institution to implement a comprehensive mitigation strategy and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs, or projects[14]. 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 the university's regulatory framework, level of administrative and technical support, access to fiscal resources, and current political climate.

A capability assessment is generally based upon two primary components: 1) an inventory of the university's relevant plans, programs and policies already in place and 2) an analysis of the university's capacity to carry them out. Careful examination of campus capabilities will detect any existing gaps, shortfalls, or weaknesses with ongoing 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 university, which should continue to be supported and enhanced through future mitigation efforts.

The capability assessment completed for ASU 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.

Capability Assessment Findings and Conclusion

Collectively, ASU's administrative, technical and fiscal capabilities are high. Some of the highlights of ASU's capabilities include the following:

- Designated a StormReady Campus by the National Weather Service

ASU's high capability will help ensure that the Mitigation Strategy is effectively carried out and that hazard risk reduction for the campus is an attainable goal. 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 Campus Hazard Mitigation Planning Committee considered not only their level of hazard risk, but also their existing capability to minimize or eliminate that risk.

[14] While the Final Rule for implementing the Disaster Mitigation Act of 2000 does not require a local capability assessment to be completed for hazard mitigation plans, it is a critical step in developing a mitigation strategy that meets the needs of the campus while taking into account their own unique abilities. The Rule does state that a 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)).

A.7 Mitigation Action Plan

The Mitigation Action Plan, or MAP, provides a functional plan of action for reducing vulnerability at Appalachian State University. It is designed to achieve the mitigation goals established in Section 4, Mitigation Strategy, of the main plan and will be maintained on a regular basis according to the plan maintenance procedures established in Section 5, Plan Maintenance, of the main plan.

Each proposed mitigation action has been identified as an effective measure (policy or project) to reduce hazard risk to the buildings on ASU's campus. 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's 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. 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.

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 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.
- Relative Cost
- Identification of University Department Responsible for each action
- Implementation Schedule—Date by which the action should be completed. More information is provided when possible.
- Implementation Status (2021)—Indication of completion, progress, deferment, or no change since the previous plan. If the action is new, that will be noted here.

All of the mitigation actions in this section have been assigned to Emergency Management and Facilities staff to ensure their implementation. Other University Departments will be consulted for input on an as-needed basis.

For the update of this plan, the ASU Campus Hazard Mitigation Planning Team participated in three activities related to the mitigation strategy for the university. Those activities included the following:

1. Review and reapproval of previous mitigation goals for the UNC Western Campuses. All eight of the campuses in the Western region decided to leave the previous mitigation goals in place and unchanged.
2. Review and update of existing mitigation actions. The Campus Hazard Mitigation Planning Team reviewed each existing action to determine if it was still relevant, if the prioritization of the action remained the same and to provide an update on the status of implementation for the actions.
3. Identification of any new mitigation actions as determined necessary. The Campus Hazard Mitigation Team identified several new actions for inclusion in the plan. New mitigation actions for this update are marked as such in the Mitigation Action Plan.

The Mitigation Action Plan for ASU is found on the following pages.

Campus-Wide Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Property Protection							
CW-PP-1	As feasible and as funding is available, install generators/back-up power, for critical facilities campus wide	All Hazards	Moderate	$25,000-$100,000 per generator	Emergency Management, Facilities	2026	New action for the 2021 update.

Anne Belk Hall Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Prevention							
ABH-P-1	Install new HVAC equipment in the disaster recovery data center which can be powered by the emergency generator in the event of power loss.	Earthquake, Geological, Tornadoes/Thunderstorms, Wildfire, Flood	Moderate	$25,000-$100,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
ABH-P-2	Prune large tress surrounding building to prevent damage to building structure or utilities, pruned trees should not overhang the roof.	Tornadoes/Thunderstorms, Severe Winter Weather	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
ABH-P-3	Correct source of water infiltration in the basement to prevent damage to electrical equipment and reduce hazard of electrical shock.	Flood	Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Property Protection							
ABH-PP-1	Move trash dumpster further away from the emergency generator and install bollards to protect generator and guarantee adequate room for routine trash service.	Earthquake, Geological, Tornadoes/Thunderstorms, Wildfire, Flood	Low	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
ABH-PP-2	Install a sprinkler system throughout building	Wildfire	Moderate	>$100,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.

B.B. Dougherty Administration Building Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Prevention							
DAB-P-1	Install sufficient supply of backup power to provide facility operation during power outages.	Earthquake, Geological, Tornadoes/Thunderstorms, Wildfire, Flood	Moderate	>$100,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
DAB-P-2	Regularly inspect roof drains to make sure they are free of clogs.	Wind/Rain Events	Low	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Property Protection							
DAB-PP-1	Retrofit windows with reinforced impact resistant film or new glazing.	Earthquake, Hurricane, Tornadoes/Thunderstorms	Low	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
DAB-PP-2	Regularly prune trees located adjacent to the facility to prevent damage to building structure or utilities. Pruned trees should not overhang the roof, Dead or dying trees should be completely removed.	Wind/Rain Events	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.

Central Dining Hall Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Prevention							
CDH-P-1	Conduct routine inspection of the bridge at the rear of the facility to identify the onset of flood or corrosion related damage	Flood	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
CDH-P-2	Implement monitoring of roof during winter snowstorms, excessive drifting should be brought to the attention of engineer on record to determine if snow drifts are within design limits.	Severe Winter Weather	Low	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Property Protection							
CDH-PP-1	Retrofit privacy panels to ensure enclosure from all sides to prevent wind from creating uplift.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms	Low	N/A	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
CDH-PP-2	Raise steam and sewer lines to prevent damage caused by flood borne debris.	Flood	Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
CDH-PP-3	Elevate critical/valuable contents from lower areas of the facility.	Geological, Severe Winter Weather, Flood	High	N/A	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.

Drinking Water System Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Prevention							
DWS-P-1	Implement a perimeter road around the reservoir to facilitate maintenance and security. Trees along perimeter fence should be pruned to prevent damage to fence, and potential security breaches.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms, Severe Winter Weather, Wildfire	Low	>$100,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
DWS-P-2	Prune trees surrounding on-campus pump station to prevent further damage to the facility.	Earthquake, Hurricane and Coastal Hazards, Tornadoes/Thunderstorms, Severe Winter Weather, Wildfire	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Property Protection							
DWS-PP-1	Re-install temporary structure at the on-campus water tank on top of a proper footing with adequate anchorage.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms, Wildfire	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Natural Resource Protection							
DWS-NRP-1	Purchase land where possible in the watershed which supplies the drinking water reservoir. Increased development has increased the sediment load in lake water and has increased difficulty of filtration.	Geological, Flood	High	>$100,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
DWS-NRP-2	Establish new grass seeding and silt fence erosion control measures	Earthquake, Geological, Flood	Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
	in areas experiencing erosion.						
Structural Projects							
DWS-SP-1	Install mechanical equipment to building foundation in order to comply with building code.	Earthquake, Geological, Hurricane and Coastal Hazards, Tornadoes/Thunderstorms, Severe Winter Weather, Wildfire, Flood	Low	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.

Holmes Convocation Center Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Prevention							
HCC-P-1	Anchor vibration isolators supporting rooftop ventilation fans correctly, should be anchored to roof deck to provide required strength in accordance with governing codes.	Earthquake, Geological	Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
HCC-P-2	Address water infiltration from rooftop to prevent disruption of events in arena below.	Flood, Severe Winter Weather	High	$25,000-$100,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Property Protection							
HCC_PP-1	Install protective bollards to prevent accidental vehicle impacts	Earthquake, Geological, Hurricane and Coastal Hazards, Tornadoes/Thunderstorms, Severe Winter Weather, Wildfire, Flood	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
HCC-PP-2	Replace or remove rust from generator fuel tank and then protect from future corrosion. Replace or repair corroded anchorage hardware as well.	Geological	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
HCC-PP-3	Remove all loose concrete from areas experiencing thaw damage and apply water sealer paint to prevent further damage.	Geological, Severe Winter Weather	High	$25,000-$100,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Emergency Services							
HCC-ES-1	Acquire adequate power to run lighting, climate control, and safety systems if facility is to serve as an emergency shelter.	All	Moderate	>$100,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.

Miles Annas Student Support Center Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Prevention							
SSC-P-1	Relocate emergency generator or acquire protective bollards to prevent damage from vehicles.		Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
SSC-P-2	Routinely prune trees adjacent to the facility to prevent damage from falling debris.	Earthquake, Geological, Tornadoes/Thunderstorms	Low	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Property Protection							
SSC-PP-1	Acquire a larger emergency generator to provide power to sustain operations of the infirmary in the event of a disaster. The new generator should be located in a safer location than the current position.	All	Moderate	>$100,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Structural Projects							
SSC-SP-1	Repave and change the grade of the rear parking lot to divert water from the low lying entrance to the building.	FL	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.

Physical Plant Complex Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Prevention							
PPC-P-1	Construct bollards to protect areas subject to recurring vehicle impacts.		Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
PPC-P-2	Routinely prune trees adjacent to the remote storage facility.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms, Severe Winter Weather, Earthquake, Geological	Low	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
PPC-P-3	Construct bollards to protect the transformer at the remote storage facility		Low	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Property Protection							
PPC-PP-1	Relocate propane storage tanks onto a proper foundation using mechanical connectors to ensure proper anchorage in compliance with the building code.	Earthquake, Geological, Flood, Tornadoes/Thunderstorms, Hurricane and Coastal Hazards	Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
PPC-PP-2	Install an emergency generator to enable full maintenance operations during post-disaster recovery.	All	Moderate	>$100,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Emergency Services							
PPC-ES-1	Install a fire alarm in the vehicle maintenance storage area.	Wildfire	High	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.

Raley Hall Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Prevention							
RH-P-1	Repair waterproofing in the glass block wall to prevent further damage to the facility	Flood, Hurricane and Coastal Hazards	Moderate	$25,000-$100,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
RH-P-2	Service drains in courtyard routinely to prevent flooding. A supplemental drain should be added near the facility's front door to prevent another flood.	Flood	Low	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
RH-P-3	Fasten coping securely to the roof with no bends which prevents a strong wind from being able to tear it from the roof.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
RH-P-4	Service drains surrounding the outside air intakes regularly, a supplemental drain should be installed near this area to prevent flooding.	Flood	Low	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
RH-P-5	Prune trees near the facility to prevent damage from falling debris.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms	Low	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.

Rivers Street Parking Garage Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Prevention							
RSPG-P-1	Construct a second exit from the Police Dispatch room to enhance egress.	All	Low	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
RSPG-P-2	Service drainage system routinely to prevent system failure. Facilities maintenance should provide emergency pumping equipment that can be used in the event of a system failure.	Flood	Low	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Property Protection							
RSPG-PP-1	Reinforce Police Department emergency dispatch center windows with impact resistant film.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms	Low	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.

Steam Plant Complex Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Prevention							
SPC-P-1	Increase exit route redundancies within the facility especially in corridors where large equipment could cause a route to be blocked if it were to catch fire.	Wildfire	Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
SPC-P-2	Anchor vital facility equipment to a proper foundation in compliance with seismic code requirements.	Earthquake	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
SPC-P-3	Determine the cause of the CMU wall cracking, possible slab movement should be investigated and corrected.	Earthquake. Geological	High	$25,000-$100,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Property Protection							
SPC-PP-1	Elevate Steam crossing to prevent damage from water or flood borne debris.	Flood	Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
SPC-PP-2	Reinforce windows with impact resistant film or new glazing.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms	Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.

Annex B North Carolina A&T

This section provides planning process, campus profile, hazard risk, vulnerability, capability, and mitigation action information specific to North Carolina A&T (NCAT) State University. This section contains the following subsections:

- B.1 Planning Process Details
- B.2 Campus Profile
- B.3 Asset Inventory
- B.4 Hazard Identification
- B.5 Hazard Profiles, Analysis, and Vulnerability
- B.6 Capability Assessment
- B.7 Mitigation Strategy

B.1 Planning Process Details

The update of the campus hazard mitigation plan was conducted by a Campus Hazard Mitigation Planning Team comprised of university staff and faculty. The committee followed a planning process prescribed by FEMA and participated in a series of meetings to update the plan. Details about the meetings held by the committee are provided below.

TABLE B.1: NCA&T CAMPUS HAZARD MITIGATION PLANNING COMMITTEE

LAST NAME	FIRST NAME	TITLE	ATTENDED FIRST MEETING	ATTENDED SECOND MEETING
Auman*	Travis	EM Director	X	X
Confresi	Vanessa	Clery Act Compliance	X	X
Griffin	Shante	Communications Supervisor	X	
Jackson	Mike	Director of Process Improvement	X	X
Lennon	David	Director of Facilities	X	
Newman	Louisa	Director EHS	X	X
Perkins	Andy	AVC Facilities	X	X
Starnes	Geoff	Deputy CIO	X	X
Taylor	Jerrell	Building Environment Services Supervisor		

LAST NAME	FIRST NAME	TITLE	ATTENDED FIRST MEETING	ATTENDED SECOND MEETING
Williams	Marc	Dean of Students	X	X

* Primary Point of Contact

December 11, 2019 – Kickoff Meeting

ESP Associates' Project Manager, Nathan Slaughter, 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 Campus Hazard Mitigation Planning Team and began by having attendees introduce themselves. The 9 attendees included faculty and staff from various departments at the University. 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 was managing the planning effort and had assigned ESP Associates, Inc. to manage the update.

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 on campus (buildings, infrastructure critical facilities, etc.), and ensure that future development on campus 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 a discussion about various mitigation techniques. He briefly explained the six different categories of mitigation techniques: emergency services, prevention, natural resource protection, structural projects, public education and awareness, and property protection. The attendees were then asked what types of mitigation projects would be needed the most at NCA&T if FEMA funding was available. Most attendees felt that emergency services activities would be most needed on the campus. This helped demonstrate how priorities in mitigation actions should be considered for the plan.

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

- Coordinate between the eight participating campuses to update the existing plan,
- Update the plan to demonstrate progress and reflect current conditions,
- Complete the update in a timely manner because the existing plan expired in October of 2017,
- Increase public awareness and education,
- Maintain grant eligibility for participating campuses, and
- Maintain compliance with State and Federal requirements.

Mr. Slaughter reviewed the list of participating campuses with the group. He also explained the project tasks to be accomplished. These included the planning process, risk assessment, capability assessment, mitigation strategy, mitigation action plan, and plain maintenance procedures.

He explained that the project as being managed by a Campus Hazard Mitigation Steering Committee that had one representative from each of the eight campuses. For NCA&T, that representative was Travis Auman, EM Director. He explained that the group currently in the room would be known as the Campus Hazard Mitigation Planning Team.

Mr. Slaughter explained that this update would expand the scope of the plan to not only address natural hazards, as was previously done for the existing plan, but that it would also address manmade/technological hazards as well. This was done to ensure alignment with the State of North Carolina's Hazard Mitigation Plan.

Mr. Slaughter explained that the plan would address campus vulnerability, where feasible, to identify specific types and numbers of campus assets that are at risk to the identified hazards. He said that an attempt would be made to address other types of vulnerability as well to include social, economic and environmental vulnerabilities.

He then discussed the capability assessment and how the plan would include a discussion on the University's capability to address their hazard vulnerability through mitigation. Next, he discussed the mitigation strategy and explained how that section of the plan would be reviewed and updated as required by FEMA.

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

Mr. Slaughter then reviewed the roles and responsibilities of ESP Associates, Inc, the campus leads and stakeholders. The presentation concluded with a discussion of the next steps to be taken in the project development. He explained that a Hazard Mitigation Public Survey was being developed and that it would be distributed soon. The next campus HMPT meeting was discussed and would be held sometime in the Spring or Summer of 2020. The purpose of the second meeting would be to discuss the findings of the risk and capability assessments and to begin updating existing mitigation actions and identify new goals.

December 4, 2020 – Mitigation Strategy Meeting – Zoom Meeting

Following a hiatus in the planning process caused by the onset, response and initial recovery from the COVID 19 pandemic, the NCA&T Campus Hazard Mitigation Planning Team held an online Mitigation Strategy Meeting on December 4, 2020.

Mr. Slaughter began the meeting with brief introductions and an overview of the agenda for the day. He provided a brief refresher on the definition of mitigation and a recap of the Disaster Mitigation Act of 2000, the key objectives of the project and the project schedule (which remained somewhat delayed because of the COVID-19 pandemic, but still on track for completion of the final plan).

He then began providing more detailed information about the hazards that impact the University. He started by recapping the number of hazard events experienced since the previous plan and discussed the presidential disaster declarations that have been experienced since the previous update. These included one declaration for a severe winter storm. Three for hurricanes (Matthew, Florence and Dorian), one for a tornado and severe storms and the COVID-19 pandemic. He provided summary stats and slides for the following hazards: drought, hail, hurricanes and tropical storms, lightning, severe thunderstorms, tornadoes, flood, wildfire, winter storms and freeze, dam failure, earthquake, landslides, excessive heat, hazardous materials incident, public health hazards/infectious disease, cyber nuclear power plants, electromagnetic pulse and terrorism.

Mr. Slaughter provided an overview of the Priority Risk Index. The PRI is a quantitative scoring of hazards which is used to focus in on the hazards of greatest concern for the University. Using the PRI, the following hazards were considered the be highest risk for the University: hazardous substances, infectious disease, severe winter weather, and hurricanes/coastal hazards.

There was some discussion about how basement flooding occurs in certain residence halls and academic buildings. There was also discussion about what the committee considered to be a big risk to the campus: the rail line and trains that run behind the steam plant and the vulnerability that poses.

Following the hazard identification and PRI review, Mr. Slaughter reviewed the listing of key assets from the prior plan and discussed the need to update that ranking. He also mentioned that social vulnerability would be included in the plan to some extent and he presented slides on social vulnerability for Guilford County.

There was also a brief discussion about the capability assessment that would be included in the plan for the University. He mentioned how that assessment would be conducted and what it would try to capture (administrative, technical, fiscal, and political capabilities of the University).

The remainder of the meeting was spent discussing the Mitigation Strategy. Mr. Slaughter gave an overview of the process for updating the Mitigation Strategy and presented the existing mitigation goals for the UNC Western Campuses regional plan. He asked the NCA&T Campus Hazard Mitigation Planning Team to review the goals to determine whether or not they still reflect current vulnerabilities and current mitigation priorities. The committee members agreed that the goals were no longer relevant and new goals and associated objectives were developed, voted upon and accepted. It should be noted that these goals and objectives also align with those found in the UNC Eastern Campuses Hazard Mitigation Plan.

Mr. Slaughter then indicated that Campus Hazard Mitigation Planning Team would need to provide a status update for their existing mitigation actions (completed, deleted, or deferred) and a brief discussion of how that determination was made. Mr. Slaughter also discussed the Mitigation Action Worksheets to be completed for any new mitigation actions. Mr. Slaughter then presented sample mitigation actions for the committee members to consider to include in their plan update.

Mr. Slaughter mentioned the need to conduct public outreach measures to meet FEMA requirements and indicated that a public survey would be sent out soon and an online public meeting for the entire UNC Western Campuses region would be conducted before the plan was finalized.

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

December 17, 2020 - Internal Mitigation Strategy Discussion

Nine members from the NCA&T Campus Hazard Mitigation Planning Team met to discuss critical infrastructure and mitigation strategies. The team ranked their critical buildings and discussed updates for existing mitigation actions and identified six new actions that are included in the Mitigation Strategy section. The meeting was facilitated by Travis Auman, NCA&T's Emergency Management Director.

Involving the Public

Because this plan update was developed during the COVID-19 pandemic, the planning teams had to get creative in order to solicit feedback from the public about the plan and their thoughts on hazard mitigation. A public survey instrument was developed to provide an opportunity for the public to provide comment on their concerns about hazard impacts on the campuses and their thoughts on how mitigation could help reduce vulnerability. The public survey was distributed by each campus through different means to outreach to faculty, staff and students.

For NCA&T, 14 public survey responses were received and the results from those surveys were shared with the Campus Hazard Mitigation Planning Team. Feedback from the surveys was reviewed and considered for inclusion in this plan, as applicable, where determined to be relevant. A summary of the responses can be found in **Appendix B** and detailed survey responses can be obtained through North Carolina Emergency Management, Hazard Mitigation Planning staff.

B.2 Campus Profile

This section of the plan provides a general overview of the North Carolina A&T Campus and surrounding area.

B.2.1 Geography and the Environment

North Carolina A&T's main campus, often referred to as "Aggieland," is located approximately nine blocks east of downtown Greensboro, North Carolina. Development of the campus started in 1893 with 14 acres of donated land. Today, the main campus encompasses over 200 acres and 123 total buildings, which include 28 academic buildings, 15 student residences, and various support buildings and athletic facilities. Despite the availability on-campus housing, the residence halls are complemented by a variety of housing options. 65 percent of students live off-campus mostly in the areas closest to campus, in either apartment communities or former single-family homes. An orientation map of the North Carolina A&T State University can be seen in **Figure B.1** and a map of the main-campus can be seen in **Figure B.2**.

FIGURE B.1: NORTH CAROLINA A&T STATE UNIVERSITY LOCATOR MAP

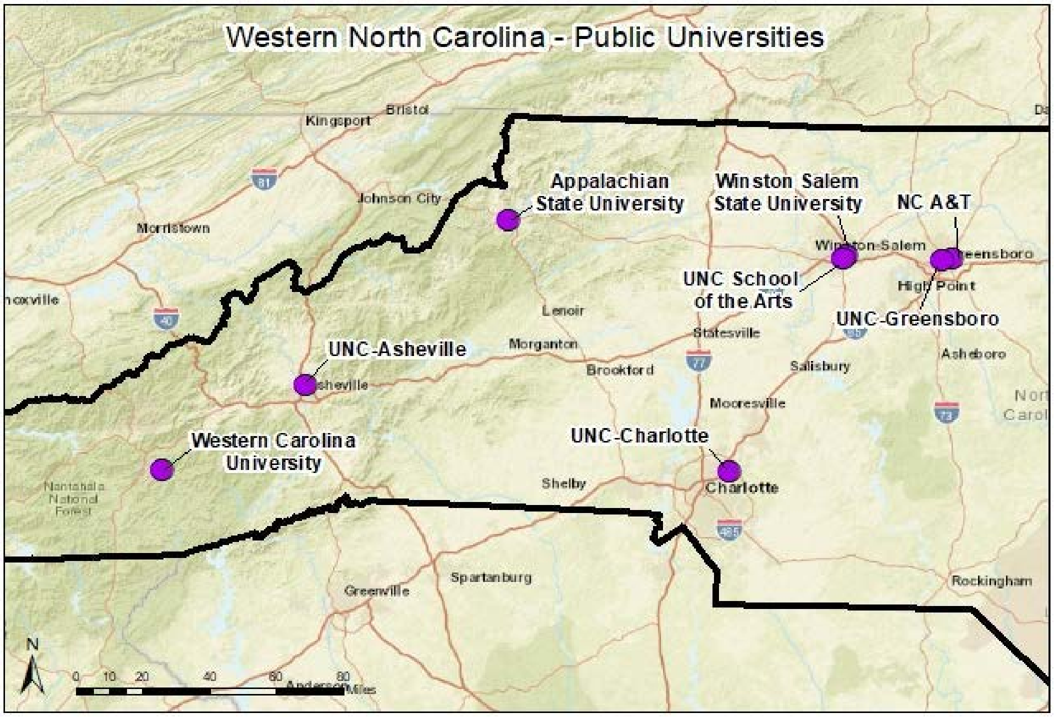
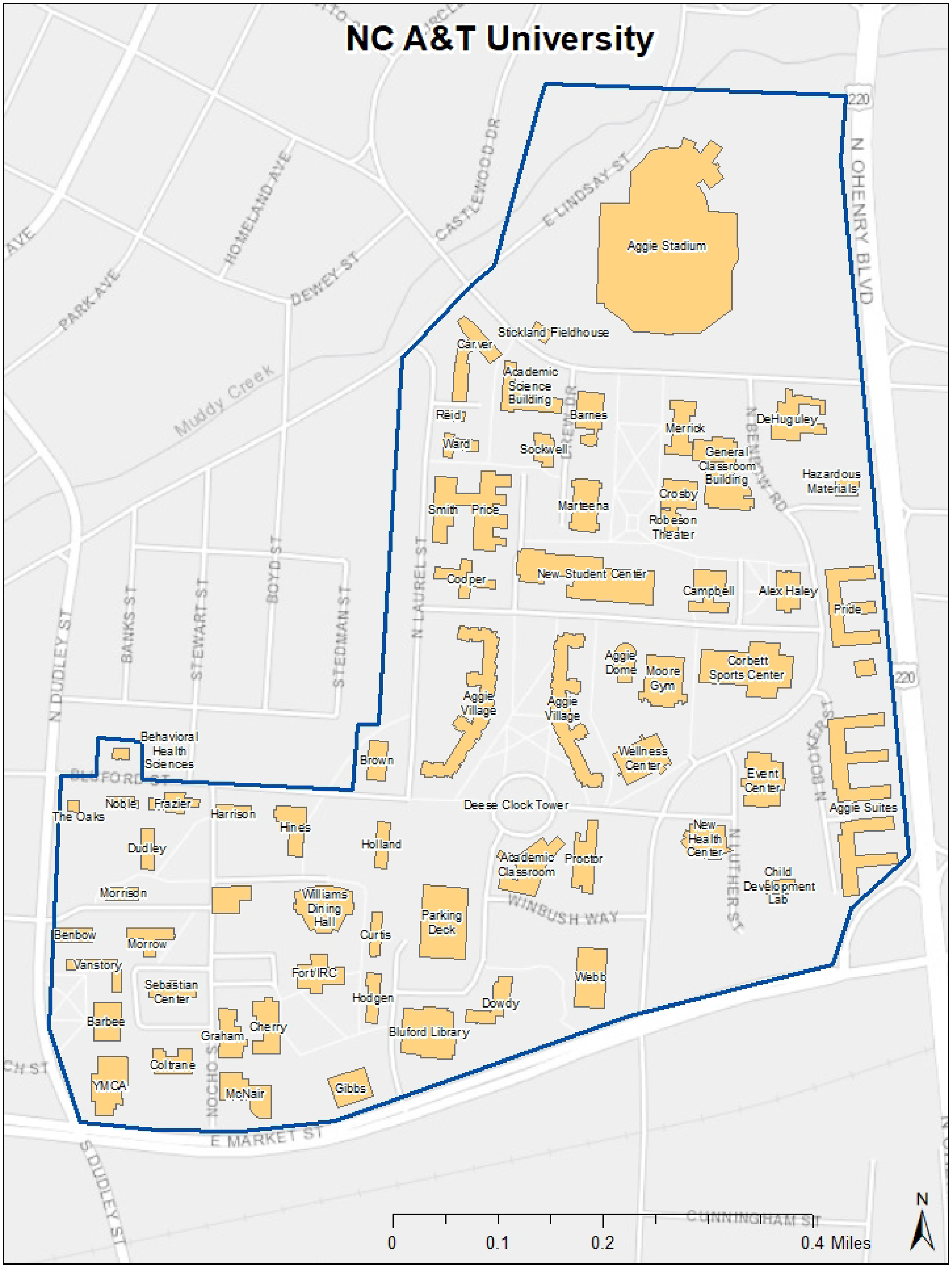


FIGURE B.2 NC A&T MAIN CAMPUS MAP



Greensboro is North Carolina's third largest city and is centrally located in the state's piedmont region. Summers are hot and humid with an average of 32 days per year with highs at or above 90°. Winters are short and generally cool, measurable snowfall occurs nearly every winter and accumulates to an average of 7.5 inches annually. Thunderstorms are common during the humid spring and summer months, some more severe than others. The monthly averages for Greensboro are presented in **Table B.2.**

TABLE B.2 MONTHLY AVERAGES FOR GREENSBORO, NORTH CAROLINA

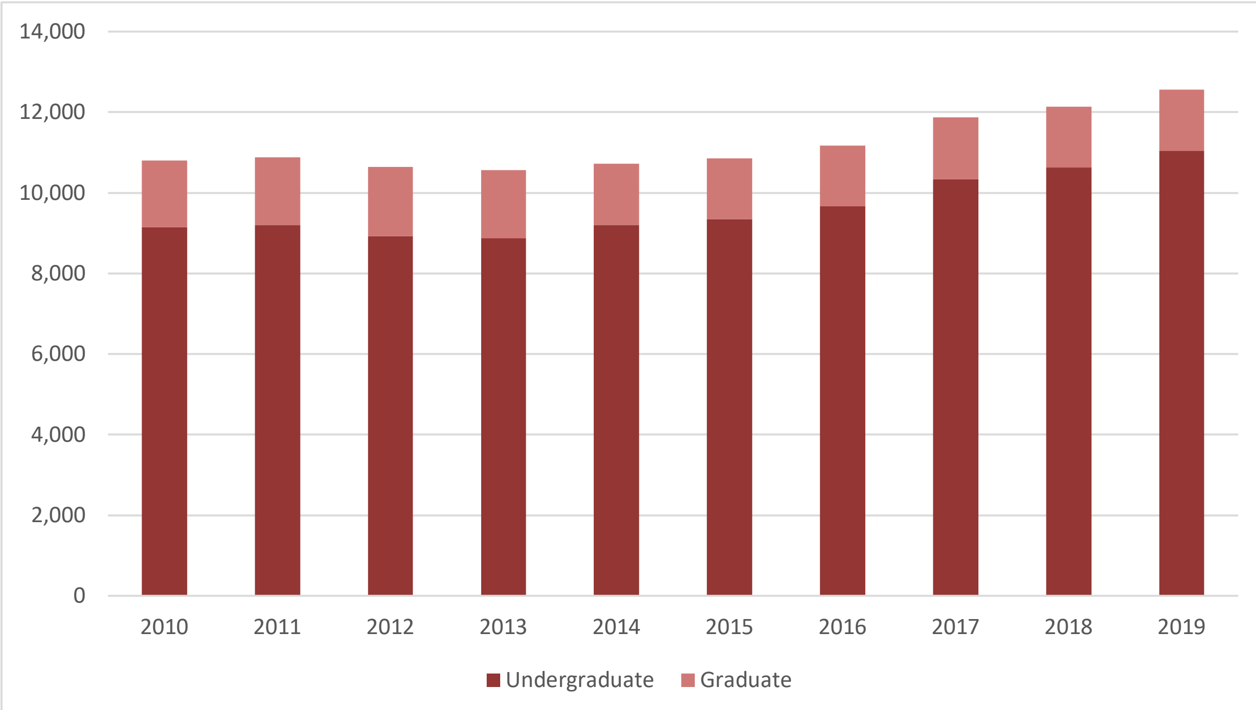
Month	Average High	Average Low	Average Precipitation
January	48°F	29°F	3.06 in
February	53°F	32°F	2.96 in
March	61°F	39°F	3.73 in
April	70°F	47°F	3.57 in
May	78°F	56°F	3.38 in
June	85°F	65°F	3.73 in
July	88°F	69°F	4.48 in
August	86°F	68°F	3.88 in
September	80°F	61°F	4.19 in
October	70°F	49°F	3.16 in
November	61°F	40°F	3.11 in
December	51°F	31°F	0.00 in

Source: National Weather Service

B.2.2 Population and Demographics

With an enrollment of near 12,000 students, North Carolina A&T is the largest historically black university in the U.S., the university was ranked seventh nationally among historically black institutions, and first among public historically black institutions. The university is also well recognized for its degree program in engineering. North Carolina A&T's population has grown steadily over the years, and has been an established university since 1893. Within the past five years NC A&T has added close to 1,600 students which translates to a 15% expansion of the total student body. The intentional steady growth in enrollment is the direct result of a strategic plan put in place in 2011 that envisioned a bold future for NC A&T by 2020. The enrollment trends over the past ten years can be seen in **Table B.3**.

TABLE B.3 NCA&T TOTAL ENROLLMENT (2019)



Source: UNC System – Data Dashboard

The majority of students attending this university are African American representing almost 80% of the entire student body at this university. For a breakdown of enrollment demographics please see **Table B.4** below.

TABLE B.4 NCA&T ENROLLMENT DEMOGRAPHICS (2019)

Race/Ethnicity	Enrollment (Fall 2019)	Percentage
White	604	5.70%
Hispanic or Latino	437	4.10%
Black or African American	8,587	80.80%
Asian	125	1.00%
Nonresident Alien	114	1.10%
American Indian or Alaska Native	37	0.30%
Native Hawaiian or Other Pacific Islander	0	0.00%
Unknown	752	7.10%

Source: 2018 College Data

B.3 Asset Inventory

An inventory of assets was compiled to identify the total count and value of property exposure on the NCA&T campus. This asset inventory serves as the basis for evaluating exposure and vulnerability by hazard. Assets for analysis include buildings, critical facilities, and critical infrastructure.

B.3.1 Building Inventory

This section provides total building exposure for the campus, which was estimated by summarizing building footprints provided by North Carolina Emergency Management and property values derived from 2020 insurance assessment data. According to that data, there are 132 buildings associated with NCA&T totaling a value of $1,602,593,073 (building and contents).

B.3.2 Critical Buildings and Infrastructure Exposure

Of significant concern with respect to any disaster event is the location of critical facilities and infrastructure in the planning area. Critical facilities are those essential services and lifelines that, if damaged during and emergency event, would disrupt campus continuity of operations or result in severe consequences to public health, safety, and welfare.

Critical buildings are a subset of the total building exposure and were identified by NCA&T's HMPT representatives. The NCA&T HMPC updated the list of critical facilities from the previous DRU plan and ranked each facility on a set of standardized criteria designed to evaluate all critical buildings in the UNC System DRU plans. Factors considered for this ranking included:

- the building's use for emergency response,
- the building's use for essential campus operations
- the building's use as an emergency shelter or for essential sheltering services,
- the presence of a generator or generator hook-ups,
- the building's use for provision of energy, chilled water or HVAC for sensitive or essential systems,
- the storage of hazardous materials,
- the building's use for sensitive research functions,
- the building's cultural or historical significance, and
- building-specific hazard vulnerabilities

Figure B.3 below shows the scoring sheet that the NCA&T Campus Mitigation Planning Team used to rate critical buildings on campus. All of the campuses in the UNC system used to same scoring methodology for consistency.

FIGURE B.3: CRITICAL BUILDING SCORING WORKSHEET

Critical Building Scoring Worksheet

Campus:
Facility Name:

		Score
1	Does the facility serve as the campus Emergency Operations Center (EOC)? Yes, Primary EOC = 6 pts Yes, Secondary EOC = 3 pts No = 0 pts	0
2	Does the facility house functions essential to campus operations? Main Telecommunication Center = 3 pts Computer Network Hub = 3 pts Adminstrative Operations = 1 pts Maintenance = 1 pt Public Safety = 1 pt	0
3	Is the facility equiped with a generator or hook-ups? Generator = 3 pts Hook-ups = 1 pt Neither = 0 pts	0
4	Does the facility serve as a pre or post disaster shelter? Both pre and post disaster shelter = 6 pts Either pre or post disaster shelter = 3 pts Neither = 0 pts	0
5	Does the facility provide services essential to sheltering? Resident Housing = 1 pt Assesmbly Space = 1 pt Food Preperation Facility = 1 pt Shower Facilities = 1 pt	0
6	Does the facility provide chilled water distribution or contain HVAC systems necessary to sensitive or essential systems? Yes = 3 pts No = 0 pts	0
7	Are there hazardous materials on-site? (greater than 25 gallons) Yes = 3 pts No = 0 pts	0
8	Does the facility house research functions that have a low level of tolerance for disruption? Yes = 2 pts No = 0 pts	0
9	Does the facility serve as storage for rare or unique collections (art, artifacts, letters, etc) or is it a historically or culturally significant building? Yes = 2 pts No = 0 pts	0
10	Does the facility have hazard specific vulnerabilities (basement susceptible to flood, etc.) Yes = 3 pts No = 0 pts	0
Notes/ Comments		

Total Score:	0
Total Possible Score:	**42**

The identified critical facilities for NCA&T, as scored by the NCA&T Campus Hazard Mitigation Planning Team are listed below:

- Dehuguley Building (14)
- Fort IRC (13)
- Corbett Sports Center (12)
- Ward Hall (10)
- Hines Hall (9)
- HAZMAT (8)
- Academic Classroom Building (7)
- Heating Plant (7)
- Carver Hall (6)
- Electric Switch Building (1)

B.4 Hazard Identification

This section describes how the regional planning committee identified the hazards to be included this plan

B.4.1 Hazard Identification

Upon a review of the full range of natural hazards suggested under FEMA planning guidance, the Campus Hazard Mitigation Planning Team identified a number of hazards that are to be addressed in its Hazard Mitigation Plan. These hazards were identified through a process that utilized input from the Campus Hazard Mitigation Planning Team members, research of past disaster declarations in the surrounding county, and review of the previous NCA&T Pre-Disaster Mitigation Plan. To maintain consistency, the Multi-Campus Hazard Mitigation Steering Committee and the Campus Hazard Mitigation Planning Teams voted to assess the same hazards that were identified in the most recent update of the North Carolina State Hazard Mitigation Plan. Therefore, since the development of the previous plan, the hazard identified and included in the plan have changed. A list of all previous hazards covered in the previous North Carolina A&T State University Pre-Disaster Mitigation Plans are viewable in **Table B.5**, 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.

TABLE B.5: 2021 NORTH CAROLINA A&T UNIVERSITY HAZARDS UPDATE

2010 North Carolina A&T State University Identified Hazards		2021 North Carolina A&T State University Identified Hazards		Description of hazards covered in 2021 Plan and Explanations
Atmospheric Hazards	Drought	**Natural Hazards**	Drought	Agricultural Drought, Hydrological Drought
	Driving Rain			
	Other High Wind events			
			Excessive Heat	
	Hurricane		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,

2010 North Carolina A&T State University Identified Hazards		2021 North Carolina A&T State University Identified Hazards		Description of hazards covered in 2021 Plan and Explanations
				Severe Winter Weather associated with Nor'easters
	Tornado		Tornadoes/Thunderstorms	Hailstorm, Torrential Rain associated with Severe Thunderstorms, Thunderstorm Wind, Lightning, Waterspout, High Wind
	Electrical Storm			
	Severe Winter Weather, including ice or snow events		Severe Winter Weather	Freezing Rain, Snowstorms, Blizzards, Wind Chill, Extreme Cold
Hydrologic Hazards			Dam Failures	
	Flood		Flooding	
Geologic Hazards	Earthquake		Earthquakes	
	Landslide, Rockslide, and other Geologic		Geological	Landslides, Sinkholes, Erosion
Other Hazards	Wildfire or Building Fire	**Other Hazards**	Wildfires	
	Animal borne and other Infectious Diseases		Infectious Disease	
	Accidental Explosion	**Technological Hazards**		
			Hazardous Substances	Hazardous Materials, Hazardous Chemicals, Oil Spill
			Radiological Emergency – Fixed Nuclear Facilities	
			Terrorism	Chemical, Biological, Radiological, Nuclear, Explosive
			Cyber	
			Electromagnetic Pulse	

B.4.2 Disaster Declarations

Disaster declarations provide insight into the hazards that may impact North Carolina A&T State University. **Table B.6** shows the fourteen presidential disaster to impact Guilford County since 1977. There have been eighteen total disaster declarations in Guilford County since 1977.

TABLE B.6: GUILFORD COUNTY DISASTER DECLARATIONS

Year	Disaster Number	Description
1989	844	HURRICANE HUGO
1989	827	TORNADOES
1996	1087	BLIZZARD OF '96
1996	1103	WINTER STORM
1996	1134	HURRICANE FRAN
1999	1292	HURRICANE FLOYD MAJOR DISASTER DECLARAIONS
2000	1312	SEVERE WINTER STORM

2002	1448	SEVERE ICE STORM
2003	1457	ICE STORM
2004	1553	HURRICANE IVAN
2014	4167	SEVERE WINTER STORM
2018	4393	HURRICANE FLORENCE
2018	4364	TORNADO & SEVERE STORMS
2020	4487	COVID-19 PANDEMIC

B.4.3 Summary of Hazard Impacts Since Previous Plan

Since the approval of the previous North Carolina A&T State University Pre-Hazard Mitigation Plan (June 30th, 2010), there have been 275 hazard events recorded for Guilford County in the National Centers for Environmental Storm Event Database. It is important to take note of those hazard events and consider them in the *Hazard Identification* section to help ensure that the appropriate hazards are being considered in the risk assessment sections in the Mitigation Strategy. **Table B.7** documents the hazard events recorded. Details for some these events are discussed in further detail in the *Hazard Profiles* section.

TABLE B.7: SUMMARY OF HAZARD EVENTS SINCE PREVIOUS PLAN

Hazard Type*	Number of Reported Events in Guilford County
Cold/Wind Chill	0
Flash Flood	51
Flood	2
Hail	34
Heavy Snow	0
High Wind	0
Lightning	2
Strong Wind	12
Thunderstorm Wind	144
Tornado	1
Tropical Storm	1
Winter Storm	14
Winter Weather	14
TOTAL NUMBER OF REPORTED EVENTS	**275**

* The hazard type names that NCEI uses are different than the names of hazards used in this plan; however, one can still get an understanding of the types of hazards that impact the region as the hazard types are similar in name.

B.4.4 Hazard Evaluation

Table B.8 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 furthered 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 further evaluations and updates of the risk assessment if deemed necessary by the Multi-Campus Hazard Mitigation Steering Committee and the Campus Hazard Mitigation Steering Committee during the plan update process.

TABLE B.8: 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?
NATURAL HAZARDS			
Avalanche	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of the NC State Hazard Mitigation Plan • Review of the previous North Carolina A&T State University Pre-Disaster Mitigation Plan • Review of US Forest Service National Avalanche Center website	• The United States avalanche hazard is limited to mountainous western states including Alaska as well as some areas of low risk in New England. • Avalanche hazard was removed from the North Carolina State Hazard Mitigation Plan after determining the mountain elevation in Western North Carolina did have enough snow not to produce this hazard. • Avalanche is not included in the previous North Carolina A&T State University Pre-Disaster Mitigation Plan.
Drought	**YES**	• Review of the NC State Hazard Mitigation Plan • Review of the North Carolina Drought Monitor website • Review of the previous North Carolina A&T State University Pre-Disaster Mitigation Plan	• There are reports of drought conditions in each of the past nineteen years in Guilford County, according to the North Carolina Drought Monitor. • Droughts are discussed in NC State Hazard Mitigation.
Hailstorm	**YES (Assessed under Tornadoes/ Thunderstorms)**	• Review of NC State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment	• Hailstorm events are discussed in the state plan under the Severe Thunderstorm hazard. • NCEI reports 70 hailstorm events (0.75-inch size hail to

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?
		• Review of NOAA NCEI Storm Events Database • Review of the previous North Carolina A&T State University Pre-Disaster Mitigation Plan	2.75 inches) for Guilford County between 1959 and 2018. For these events there was over $1,750 in property damages. • 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.
Excessive Heat	**YES**	• Review of NOAA NCEI Storm Events Database • Review of the North Carolina State Hazard Mitigation Plan • Review of the previous North Carolina A&T State University Pre-Disaster Mitigation Plan	• NCEI reports at least one extreme heat event for Guilford county which resulted in one fatality. • The NC State Hazard Mitigation Plan includes Extreme Heat as a hazard. • Extreme Heat was not addressed in the previous North Carolina A&T State University Pre-Disaster Mitigation Plan.
Hurricane and Coastal Hazards	**YES**	• Review of NC State Hazard Mitigation Plan • Analysis of NOAA historical tropical cyclone tracks and National Hurricane Center Website • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations	• Hurricane and coastal hazard events are discussed in the state plan and are listed as a top hazard of concern. • NOAA historical records indicate 17 hurricane/coastal hazards have come within 25 miles of Guilford County since 1850. • Five out of fourteen disaster declarations in Guilford County are directly related to hurricane and costal hazard events. • The 50-year return period peak gust for hurricane and tropical

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?
		• Review of the previous North Carolina A&T State University Pre-Disaster Mitigation Plan	storm events in Guilford County is between 63-68 mph. • Hurricane hazards were addressed in the previous North Carolina A&T State University Pre-Disaster Mitigation Plan.
Lightning	**YES (Assessed under Tornadoes/Thunderstorms)**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of NOAA NCEI Storm Events Database, NOAA lightning statistics • Review of the previous North Carolina A&T State University Pre-Disaster Mitigation Plan	• Lightning events are discussed in the state plan as part of the severe thunderstorm hazard. • NCEI reports 9 lightning events for Guilford County since 1996. These events have resulted in nearly $2.1 million in property damage.
Nor'easter	**NO**	• Review of NC State Hazard Mitigation Plan • Review of the previous North Carolina A&T State University Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database	• Nor'easters are discussed in the state plan. • NCEI does not report any nor'easter activity for Guilford County. However, nor'easters may have affected the County as severe winter storms. In this case, the activity would be reported under winter storm events. • Nor'easters were not addressed in the previous North Carolina A&T State University Pre-Disaster Mitigation Plan.

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?
Tornadoes/ Thunderstorm	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous North Carolina A&T State University Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations.	• Tornado events are discussed in the NC State Hazard Mitigation Plan. • NCEI reports 14 tornado events in Guilford County since 1954. These events have resulted in 1 death and 5 injuries and over $79.6 million (2018 dollars) in property damage with the most severe being an F1. • Tornado events were addressed in the previous North Carolina A&T State University Pre-Disaster Mitigation Plan.
Severe Thunderstorm	**YES (Assessed under Tornadoes/Thunderstorms)**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous North Carolina A&T State University Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations.	• Severe thunderstorm events are discussed in the NC State Hazard Mitigation Plan. • NCEI reports 328 thunderstorm wind events in Guilford County since 1956. These events have resulted in 1 injury and over $1.4 million in property damage. • Severe thunderstorm events were addressed in the previous North Carolina A&T State University Pre-Disaster Mitigation Plan.
Severe Winter Weather	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan	• Severe winter weather events, including snow storms and ice storms, are discussed in the state plan. They are listed as top hazards of concern. • NCEI reports that Guilford County has been affected by 43

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?
		• Review of the previous North Carolina A&T State University Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations.	snow and ice events since 1993. These events resulted in over $570,000 in damages. • Six of the region's fourteen disaster declarations were directly related to winter storm events. • Winter storm events were addressed in the previous North Carolina A&T State University Pre-Disaster Mitigation Plan.
Earthquakes	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous North Carolina A&T State University Pre-Disaster Mitigation Plan • Review of the National Geophysical Data Center USGS Earthquake Hazards Program website	• Earthquake events are discussed in the state plan. 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. • Earthquakes were addressed in the previous North Carolina A&T State University Pre-Disaster Mitigation Plan. • 6 events are known to have occurred in the region according to the National Geophysical Data Center. The greatest magnitude reported was a 4. In 2020, a strong earthquake in Sparta, NC was felt on campus. • According to USGS seismic hazard maps, the peak ground acceleration (PGA) with a 10% probability of exceedance in 50 years for the area is

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?
			approximately 4%g. FEMA recommends that earthquakes be further evaluated for mitigation purposes in areas with a PGA of 3%g or more.
Expansive Soils	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous North Carolina A&T State University Pre-Disaster Mitigation Plan • Review of USDA Soil Conservation Service's Soil Survey	• Expansive soils are not included in the State plan. • According to FEMA and USDA sources, North Carolina A&T State University is located in an area that has a "little to no" clay swelling potential. • The previous North Carolina A&T State University Pre-Disaster Mitigation Plan did not identify expansive soils as a potential hazard.
Geological (Landslides, Sinkholes, Erosion)	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous North Carolina A&T State University Pre-Disaster Mitigation Plan • Review of USGS Landslide Incidence and Susceptibility Hazard Map • Review of the North Carolina Geological Survey database of historic landslides	• Landslide/debris flow events are discussed in the state plan. • USGS landslide hazard maps indicate "low" to "moderate" landslide risk for Guilford County. • Data provided by NCGS indicate no recorded landslide events in the North Carolina A&T State University or Guilford County. • Geological hazards were addressed in the previous North Carolina A&T State University Pre-Disaster Mitigation Plan.
Land Subsidence	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment	• The state plan delineates certain areas that are susceptible to land subsidence hazards in

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?
		• Review of NC State Hazard Mitigation Plan • Review of the previous North Carolina A&T State University Pre-Disaster Mitigation Plan	North Carolina; however, none of these areas are located in Guilford County. • Land Subsidence was not addressed in the previous North Carolina A&T State University Pre-Disaster Mitigation Plan.
Tsunami	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous North Carolina A&T State University Pre-Disaster Mitigation Plan • Review of FEMA "How-to" mitigation planning guidance (Publication 386-2, "Understanding Your Risks – Identifying Hazards and Estimating Losses).	• Tsunamis are included as a hazard in the state plan, however, they are not a risk for Guilford County. • Tsunamis were not addressed in the previous North Carolina A&T State University Pre-Disaster Mitigation Plan. • No record exists of a catastrophic Atlantic basin tsunami impacting the mid-Atlantic coast of the United States. • Tsunami inundation zone maps are not available for communities located along the U.S. East Coast. • 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.
Volcano	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment	• There are no active volcanoes in North Carolina and are not addressed in the state plan.

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?
		• Review of NC State Hazard Mitigation Plan • Review of USGS Volcano Hazards Program website	• There has not been a volcanic eruption in North Carolina in over 1 million years. • No volcanoes are located near North Carolina A&T State University.
Dam Failure	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous North Carolina A&T State University Pre-Disaster Mitigation Plan • Review of North Carolina Division of Land Management website	• Dam failure is discussed in the state plan as a hazard of concern for the North Carolina A&T State University. • Of the 320 dams reported on the National Inventory of Dams in Guilford County, 76 are high hazard, (High hazard is defined as "where failure or mis operation will probably cause loss of human life.") • Dam failure was not addressed in the previous North Carolina A&T State University Pre-Disaster Mitigation Plan.
Erosion	**YES (Referenced in Geological Hazards)**	• Review of NC State Hazard Mitigation Plan • Review of the previous North Carolina A&T State University Pre-Disaster Mitigation Plan	• Riverine erosion is addressed in the previous North Carolina A&T State University Pre-Disaster Mitigation Plan. • Coastal erosion is discussed in the state plan but only for coastal areas (there is no discussion of riverine erosion).
Flooding	**YES**	• Review of NC State Hazard Mitigation Plan • Review of historical disaster declarations	• The flood hazard is thoroughly discussed in the state plan. • Five of the fourteen Presidential Disaster Declarations for

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?
		• Review of NOAA NCEI Storm Events Database • Review of the previous North Carolina A&T State University Pre-Disaster Mitigation Plan	Guilford County were directly related to flooding events. • NCEI reports that Guilford County have been affected by 100 flood events since 1996. These events in total caused over $18.1 million in property damages. • Flooding was addressed in the previous North Carolina A&T State University Pre-Disaster Mitigation Plan.
Storm Surge	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous North Carolina A&T State University Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database	• Storm surge is discussed in the state plan but is not a risk to Guilford County. • Storm surge was not addressed in the previous North Carolina A&T State University Pre-Disaster Mitigation Plan. • No historical events were reported by NCEI • Given the inland location of North Carolina A&T State University, storm surge would not affect the area.
OTHER HAZARDS			
Wildfires	**YES**	• Review of NC State Hazard Mitigation Plan • Review of the previous North Carolina A&T State University Pre-Disaster Mitigation Plan	• Wildfires occur in virtually all parts of the United States. Wildfire hazard risk will increase as low-density development along the urban/wildland interface increases. • Wildfires were not addressed in the previous North Carolina A&T

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?
		• Review of Southern Wildfire Risk Assessment (SWRA) Data • Review of the NC Division of Forest Resources website	State University Pre-Disaster Mitigation Plan. • According to the North Carolina Division of Forest Resources, Guilford County experiences an average of 17 fires each year which burn a combined 41 acres
Hazardous Substances	**YES**	• North Carolina State Hazard Mitigation Plan • Review of the previous North Carolina A&T State University Pre-Disaster Mitigation Plan • Review of the Guilford County Hazard Mitigation Plan	• Review of Pipeline and Hazardous Materials Safety Administration data indicates 55 HAZMAT incidents occurred in Guilford County. • Guilford County has record of 5,547 Facility Registry Services Sites in the County. • This update assesses hazardous materials, hazardous chemicals, and oil spills under this hazard.
Infectious Disease	**YES**	• Review of the previous North Carolina A&T State University Pre-Disaster Mitigation Plan • Review of the NC State Hazard Mitigation Plan.	• Infectious Disease is identified as a hazard in the state plan. • Although the previous North Carolina A&T Pre-Disaster Mitigation Plan did not include infectious disease as a hazard, it is assessed in this update to maintain consistency with the NC State Hazard Mitigation Plan • Infectious Disease has caused one of the eighteen disaster declarations in Guilford County
TECHNOLOGICAL HAZARDS			
Terrorism	**YES**	• Review of the NC State Hazard Mitigation Plan	• Although the previous hazard mitigation plan for North

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?
		• Review of previous North Carolina A&T State University Pre-Disaster Mitigation Plan • Review of local official knowledge	Carolina A&T State University did not include terrorism threat as a hazard, it is assessed in this update to maintain consistency with the NC State Hazard Mitigation Plan. • There is a fixed nuclear facility in the state. • This hazard will assess chemical, biological, radiological, nuclear, and explosive terrorism events.
Radiological Emergency – Fixed Nuclear Facilities	**YES**	• Review of the previous North Carolina A&T State University Pre-Disaster Mitigation Plan • Review of IAEA list of fixed nuclear power stations in the United States • Discussion with local officials about location of nuclear power stations	• Portions of Guilford County are located within the 50 IPZ for Shearon Harris Nuclear Power Plant. • Although radiological emergencies are not identified in any previous plans, local officials expressed a desire to address them in this plan • 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 50-mile evacuation zone for the Shearon Harris Nuclear Power Plant
Cyber	**YES**	• Review of NC State Hazard Mitigation Plan	• Changing future conditions encourage the assessment of the possibility of a cyber-attack with the increase in global technology

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?
Electromagnetic Pulse	**YES**	• Review of NC State Hazard Mitigation Plan	• Changing future conditions encourage the assessment of the possibility of an electromagnetic pulse with the increase in global technology

B.5 Hazard Profiles, Analysis, and Vulnerability

This section includes detailed hazard profiles for each of the hazards identified in the Hazard Identification section as significant enough for further evaluation in the North Carolina A&T State University Hazard Mitigation Plan. It contains the following subsections:

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

44 CFR Requirement

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

B.5.1 OVERVIEW

This section includes detailed hazard profiles for each of the hazards identified in the Hazard Identification section as significant enough for further evaluation in the North Carolina A&T State University 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 Campus Hazard Mitigation Planning Team as it relates to unique historical or anecdotal hazard information as it applies specifically for NCAT.

After reviewing the list of assessed hazards from the previous plan, the North Carolina A&T State University Campus Hazard Mitigation 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**
  - 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

Much of the information in this section begins with a review of how the hazards impact Guilford County because that is the level at which the most readily-available and best-available information is provided. Where feasible, County-level information is supplemented with campus-specific details.

Natural Hazards

B.5.2 DROUGHT

B.5.2.1 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, 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. It is also notable that drought conditions typically do not cause significant damage to the built environment.

B.5.2.2 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 B.9.**

TABLE B.9: 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 NOAA and the North Carolina Drought Monitor, Guilford County has had drought occurrences in every year in the last nineteen years (2000-2019) (**Table B.10**). The National Center for Environmental Information did not report any drought conditions for Guilford County. It should be noted that the North Carolina Drought Monitor also estimates what percentage of the county is in each classification of drought severity. For example, the most severe classification reported may be exceptional, but a majority of the county may actually be in a less severe condition.

TABLE B.10: SUMMARY OF DROUGHT OCCURRENCES IN GUILFORD COUNTY (2000-2019)

Year	Guilford County
2000	Severe Drought
2001	Extreme Drought
2002	Exceptional Drought
2003	Abnormally Dry
2004	Abnormally Dry
2005	Severe Drought
2006	Severe Drought
2007	Exceptional Drought
2008	Exceptional Drought
2009	Moderate Drought
2010	Moderate Drought
2011	Severe Drought
2012	Moderate Drought
2013	Abnormally Dry
2014	Abnormally Dry
2015	Moderate Drought
2016	Abnormally Dry
2017	Moderate Drought
2018	Moderate Drought
2019	Moderate Drought

Source: NOAA, Storm and Weather Events Database

B.5.2.3 Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of Guilford County, including the North Carolina A&T campus, 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[1].

[1] *U.S. Seasonal Drought Outlook. National Weather Service Climate Prediction Center. http://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php*

B.5.3 EXCESSIVE HEAT

B.5.3.1 Location and Spatial Extent

Excessive heat typically impacts a large area and cannot be confined to any geographic or political boundaries. The entire North Carolina A&T campus is susceptible to extreme heat conditions.

B.5.3.2 Historical Occurrences

Data from the National Centers for Environmental Information showed that there has been one reported fatality due to excessive heat event in Guilford County. Typical weather conditions in Greensboro, North Carolina, where the campus is located, tend to rise above 79 degrees Fahrenheit. **Table B.11** shows the average maximum temperatures from 2001 to 2019.

TABLE B.11: AVERAGE MAXIMUM TEMPERATURE IN GREENSBORO, NORTH CAROLINA

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
48°F	53°F	61°F	70°F	78°F	85°F	88°F	86°F	80°F	70°F	61°F	51°F

Source: State Climate Office of North Carolina

The highest temperature ever recorded in High Point, was 106°F on July 20, 1926.[2]

B.5.3.3 Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of Guilford County, including the North Carolina A&T campus, has a probability level of likely (10 to 100 percent annual probability) for future extreme heat events to impact the region.

[2] http://climate.ncsu.edu/

B.5.4 HURRICANE AND COASTAL HAZARDS

B.5.4.1 Location and Spatial Extent

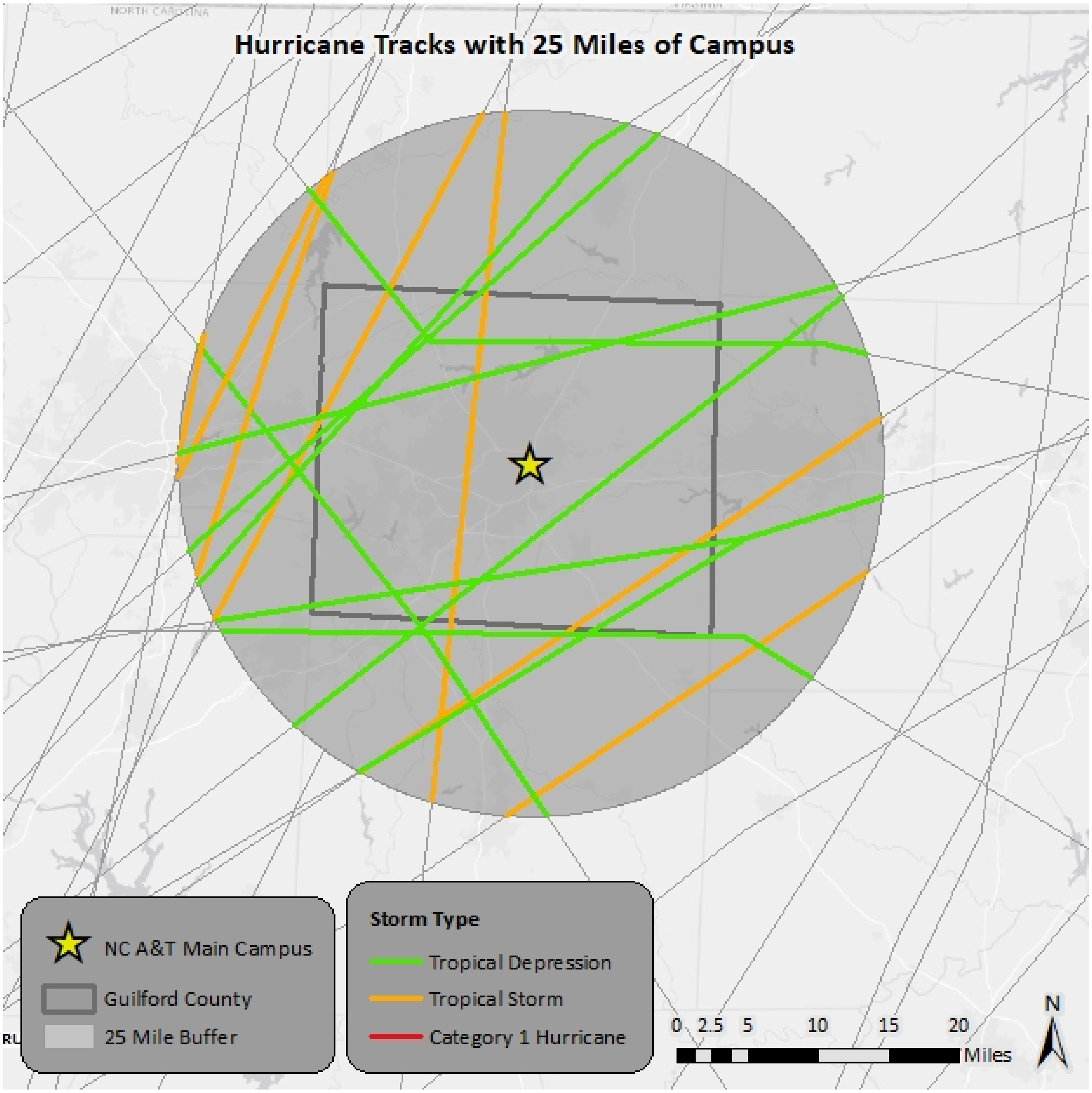
Hurricanes, coastal hazards, and tropical storms threaten the entire Atlantic and Gulf seaboard of the United States. While coastal areas are most directly exposed to the brunt of landfalling storms, their impact is often felt hundreds of miles inland and they can affect the North Carolina A&T Campus.

B.5.4.2 Historical Occurrences

According to the National Hurricane Center's historical storm track records, 17 tropical depressions or tropical storm tracks have passed within 25 miles of NCA&T campus since 1850[3]. This includes 9 tropical depressions, 8 tropical storms. These storm events are shown in **Figure B.4.** Furthermore, **Table B.12** provides for each event the date of occurrence, name (if applicable), maximum wind speed (as recorded within 25 miles of Guilford County) and Category of the storm based on the Saffir-Simpson Scale.

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

FIGURE B.4: HISTORICAL HURRICANE STORM TRACKS WITHIN 25 MILES OF NORTH CAROLINA A&T



Source: National Oceanic and Atmospheric Administration; National Hurricane Center

TABLE B.12: HISTORICAL STORM TRACKS WITHIN 25 MILES OF NORTH CAROLINA A&T (1850–2018)

Year	Storm Name	Maximum Wind Speed (knots)	Storm Category
1859	UNNAMED	40	Tropical Storm
1863	UNNAMED		Tropical Storm
1878	UNNAMED	60	Tropical Storm
1882	UNNAMED	40	Tropical Storm
1886	UNNAMED	35	Tropical Depression
1893	UNNAMED	65	Tropical Storm
1911	UNNAMED	25	Tropical Depression
1920	UNNAMED	35	Tropical Depression
1928	UNNAMED	30	Tropical Depression
1952	ABLE	40	Tropical Storm
1964	CLEO	25	Tropical Depression
1968	ABBY	25	Tropical Depression
1979	DAVID	45	Tropical Storm
1985	BOB	45	Tropical Storm
1985	DANNY	25	Tropical Depression
1999	DENNIS	30	Tropical Depression
2004	JEANNE	20	Tropical Depression

Source: National Hurricane Center

The National Centers for Environmental Information did record 4 hurricane events and one tropical storm event in Guilford County between 1996 and 2018. Hurricane and tropical storm events have caused 5 disaster declarations in Guilford County. While these were not recorded in the database, effects from these types of storms were likely still felt in other hazards, including thunderstorms and flooding. Flooding is generally the greatest hazard of concern with hurricane and tropical storm events in the area near North Carolina A&T. 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.

B.5.4.3 Probability of Future Occurrences

Given the inland location of the campus, it is more likely to be affected by remnants of hurricane and tropical storm systems (as opposed to a major hurricane) which may result in flooding or high winds. The probability of being impacted is less than coastal areas, but still remains a real threat to North Carolina A&T due to induced events like flooding and land sliding. Based on historical evidence, the probability level of future occurrence is likely (between 10 and 100 percent annual probability). However, when the area is impacted, the damage could be severe, threatening lives and property on campus.

B.5.5 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 hailstorms and lightning.

B.5.5.1 Location and Spatial Extent

Tornadoes

Tornadoes occur throughout the state of North Carolina, and thus in the area surrounding North Carolina A&T. 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 area surrounding the North Carolina A&T campus 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 North Carolina A&T State University typically experiences several straight-line wind events each year. These wind events can and have caused significant damage. It is assumed that the area surrounding the North Carolina A&T State University campus 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 all of the area surrounding the North Carolina A&T campus is uniformly exposed to severe thunderstorms; therefore, the campus itself is also 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 area surrounding the North Carolina A&T campus is uniformly exposed to lightning.

B.5.5.2 Historical Occurrences

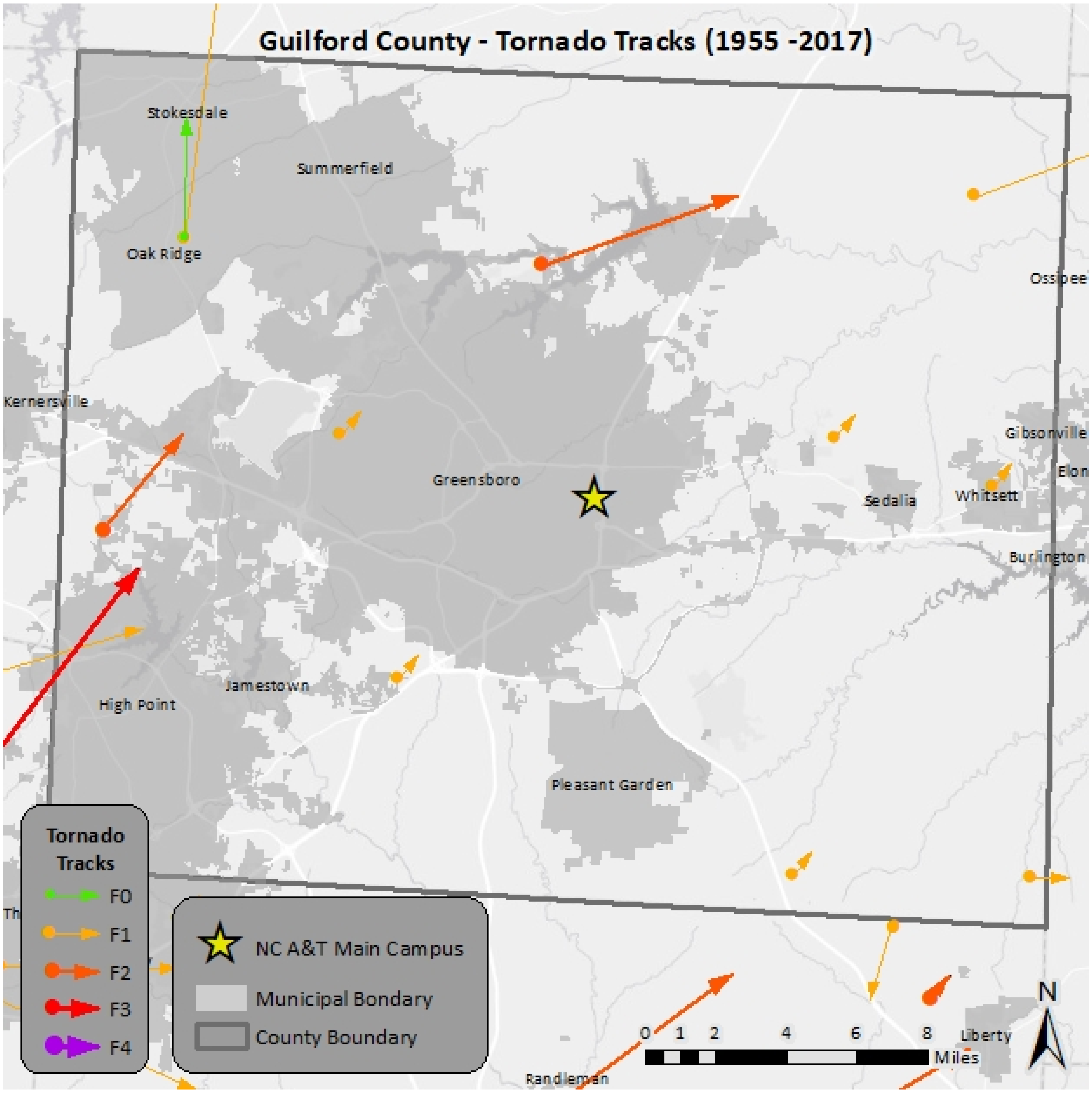
Tornadoes

Tornadoes are a somewhat rare occurrence; however, they have and do occur in the area. According to the National Centers for Environmental Information, there have been 14 recorded tornado events in Guilford County since 1954 (**Table B.13**), resulting in over $79.6 million in property damages[4]. In addition, 1 death and 5 injuries were reported. The magnitude of these tornadoes ranges from F0 to F2 in intensity, although an F5 event is possible but not likely. 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

[4] 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 Guilford County. As additional local data becomes available, this hazard profile will be amended.

occurrences have gone unreported over the past 69 years. **Figure B.5** shows a map of tornado impact in Guilford County.

FIGURE B.5: TORNADO TRACKS IN GUILFORD COUNTY (1950 – 2017)



Source: National Centers for Environmental Information

TABLE B.14: HISTORICAL TORNADO IMPACTS IN GUILFORD COUNTY

Location	Date	Magnitude	Deaths / Injuries	Property Damage	Details
Guilford County	6/16/1954	F2	0/1	$2,500	n/a
Guilford County	4/5/1957	F1	0/1	$250,000	n/a
Guilford County	9/29/1959	F1	0/0	$25,000	n/a
Guilford County	6/12/1962	F1	0/0	$2,500	n/a
Guilford County	4/17/1967	F1	0/0	$25,000	n/a
Guilford County	5/14/1967	F1	0/0	$250,000	n/a
Guilford County	10/8/1976	F1	0	$25,000	n/a
Greensboro Arpt	5/7/1998	F1	0/0	$100,000	A tornado touched down approximately 1 mile southeast of the Piedmont-Triad International Airport near Greensboro. The first damage occurred just south of West Friendly Avenue. The tornado moved to the southeast and lifted at Jamestown Road approximately 1.5 miles from its initial touchdown. Damage was rated at F1 initially and F0 at the point it rose back into the thunderstorm. This tornado was produced by the same parent storm that produced the Clemmons tornado less than an hour before this one.
Climax	5/7/1998	F1	0/0	$0	A tornado touched down in extreme southeast Guilford County and tracked to the southeast for approximately 2.5 miles. It moved into extreme northeast Randolph county before lifting about 2 miles north of Liberty. The tornado F1 damage. The exact path stretched from Lake Juno to Liberty Grove Road
Stokesdale	9/17/2004	F1	0/0	$0	A tornado touched down near the intersection of Harrell Road and Lee's Glen Road. The tornado then tracked north across Meadows Drive and Haw Meadows Drive when falling trees caused significant damage to at least three homes, one of which was a total loss. The tornado continued north to Prince Edward Road where about 70 percent of the trees in a heavily wooded area were snapped or downed. In Guilford County, three houses suffered total losses, nine homes sustained major damage, and 52 sustained minor damage.
Oak Ridge	7/7/2005	F0	0/0	$0	A tornado blew down trees from Oak Ridge to Stokesdale.

Location	Date	Magnitude	Deaths / Injuries	Property Damage	Details
Deep River	5/8/2008	EF2	1/3	$4,000,000	The tornado, originally an EF-0, initially touched down just north of Squire Davis Park near the intersection of Sandy Ridge Road and Johnson Street. From there the tornado tracked northeast and intensified to EF-1 intensity as it approached the Farmers Market and Interstate 40. The tornado overturned several cars and tractor trailers as it crossed Interstate 40. As the tornado moved further northeast into an industrial complex, it further strengthened to EF-2 with winds estimated around 130 mph based on damage to warehouses. Numerous warehouses along Little Santee Road, Capital Drive, and West Market Street sustained significant damage. Numerous vehicles and tractor trailers were also overturned in the industrial complex. At its widest point, the tornado was just over 200 yards wide. The tornado quickly lifted off of the ground after crossing West Market Street near the post office. The tornado was on the ground for about four miles. One fatality occurred along West Market Street next to the Lamination Service Building located at 8717 West Market Street. The fatality occurred as a 51-year-old man slept in the rig of his tractor trailer. Three other injuries were reported, two of which occurred in automobiles and another in the I.H. Caffey Warehouse Distribution Center.
High Point	3/28/2010	EF3	0/0	$10,000,000	The tornado initially touched down as an EF1 with winds around 100 mph near Old Plank Road in southwest Guilford County. It was in this area where the Apple Tree Academy sustained significant damage and two vehicles including a small bus were rolled 50 yards across the street. From this point the tornado continued northeast across Highway 311. The next area to experience damage was just north of Highway 311 and south of Old Mill Road along Langdale, Imperial and Impala Drives. Tornado damage in this area continued to indicate EF1 winds with numerous trees down along with a number of homes with roof and siding damage. The tornado intensified to an EF2 as it crossed Old Mill Road towards Johnson Street. The EF2 tornado severely damaged numerous homes along Brandon Drive. EF2 tornado damage continued north of Old Mill Road to Skeet Club Road along either side of Johnson Road with winds around 130 mph for most of its duration but briefly reached EF3 intensity with winds of 138 mph near Hampton Park Drive at 1278 Silverstone Court where the upper level of a two story home was blown off. The tornado finally lifted off the ground north of Kendale Road. In total 603 single family homes were damaged with 21 homes being completely destroyed. Thirty-one multifamily homes were damaged with 16 reported destroyed.

Location	Date	Magnitude	Deaths / Injuries	Property Damage	Details
Greensboro	4/15/2018	EF2	0/0	$65,000,000	The tornado initially touched down on the north side of I-40 near where Willow Road crosses I-40. Damage at this point consisted of snapped trees and was consistent with 90 mph wind speeds, or EF-1 on the Enhanced Fujita Scale. The tornado remained on the ground as it traveled north toward Peeler Elementary School. Numerous homes in this area were damaged along with substantial tree damage. The tornado wind speeds at this location were estimated to be approximately 100 mph. The tornado continued traveling north and reached a peak intensity and maximum path width in the Hampton Community and near Hampton Elementary School. The tornado then continued north-northeast and mostly remained on the ground all the way to the Guilford/Rockingham County line. The tornado appeared to produce minor tree damage (with wind speeds 80 mph or less) just before crossing into Rockingham County. Finally, the aforementioned path length (16 miles) consists of just the Guilford County path. The tornado continued into Rockingham County, and remained on the ground for an additional 17.6 miles.

Source: National Centers for Environmental Information

Thunderstorms

According to NCEI, there have been 328 reported thunderstorm and high wind events since 1956 in Guilford County[5]. These events caused over $1.4 million (2019 dollars) in damages. There were reports of one injury. **Table B.15** summarizes this information.

TABLE B.15: HISTORICAL THUNDERSTORM IMPACTS IN GUILFORD COUNTY

Location	Date	Deaths	Injuries	Property Damage
GUILFORD COUNTY	1956-08-02	0	0	$0
GUILFORD COUNTY	1957-07-17	0	0	$0
GUILFORD COUNTY	1960-05-25	0	0	$0
GUILFORD COUNTY	1962-08-09	0	0	$0
GUILFORD COUNTY	1963-03-19	0	0	$0
GUILFORD COUNTY	1964-07-03	0	0	$0
GUILFORD COUNTY	1964-07-13	0	0	$0
GUILFORD COUNTY	1965-04-27	0	0	$0
GUILFORD COUNTY	1965-07-04	0	0	$0
GUILFORD COUNTY	1966-05-01	0	0	$0
GUILFORD COUNTY	1967-05-29	0	0	$0

[5] 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 Guilford County. As additional local data becomes available, this hazard profile will be amended.

Location	Date	Deaths	Injuries	Property Damage
GUILFORD COUNTY	1967-08-04	0	0	$0
GUILFORD COUNTY	1969-06-24	0	0	$0
GUILFORD COUNTY	1970-07-04	0	0	$0
GUILFORD COUNTY	1971-06-29	0	0	$0
GUILFORD COUNTY	1975-03-24	0	0	$0
GUILFORD COUNTY	1976-02-18	0	0	$0
GUILFORD COUNTY	1976-07-15	0	0	$0
GUILFORD COUNTY	1976-08-14	0	0	$0
GUILFORD COUNTY	1976-08-14	0	0	$0
GUILFORD COUNTY	1979-07-04	0	0	$0
GUILFORD COUNTY	1979-08-21	0	0	$0
GUILFORD COUNTY	1980-08-01	0	0	$0
GUILFORD COUNTY	1980-08-15	0	0	$0
GUILFORD COUNTY	1981-06-06	0	0	$0
GUILFORD COUNTY	1981-07-28	0	0	$0
GUILFORD COUNTY	1982-05-29	0	0	$0
GUILFORD COUNTY	1983-03-06	0	0	$0
GUILFORD COUNTY	1984-07-10	0	0	$0
GUILFORD COUNTY	1984-07-26	0	0	$0
GUILFORD COUNTY	1984-07-26	0	0	$0
GUILFORD COUNTY	1985-06-03	0	0	$0
GUILFORD COUNTY	1985-06-05	0	0	$0
GUILFORD COUNTY	1985-06-05	0	0	$0
GUILFORD COUNTY	1985-07-04	0	0	$0
GUILFORD COUNTY	1985-07-04	0	0	$0
GUILFORD COUNTY	1985-07-10	0	0	$0
GUILFORD COUNTY	1985-10-15	0	0	$0
GUILFORD COUNTY	1985-10-15	0	0	$0
GUILFORD COUNTY	1986-06-28	0	0	$0
GUILFORD COUNTY	1986-07-29	0	0	$0
GUILFORD COUNTY	1986-07-29	0	0	$0
GUILFORD COUNTY	1987-04-15	0	0	$0
GUILFORD COUNTY	1987-06-01	0	0	$0
GUILFORD COUNTY	1987-09-10	0	0	$0
GUILFORD COUNTY	1988-05-10	0	0	$0
GUILFORD COUNTY	1988-05-17	0	0	$0
GUILFORD COUNTY	1988-05-23	0	0	$0
GUILFORD COUNTY	1988-06-26	1	0	$0
GUILFORD COUNTY	1988-07-10	0	0	$0
GUILFORD COUNTY	1988-07-10	0	0	$0
GUILFORD COUNTY	1989-04-26	0	0	$0
GUILFORD COUNTY	1989-05-05	0	0	$0

Location	Date	Deaths	Injuries	Property Damage
GUILFORD COUNTY	1989-05-05	0	0	$0
GUILFORD COUNTY	1989-05-06	0	0	$0
GUILFORD COUNTY	1989-05-06	0	0	$0
GUILFORD COUNTY	1989-05-06	0	0	$0
GUILFORD COUNTY	1989-05-23	0	0	$0
GUILFORD COUNTY	1989-06-16	1	0	$0
GUILFORD COUNTY	1989-06-16	0	0	$0
GUILFORD COUNTY	1989-07-12	0	0	$0
GUILFORD COUNTY	1990-02-10	0	0	$0
GUILFORD COUNTY	1990-05-01	0	0	$0
GUILFORD COUNTY	1990-07-01	0	0	$0
GUILFORD COUNTY	1990-07-11	0	0	$0
GUILFORD COUNTY	1990-08-29	0	0	$0
GUILFORD COUNTY	1990-10-18	0	0	$0
GUILFORD COUNTY	1991-04-09	0	0	$0
GUILFORD COUNTY	1991-04-29	0	0	$0
GUILFORD COUNTY	1991-07-03	0	0	$0
GUILFORD COUNTY	1991-07-03	0	0	$0
GUILFORD COUNTY	1992-03-10	0	0	$0
GUILFORD COUNTY	1992-03-10	0	0	$0
GUILFORD COUNTY	1992-04-24	0	0	$0
GUILFORD COUNTY	1992-08-11	0	0	$0
GUILFORD COUNTY	1992-08-11	0	0	$0
GUILFORD COUNTY	1992-11-22	0	0	$0
Greensboro	1993-08-12	0	0	$0
Greensboro	1993-08-17	0	0	$0
Greensboro	1993-08-26	0	0	$0
Gibsonville	1993-08-26	0	0	$0
Brownes Summit	1995-06-08	0	0	$0
Julian	1995-10-27	0	0	$0
COUNTYWIDE	1996-01-19	0	0	$0
GREENSBORO	1996-04-20	0	0	$0
GREENSBORO	1996-05-11	0	0	$200,000
GREENSBORO	1996-05-24	0	0	$0
GREENSBORO	1997-03-05	0	0	$50,000
CLIMAX	1997-07-16	0	0	$0
SUMMERFIELD	1997-07-28	0	0	$0
GREENSBORO	1997-07-28	0	0	$10,000
GREENSBORO	1998-06-16	0	0	$0
GREENSBORO	1998-06-30	0	1	$0
GREENSBORO	1999-07-07	0	0	$0
PLEASANT GARDEN	2000-03-11	0	0	$0

Location	Date	Deaths	Injuries	Property Damage
HIGH PT	2000-05-20	0	0	$0
GIBSONVILLE	2000-05-20	0	0	$0
GREENSBORO ARPT	2000-05-25	0	0	$0
HIGH PT	2000-05-25	0	0	$0
GREENSBORO	2000-05-25	0	0	$0
SUMMERFIELD	2000-06-15	0	0	$0
JAMESTOWN	2000-06-15	0	0	$0
OAK RIDGE	2000-06-15	0	0	$0
GREENSBORO	2000-08-10	0	0	$0
GIBSONVILLE	2000-08-18	0	0	$0
STOKESDALE	2000-09-14	0	0	$0
GREENSBORO ARPT	2000-09-14	0	0	$0
PLEASANT GARDEN	2001-05-22	0	0	$0
SUMMERFIELD	2002-05-13	0	0	$0
GREENSBORO	2002-06-01	0	0	$0
GREENSBORO	2003-06-27	0	0	$0
GREENSBORO	2003-06-27	0	0	$0
SEDALIA	2003-07-13	0	0	$0
COLFAX	2003-08-17	0	0	$0
STOKESDALE	2004-08-12	0	0	$0
HIGH PT	2005-03-08	0	0	$0
SEDALIA	2005-03-08	0	0	$0
MONTICELLO	2005-07-13	0	0	$0
GREENSBORO	2006-04-03	0	0	$0
HIGH PT	2006-04-17	0	0	$0
GREENSBORO	2006-04-17	0	0	$0
HIGH PT	2006-04-17	0	0	$0
CLIMAX	2006-05-18	0	0	$0
GREENSBORO	2006-06-11	0	0	$0
GREENSBORO	2006-06-11	0	0	$0
GREENSBORO	2006-06-11	0	0	$0
GREENSBORO	2006-06-11	0	0	$0
GREENSBORO	2006-06-11	0	0	$0
OAK RIDGE	2006-07-04	0	0	$0
JAMESTOWN	2006-07-14	0	0	$0
MC LEANSVILLE	2006-07-19	0	0	$0
HIGH PT	2006-07-19	0	0	$0
JAMESTOWN	2006-07-19	0	0	$0
GIBSONVILLE	2006-07-20	0	0	$0
JAMESTOWN	2006-07-22	0	0	$0
SUMMERFIELD	2006-07-28	0	0	$0
GREENSBORO	2006-08-03	0	0	$0

Location	Date	Deaths	Injuries	Property Damage
PLEASANT GARDEN	2006-08-07	0	0	$0
GREENSBORO	2006-08-30	0	0	$0
SUMMERFIELD	2006-08-30	0	0	$0
GREENSBORO	2006-09-28	0	0	$0
GREENSBORO	2006-11-16	0	0	$0
GREENSBORO	2007-04-15	0	0	$0
GREENSBORO	2007-06-04	0	0	$0
GREENSBORO	2007-06-04	0	0	$0
GREENSBORO	2007-06-04	0	0	$0
GREENSBORO	2007-06-05	0	0	$0
GIBSONVILLE	2007-06-11	0	0	$0
STOKESDALE	2007-06-19	0	0	$0
MC LEANSVILLE	2007-06-27	0	0	$0
GIBSONVILLE	2007-06-27	0	0	$0
STOKESDALE	2007-06-27	0	0	$0
OAK RIDGE ARPT	2007-06-27	0	0	$0
STOKESDALE	2007-08-21	0	0	$0
GREENSBORO	2007-08-21	0	0	$0
GUILFORD	2008-03-04	0	0	$0
DEEP RIVER	2008-03-04	0	0	$0
HAMILTON LAKES	2008-03-04	0	0	$0
(GSO)GREENSBORO RGNL	2008-05-08	0	0	$0
MONTICELLO	2008-05-08	0	0	$0
GREENSBORO MAY ARPT	2008-06-23	0	0	$0
PLEASANT GARDEN	2008-07-08	0	0	$0
COLFAX	2009-05-06	0	0	$0
PLEASANT GARDEN	2009-05-09	0	0	$0
RUDD	2009-06-03	0	0	$0
HAMILTON LAKES	2009-06-03	0	0	$0
DEEP RIVER	2009-06-03	0	0	$0
GREENSBORO	2009-06-03	0	0	$0
GUILQUARRY	2009-06-10	0	0	$0
HIGH PT	2009-07-13	0	0	$15,000
CLIMAX	2009-08-05	0	0	$0
BRIGHTWOOD	2009-08-20	0	0	$0
BROWNS SUMMIT	2009-09-28	0	0	$0
BROWNS SUMMIT	2009-09-28	0	0	$0
COLFAX	2010-04-08	0	0	$0
POMONA	2010-06-14	0	0	$1,000
PINECROFT	2010-06-14	0	0	$0

Location	Date	Deaths	Injuries	Property Damage
SCALESVILLE	2010-06-15	0	0	$0
GREENSBORO MAY ARPT	2010-06-15	0	0	$0
HAMILTON LAKES	2010-06-16	0	0	$0
PLEASANT GARDEN	2010-06-23	0	0	$5,000
SUMMERFIELD	2010-06-24	0	0	$0
SUMMERFIELD	2010-06-24	0	0	$10,000
GUILFORD	2010-07-13	0	0	$0
DEEP RIVER	2010-07-16	0	0	$5,000
PLEASANT GARDEN	2010-07-20	0	0	$0
HILL TOP	2010-08-05	0	0	$0
GREENSBORO ARPT	2010-08-11	0	0	$0
COLFAX	2010-11-16	0	0	$0
HIGH PT	2011-04-05	0	0	$250,000
PLEASANT GARDEN	2011-04-28	0	0	$0
BESSEMER	2011-04-28	0	0	$0
HILLSDALE	2011-04-28	0	0	$0
MONTICELLO	2011-04-28	0	0	$0
GREENSBORO MAY ARPT	2011-05-26	0	0	$0
OAK RIDGE	2011-05-26	0	0	$0
OAK RIDGE	2011-05-27	0	0	$0
MC LEANSVILLE	2011-06-11	0	0	$0
HILLSDALE	2011-06-18	0	0	$0
GREENSBORO MAY ARPT	2011-06-18	0	0	$0
BESSEMER	2011-06-22	0	0	$0
GREENSBORO	2011-06-22	0	0	$0
DEEP RIVER	2011-06-28	0	0	$0
SEDALIA	2011-07-04	0	0	$0
COLFAX	2011-07-24	0	0	$0
SUMMERFIELD	2011-07-24	0	0	$0
WHITSETT	2011-08-14	0	0	$0
GUILQUARRY	2012-02-22	0	0	$0
GREENSBORO MAY ARPT	2012-02-22	0	0	$0
BATTLE GROUND	2012-02-24	0	0	$0
GREENSBORO ARHRBR AR	2012-03-24	0	0	$0
HIGH PT	2012-06-01	0	0	$0
TERRA COTTA	2012-06-01	0	0	$15,000
BATTLE GROUND	2012-06-22	0	0	$0

Location	Date	Deaths	Injuries	Property Damage
CLIMAX	2012-07-20	0	0	$0
WHITSETT	2012-07-21	0	0	$0
GBSNVLL MC LEAN ARPT	2012-08-08	0	0	$0
BATTLE GROUND	2012-09-02	0	0	$0
PINECROFT	2012-09-02	0	0	$0
GIBSONVILLE	2012-09-02	0	0	$0
OAK RIDGE ARPT	2012-09-08	0	0	$0
HILLSDALE	2012-10-18	0	0	$0
DEEP RIVER	2013-01-30	0	0	$500
GROOMTOWN	2013-04-19	0	0	$500
OAK RIDGE ARPT	2013-04-19	0	0	$0
GUILFORD	2013-06-10	0	0	$0
GUILQUARRY	2013-06-13	0	1	$200,000
BATTLE GROUND	2013-06-25	0	0	$0
SEDGEFIELD	2013-06-28	0	0	$2,000
GREENSBORO	2013-07-21	0	0	$0
OAK RIDGE ARPT	2013-08-10	0	0	$0
OAK RIDGE	2013-08-10	0	0	$1,000
OAK RIDGE	2013-08-10	0	0	$1,000
SEDGEFIELD	2013-08-10	0	0	$0
VANDALIA	2013-09-01	0	0	$1,000
HAMILTON LAKES	2014-02-21	0	0	$3,000
(GSO)GREENSBORO RGNL	2014-03-12	0	0	$5,000
HAMILTON LAKES	2014-06-10	0	0	$1,000
BRIGHTWOOD	2014-06-16	0	0	$0
GUILQUARRY	2014-06-19	0	0	$0
OAK RIDGE	2014-06-19	0	0	$0
HIGH PT	2014-06-19	0	0	$0
HIGH PT	2014-06-19	0	0	$0
BATTLE GROUND	2014-09-16	0	0	$0
HILLSDALE	2015-04-20	0	0	$0
DEEP RIVER	2015-06-30	0	0	$25,000
MC LEANSVILLE	2015-06-30	0	0	$0
(GSO)GREENSBORO RGNL	2015-07-13	0	0	$0
HIGH PT	2015-08-05	0	0	$4,000
SEDGEFIELD	2015-08-05	0	0	$0
JAMESTOWN	2015-08-05	0	0	$0
PLEASANT GARDEN	2015-08-05	0	0	$0
VANDALIA	2015-08-05	0	0	$0

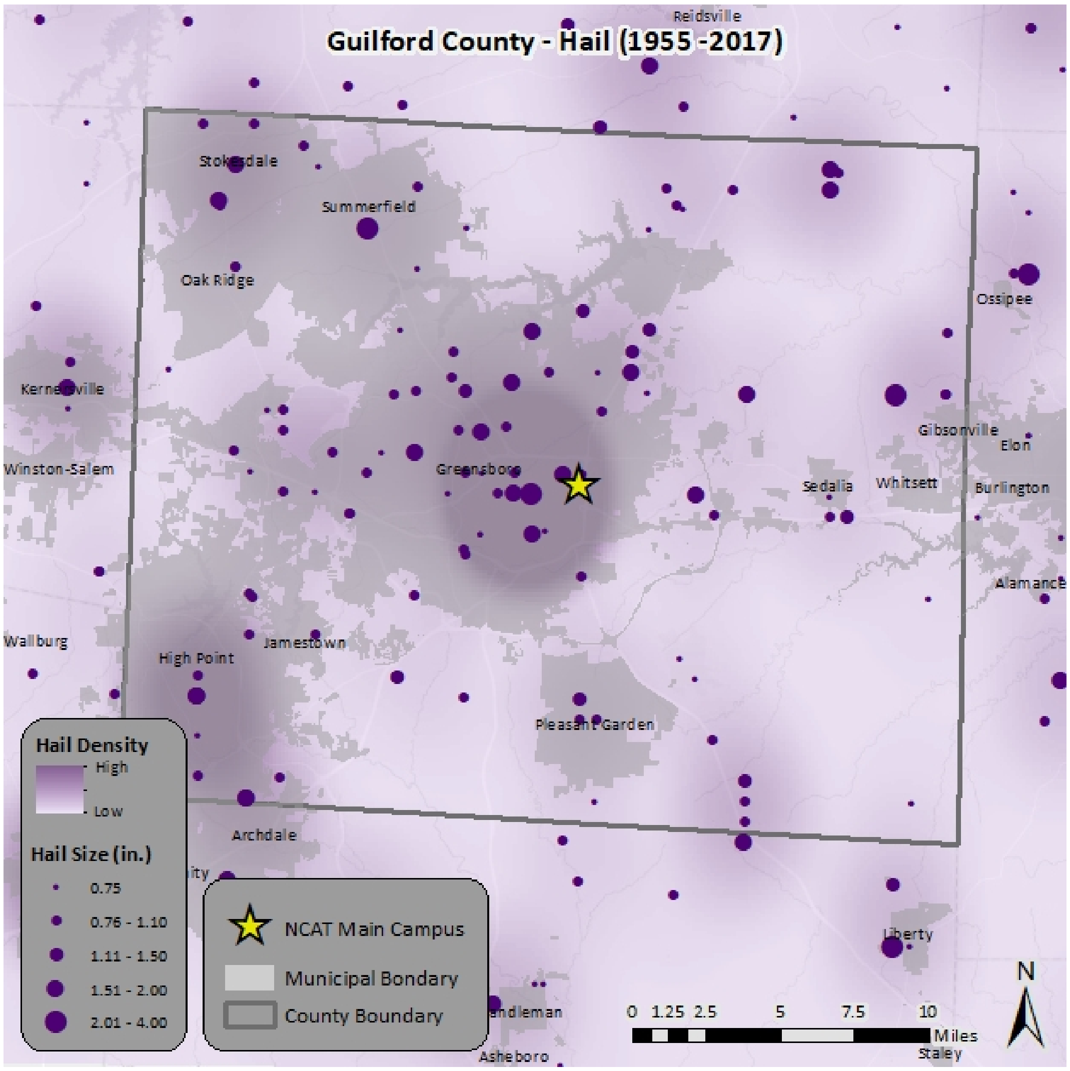
Location	Date	Deaths	Injuries	Property Damage
GREENSBORO MAY ARPT	2015-08-05	0	0	$0
SEDGEFIELD	2016-02-24	0	0	$0
GUILFORD	2016-05-02	0	0	$5,000
BATTLE GROUND	2016-05-02	0	0	$0
GUILFORD	2016-05-02	0	0	$25,000
HIGH PT	2016-05-03	0	0	$5,000
GREENSBORO MAY ARPT	2016-05-12	0	0	$1,000
SUMMERFIELD	2016-05-21	0	0	$2,000
OSCEOLA	2016-06-24	0	0	$500
BATTLE GROUND	2016-07-08	0	0	$0
COLFAX	2016-07-08	0	0	$0
GUILQUARRY	2016-07-27	0	0	$5,000
COLFAX	2016-07-27	0	0	$0
FOUR MILE	2016-08-27	0	0	$2,500
VANDALIA	2016-08-27	0	0	$0
GREENSBORO	2017-05-05	0	0	$0
BATTLE GROUND	2017-05-05	0	0	$10,000
MONTICELLO	2017-05-05	0	0	$10,000
BROWNS SUMMIT	2017-05-05	0	0	$100,000
TERRA COTTA	2017-05-05	0	0	$0
HILLSDALE	2017-05-05	0	0	$10,000
OSCEOLA	2017-05-31	0	0	$2,000
GUILQUARRY	2017-06-13	0	0	$10,000
GUILFORD	2017-06-13	0	0	$3,000
BATTLE GROUND	2017-06-14	0	0	$5,000
ALLEN JAY	2017-06-18	0	0	$500
PINECROFT	2017-06-18	0	0	$0
MC LEANSVILLE	2017-07-13	0	0	$5,000
HILL TOP	2017-07-23	0	0	$5,000
GIBSONVILLE	2018-06-20	0	0	$50,000
BESSEMER	2018-07-06	0	0	$0
SEDALIA	2018-07-06	0	0	$2,500
OAK RIDGE ARPT	2018-07-21	0	0	$0
SUMMERFIELD	2018-07-21	0	0	$0
MONTICELLO	2018-07-22	0	0	$2,500
MC LEANSVILLE	2018-08-07	0	0	$0
BROADVIEW	2018-09-01	0	0	$1,500
GREENSBORO	2018-09-01	0	0	$0
HIGH PT	2019-04-12	0	0	$2,000
BESSEMER	2019-04-12	0	0	$3,000

Location	Date	Deaths	Injuries	Property Damage
OAK RIDGE	2019-04-15	0	0	$4,000
JAMESTOWN	2019-04-19	0	0	$0
GREENSBORO	2019-04-19	0	0	$0
SCALESVILLE	2019-04-19	0	0	$0
SCALESVILLE	2019-04-19	0	0	$0
FOUR MILE	2019-05-31	0	0	$10,000
TERRA COTTA	2019-05-31	0	0	$3,000
SUMMERFIELD	2019-06-20	0	0	$2,500
HILLSDALE	2019-06-20	0	0	$0
GUILFORD	2019-06-20	0	0	$1,500
BROWNS SUMMIT	2019-06-20	0	0	$0
BROADVIEW	2019-06-20	0	0	$10,000
BESSEMER	2019-06-20	0	0	$0
BROADVIEW	2019-06-20	0	0	$0
BROADVIEW	2019-06-20	0	0	$10,000
BATTLE GROUND	2019-07-23	0	0	$0
KOONTZVILLE	2019-08-01	0	0	$15,000
TERRA COTTA	2019-08-01	0	0	$0
HAMILTON LAKES	2019-08-19	0	0	$3,000
SCALESVILLE	2019-08-21	0	0	$0
GREENSBORO ARHRBR AR	2019-08-21	0	0	$0
RUDD	2019-08-21	0	0	$0
TERRA COTTA	2019-08-21	0	0	$0
MC LEANSVILLE	2019-08-21	0	0	$10,000
(GSO)GREENSBORO RGNL	2019-08-22	0	0	$0
SUMMERFIELD	2019-08-22	0	0	$35,000
GREENSBORO	2019-10-31	0	0	$20,000
BATTLE GROUND	2019-10-31	0	0	$0
BATTLE GROUND	2019-10-31	0	0	$25,000
GROOMTOWN	2019-10-31	0	0	$10,000
PLEASANT GARDEN	2019-10-31	0	0	$0
CLIMAX	2019-10-31	0	0	$0
HILLSDALE	2020-01-11	0	0	$10,000
POMONA	2020-01-11	0	0	$5,000
(GSO)GREENSBORO RGNL	2020-02-06	0	0	$200,000

Source: National Center for Environmental Information

Hailstorms
According to the National Centers for Environmental Information, 70 recorded hailstorm events have affected Guilford County since 1967 summarized in **Table B.16.** [6] In all, hail occurrences resulted in over $1,750 (2020 dollars) in property damages. Hail ranged in diameter from 0.75 inches to 2.75 inches. It should be noted that hail is notorious for causing substantial damage to cars, roofs, and other areas of the built environment that may not be reported to the National Centers for Environmental Information. **Figure B.6** shows a map of hailstorm occurrences in Guilford County.

FIGURE B.6: HAIL OCCURANCES IN GUILFORD COUNTY



Source: National Centers for Environmental Information

[6] 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 Guilford County. 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 B.16: HISTORICAL HAIL OCCURANCES IN GUILFORD COUNTY

Location	Date	Magnitude (in)	Deaths	Injuries	Property Damage*
GUILFORD COUNTY	1967-08-07	0.75 "	0	0	$0
GUILFORD COUNTY	1978-06-22	1.00 "	0	0	$0
GUILFORD COUNTY	1979-08-21	1.00 "	0	0	$0
GUILFORD COUNTY	1982-04-27	1.00 "	0	0	$0
GUILFORD COUNTY	1982-05-29	1.75 "	0	0	$0
GUILFORD COUNTY	1983-04-02	2.75 "	0	0	$0
GUILFORD COUNTY	1984-04-14	1.75 "	0	0	$0
GUILFORD COUNTY	1984-05-06	1.75 "	0	0	$0
GUILFORD COUNTY	1985-05-15	0.75 "	0	0	$0
GUILFORD COUNTY	1985-05-22	2.50 "	0	0	$0
GUILFORD COUNTY	1985-06-03	1.00 "	0	0	$0
GUILFORD COUNTY	1985-06-05	1.25 "	0	0	$0
GUILFORD COUNTY	1985-06-05	1.00 "	0	0	$0
GUILFORD COUNTY	1987-04-12	1.75 "	0	0	$0
GUILFORD COUNTY	1987-06-01	1.75 "	0	0	$0
GUILFORD COUNTY	1988-05-16	0.75 "	0	0	$0
GUILFORD COUNTY	1988-05-17	0.75 "	0	0	$0
GUILFORD COUNTY	1988-05-17	0.75 "	0	0	$0
GUILFORD COUNTY	1988-05-17	0.75 "	0	0	$0
GUILFORD COUNTY	1988-05-17	1.00 "	0	0	$0
GUILFORD COUNTY	1988-06-21	0.75 "	0	0	$0
GUILFORD COUNTY	1988-07-10	1.75 "	0	0	$0
GUILFORD COUNTY	1989-04-27	0.75 "	0	0	$0
GUILFORD COUNTY	1989-06-02	1.00 "	0	0	$0
GUILFORD COUNTY	1990-05-01	1.00 "	0	0	$0
GUILFORD COUNTY	1990-05-01	1.00 "	0	0	$0
GUILFORD COUNTY	1990-05-27	1.00 "	0	0	$0
GUILFORD COUNTY	1990-05-27	1.75 "	0	0	$0
GUILFORD COUNTY	1990-07-01	1.75 "	0	0	$0
GUILFORD COUNTY	1992-04-30	0.75 "	0	0	$0
GUILFORD COUNTY	1992-06-26	0.75 "	0	0	$0
High Point	1994-08-27	0.75 "	0	0	$0
Julian	1995-10-27	1.50 "	0	0	$0
JULIAN	1996-05-29	1.75 "	0	0	$0
HIGH POINT	1996-07-18	0.75 "	0	0	$0
GREENSBORO	1996-09-13	0.75 "	0	0	$0
JULIAN	1996-10-18	0.75 "	0	0	$0
GREENSBORO	1997-03-05	0.75 "	0	0	$0
STOKESDALE	1997-07-24	1.00 "	0	0	$0

Location	Date	Magnitude (in)	Deaths	Injuries	Property Damage*
GREENSBORO	1997-08-25	0.75 "	0	0	$0
GIBSONVILLE	1998-04-03	0.75 "	0	0	$0
HIGH PT	1998-04-17	0.88 "	0	0	$0
MONTICELLO	1998-05-01	0.75 "	0	0	$0
HIGH PT	1998-05-07	0.88 "	0	0	$0
GREENSBORO	1998-05-20	1.75 "	0	0	$0
GUILFORD	1998-05-20	1.00 "	0	0	$0
GREENSBORO	1998-05-26	0.75 "	0	0	$0
GREENSBORO	1998-06-15	0.75 "	0	0	$0
HIGH PT	2000-06-03	1.75 "	0	0	$0
SUMMERFIELD	2000-08-18	2.50 "	0	0	$0
OAK RIDGE	2001-05-12	0.88 "	0	0	$0
GREENSBORO	2001-05-25	1.00 "	0	0	$0
GREENSBORO	2001-05-25	1.00 "	0	0	$0
PLEASANT GARDEN	2002-07-01	1.50 "	0	0	$0
HIGH PT	2002-07-02	0.88 "	0	0	$0
STOKESDALE	2002-07-03	1.75 "	0	0	$0
GREENSBORO	2002-07-04	0.88 "	0	0	$0
GREENSBORO	2002-07-04	0.75 "	0	0	$0
JAMESTOWN	2003-04-26	0.88 "	0	0	$0
GREENSBORO	2003-04-26	1.25 "	0	0	$0
HIGH PT	2003-04-30	0.75 "	0	0	$0
HIGH PT	2003-05-02	0.75 "	0	0	$0
GREENSBORO	2003-05-31	1.00 "	0	0	$0
SUMMERFIELD	2003-07-13	0.88 "	0	0	$0
STOKESDALE	2003-07-19	0.88 "	0	0	$0
GREENSBORO	2003-08-05	0.75 "	0	0	$0
GREENSBORO	2003-08-22	0.88 "	0	0	$0
GREENSBORO	2004-05-09	0.75 "	0	0	$0
GIBSONVILLE	2004-05-23	0.88 "	0	0	$0
HIGH PT	2004-07-04	0.75 "	0	0	$0
HIGH PT	2004-07-17	1.00 "	0	0	$0
OAK RIDGE	2005-03-23	1.00 "	0	0	$0
GREENSBORO	2005-03-23	1.75 "	0	0	$0
SEDALIA	2005-09-20	0.75 "	0	0	$0
SUMMERFIELD	2005-10-21	0.75 "	0	0	$0
GREENSBORO	2006-04-03	0.75 "	0	0	$0
GREENSBORO	2006-05-14	0.88 "	0	0	$0
GREENSBORO	2006-05-14	0.88 "	0	0	$0
GIBSONVILLE	2006-05-14	0.88 "	0	0	$0
GREENSBORO	2006-05-14	0.88 "	0	0	$0

Location	Date	Magnitude (in)	Deaths	Injuries	Property Damage*
GREENSBORO	2006-05-14	1.00 "	0	0	$0
GIBSONVILLE	2006-05-14	0.88 "	0	0	$0
GREENSBORO	2006-05-14	1.00 "	0	0	$0
GREENSBORO	2006-05-14	0.88 "	0	0	$0
HIGH PT	2006-05-14	1.00 "	0	0	$0
GREENSBORO	2006-05-14	1.75 "	0	0	$0
GREENSBORO	2006-05-14	1.75 "	0	0	$0
GREENSBORO	2006-05-15	0.75 "	0	0	$0
GREENSBORO	2006-05-26	1.00 "	0	0	$0
HIGH PT	2006-06-08	0.75 "	0	0	$0
GREENSBORO	2006-06-11	0.75 "	0	0	$0
STOKESDALE	2006-06-11	0.75 "	0	0	$0
STOKESDALE	2006-06-11	0.75 "	0	0	$0
GREENSBORO	2006-06-11	1.50 "	0	0	$0
GREENSBORO	2006-06-11	0.75 "	0	0	$0
MC LEANSVILLE	2006-06-23	1.75 "	0	0	$0
GREENSBORO	2006-06-23	0.88 "	0	0	$0
HIGH PT	2006-06-23	0.88 "	0	0	$0
GREENSBORO	2006-06-23	1.00 "	0	0	$0
GREENSBORO	2006-06-23	1.00 "	0	0	$0
GREENSBORO	2006-06-23	0.75 "	0	0	$0
STOKESDALE	2006-07-04	1.00 "	0	0	$0
PLEASANT GARDEN	2006-08-07	0.75 "	0	0	$0
HIGH PT	2006-08-30	1.00 "	0	0	$0
GREENSBORO	2006-08-30	0.75 "	0	0	$0
HIGH PT	2006-08-30	0.75 "	0	0	$0
GREENSBORO	2006-09-28	0.88 "	0	0	$0
STOKESDALE	2006-09-28	0.75 "	0	0	$0
SUMMERFIELD	2006-09-28	0.75 "	0	0	$0
GREENSBORO	2007-04-15	0.88 "	0	0	$0
GREENSBORO	2007-06-27	0.75 "	0	0	$0
GREENSBORO	2007-06-27	0.75 "	0	0	$0
CLIMAX	2008-03-04	0.75 "	0	0	$0
GREENSBORO MAY ARPT	2008-03-04	0.75 "	0	0	$0
COLFAX	2008-03-04	0.75 "	0	0	$0
HIGH PT	2008-04-20	1.00 "	0	0	$0
BROWNS SUMMIT	2008-05-08	0.75 "	0	0	$0
BATTLE GROUND	2008-05-08	1.75 "	0	0	$0
BROWNS SUMMIT	2008-05-09	0.75 "	0	0	$0
SHERWOOD VLG	2008-05-20	0.88 "	0	0	$0

Location	Date	Magnitude (in)	Deaths	Injuries	Property Damage*
BATTLE GROUND	2008-05-31	0.75 "	0	0	$0
SUMMERFIELD	2008-05-31	0.75 "	0	0	$0
BATTLE GROUND	2008-05-31	0.88 "	0	0	$0
GUILFORD	2008-05-31	1.00 "	0	0	$0
BATTLE GROUND	2008-05-31	0.88 "	0	0	$0
PINECROFT	2008-05-31	1.00 "	0	0	$0
BATTLE GROUND	2008-05-31	1.25 "	0	0	$0
BATTLE GROUND	2008-05-31	1.00 "	0	0	$0
GREENSBORO	2008-05-31	1.00 "	0	0	$0
GUILFORD	2008-06-22	0.75 "	0	0	$0
BATTLE GROUND	2008-06-22	0.75 "	0	0	$0
HAMILTON LAKES	2008-06-22	0.88 "	0	0	$0
HAMILTON LAKES	2008-06-22	0.88 "	0	0	$0
WHITSETT	2008-06-22	0.75 "	0	0	$0
PLEASANT GARDEN	2009-05-09	0.88 "	0	0	$0
BATTLE GROUND	2009-06-03	1.00 "	0	0	$0
BROADVIEW	2009-06-03	0.75 "	0	0	$0
BESSEMER	2009-06-03	1.00 "	0	0	$0
CLIMAX	2009-06-09	1.00 "	0	0	$0
OAK RIDGE ARPT	2009-07-20	1.75 "	0	0	$0
HILLSDALE	2009-07-20	0.75 "	0	0	$0
GREENSBORO	2009-08-19	0.75 "	0	0	$0
BROWNS SUMMIT	2010-03-28	1.00 "	0	0	$1,250
DEEP RIVER	2010-05-15	1.00 "	0	0	$0
DEEP RIVER	2010-05-15	1.00 "	0	0	$0
VANDALIA	2010-05-15	1.00 "	0	0	$0
GREENSBORO ARPT	2011-04-27	0.75 "	0	0	$0
HAMILTON LAKES	2011-04-27	0.75 "	0	0	$0
GREENSBORO ARPT	2011-04-27	0.88 "	0	0	$0
BROWNS SUMMIT	2011-06-09	1.50 "	0	0	$0
FOUR MILE	2011-09-27	1.00 "	0	0	$0
GREENSBORO ARPT	2012-03-24	1.00 "	0	0	$0
GROOMTOWN	2012-03-24	1.00 "	0	0	$0
CLIMAX	2012-03-24	1.00 "	0	0	$0
GREENSBORO	2012-06-01	1.75 "	0	0	$0
PINECROFT	2012-06-01	1.00 "	0	0	$0
PLEASANT GARDEN	2013-04-19	1.00 "	0	0	$0
POMONA	2013-06-25	1.75 "	0	0	$500
GROOMTOWN	2014-06-10	1.25 "	0	0	$0
KOONTZVILLE	2014-06-16	1.25 "	0	0	$0
BRIGHTWOOD	2014-06-16	1.75 "	0	0	$0

Location	Date	Magnitude (in)	Deaths	Injuries	Property Damage*
BRIGHTWOOD	2014-06-16	1.25 "	0	0	$0
BRIGHTWOOD	2014-06-16	1.50 "	0	0	$0
BROADVIEW	2014-06-16	1.00 "	0	0	$0
OAK RIDGE ARPT	2015-04-20	1.00 "	0	0	$0
SCALESVILLE	2016-04-28	1.00 "	0	0	$0
GREENSBORO ARPT	2016-05-02	0.88 "	0	0	$0
GUILFORD	2016-05-02	0.88 "	0	0	$0
(GSO)GREENSBORO RGNL	2016-05-02	1.00 "	0	0	$0
GUILFORD	2016-05-02	1.00 "	0	0	$0
GUILQUARRY	2016-05-12	1.00 "	0	0	$0
GUILQUARRY	2016-06-29	1.00 "	0	0	$0
OSCEOLA	2016-09-28	1.00 "	0	0	$0
GREENSBORO	2016-09-28	1.75 "	0	0	$0
SEDALIA	2016-09-28	1.00 "	0	0	$0
SEDALIA	2016-09-28	1.25 "	0	0	$0
CLIMAX	2017-04-06	1.00 "	0	0	$0
GUILFORD	2019-05-31	0.88 "	0	0	$0
(GSO)GREENSBORO RGNL	2019-05-31	1.75 "	0	0	$0
HAMILTON LAKES	2019-05-31	1.25 "	0	0	$0

Source: National Centers for Environmental Information

Lightning

According to the National Centers for Environmental Information, there have been a total of 9 recorded lightning events in Guilford County since 1994[7]. These events resulted in nearly $2.1 million (2019 dollars) in damages, as listed in summary **Table B.17**. Furthermore, lightning caused one injury in the County.

It is certain that more than 9 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.

[7] 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 Guilford County. The State Fire Marshall's office was also contacted for additional information but none could be provided. As additional local data becomes available, this hazard profile will be amended.

TABLE B.17: HISTORICAL LIGHTNING IMPACTS IN GUILFORD COUNTY

Location	Date	Deaths	Injuries	Property Damage*	Details
OAK RIDGE	1997-07-28	0	0	$0	Lightning hit a home in Oak Ridge. No damage details were available
GREENSBORO	2002-03-26	0	0	$220,000	Lightning started a fire that destroyed the third floor of a home
SEDGEFIELD	2002-05-01	0	0	$300,000	A lightning strike started a fire that severely damaged a historic home.
OAK RIDGE	2002-06-26	0	0	$5,000	At least four house fires were started by lightning strikes in the Oak Ridge area.
HIGH PT	2002-07-01	0	0	$7,000	A lightning strike caused minor damage to a public library.
HAMILTON LAKES	2010-06-12	0	0	$1,500,000	Lightning struck a large fuel tank at the Colonial Pipeline gasoline tank farm resulting in a large fire destroying the tank and resulting in the closure of Interstate 40 for four hours. The tank contained 840,00 gallons of gasoline at the time of fire.
(GSO)GREENSBORO RGNL	2010-06-16	0	0	$100,000	Lightning struck the runway of the Piedmont Triad International Airport creating a hole two feet wide and 18 inches deep in the runway.
DEEP RIVER	2010-08-11	0	0	$15,000	A home on Windstream Court in High Point sustained roof damage due to a lightning strike. The damages were estimated.
BESSEMER	2010-08-11	0	0	$400	A lightning strike damaged an outbuilding at 3865 Arbor Drive in Greensboro. The damage was estimated at $300 and the content loss was $100.

Source: National Centers for Environmental Information

B.5.5.3 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 North Carolina A&T experience a direct tornado strike. The probability of future tornado occurrences affecting North Carolina A&T 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 North Carolina A&T 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 Guilford County 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), North Carolina A&T 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 are 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.

B.5.6 SEVERE WINTER WEATHER

B.5.6.1 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. North Carolina A&T 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.

B.5.6.2 Historical Occurrences

Winter weather has resulted in four disaster declarations Guilford County. This includes one severe snowfall and winter storm in 1993, the Blizzard of 1996, one subsequent 1996 winter storm, and a severe winter storm and flooding event in 2010. According to the National Centers for Environmental Information, there have been a total of 43 recorded winter storm events Guilford County since 1996 (**Table B.18**)[8]. These events resulted in $570,000 (2020 dollars) in damages.

TABLE B.18: WINTER STORM EVENTS IN GUILFORD COUNTY

Date	Deaths	Injuries	Property Damage	Description
1997-01-08	0	0	$0	n/a
1997-02-13	0	0	$0	n/a
1997-12-29	0	0	$0	n/a
2000-01-18	0	0	$0	n/a
2000-01-20	0	0	$0	n/a
2000-01-22	0	0	$0	n/a
2000-01-24	0	0	$0	n/a
2000-01-28	0	0	$0	n/a

[8] These ice and winter storm events are only inclusive of those reported by the National Centers for Environmental Information (NCEI). It is likely that additional winter storm conditions have affected Guilford County.

Date	Deaths	Injuries	Property Damage	Description
2001-02-12	0	0	$0	n/a
2002-01-03	0	0	$0	n/a
2002-01-06	0	0	$0	n/a
2002-12-04	0	0	$0	n/a
2003-02-16	0	0	$0	n/a
2003-02-27	0	0	$0	n/a
2003-12-13	0	0	$0	n/a
2004-01-26	0	0	$0	n/a
2004-02-15	0	0	$0	n/a
2004-02-26	0	0	$0	n/a
2005-01-30	0	0	$0	n/a
2005-12-15	0	0	$0	n/a
2007-01-18	0	0	$0	n/a
2007-01-21	0	0	$0	n/a
2007-12-07	1	0	$20,000	Light freezing rain during the early morning hours just prior to sunrise resulted in several automobile accidents from black ice on numerous bridges. A 40-year-old male was killed in a multi vehicle accident on Highway 421 just south of Greensboro. The accident was the result of black ice which formed on an overpass.
2008-01-17	0	0	$0	Between one to two inches of snow accumulated countywide mostly before daybreak.
2008-02-13	0	0	$0	Between one to three inches of snow fell across Guilford County between 6pm and midnight.
2009-01-22	0	0	$0	Between 1 to 2 inches of snow fell across the county resulting in the closing of local schools.
2009-02-03	0	0	$0	Around one inches of snow fell across the county around the time of evening rush hour.
2009-03-01	0	0	$0	Between five to six inches of snow fell countywide. Several automobile accidents were reported the mornings following the storm due to the re-freezing of the melting snow overnight.
2009-12-18	0	0	$0	Between 3 to 7 inches of snow fell across Guilford county and Greensboro and High point. Many primary roads including Highway 220, Highway 311 and western portions Interstate 40 became impassible during the evening. Law enforcement responded to hundreds of automobile accidents.
2009-12-30	0	0	$0	Light freezing rain was reported across the area resulting in a light coating of ice on elevated surfaces such as trees, bushes and power lines. Area roads remained clear.

Date	Deaths	Injuries	Property Damage	Description
2010-01-29	0	0	$0	Between 6 to 8 inches of snow fell across the county. Several vehicle accidents and spotty power outages were reported. Due to the cold temperatures icy road conditions persisted for several days resulting in the closure of schools and businesses.
2010-02-05	0	0	$50,000	Up to three inches of snow fell across portions of the county along with up to a quarter inch of freezing rain. A total of over fifty thousand people were without power in North Carolina. North Carolina Highway Patrol responded to over 725 calls involving vehicle accidents. Numerous trees fell due to the weight of the freezing rain.
2010-02-12	0	0	$0	Around one to two inches of snow fell across the county Friday night and early Saturday.
2010-03-02	0	0	$0	Around 3 to 4 inches of snow fell across the county. Only a few minor vehicle accidents and power outages were reported.
2010-12-04	0	0	$0	Two to three inches of snow fell across the county with the heaviest amounts reports along and north of Interstate 40.
2010-12-16	0	0	$0	A half inch of snow combined with a tenth of an inch of freezing rain to create hazardous driving conditions across the area.
2010-12-25	0	0	$0	Six to eight inches of snow fell countywide including in Greensboro and High Point. Many roads were impassible due to the heavy snow, however, other than a few minor accidents no other problems were reported due to the holiday.
2011-01-10	0	0	$0	Around one inch of snow fell across the area followed by a trace of freezing rain. This resulted in slippery road conditions and a few accidents.
2013-01-17	0	0	$0	Numerous reports of 3 inches of snow accumulation around the central part of the county.
2013-11-26	0	0	$0	Light freezing rain resulted in minor glazing on trees and other elevated surfaces in the area.
2014-01-21	0	0	$0	Snowfall amounts ranged from a dusting across southern portions of the county to near 1 inch across the north.
2014-01-28	0	0	$0	Snowfall averaged 1 to 2 inches across the county.
2014-02-12	0	0	$0	Snow fall averaged 6-8 inches across the county. In addition, ice accrual ranged between 1/10 to 1/4 inch.
2014-03-03	0	0	$0	Snowfall ranged from 1 inch across southern portions of county to as much as 2.0 inches across the north.
2014-03-06	0	0	$0	Snowfall of 3 to 7 inches fell across the county.
2014-03-17	0	0	$0	Ice accretion averaged around a tenth to two tenths of an inch across the county. Also, a few tenths of an inch of snow fell, with an isolated amount of an inch.

Date	Deaths	Injuries	Property Damage	Description
2015-01-13	0	0	$0	A thin glaze of ice was reported on trees and elevated surfaces. Icy bridges and overpasses created difficult travel conditions during the morning on the 14th, with several automobile accidents reported throughout the county.
2015-02-16	0	0	$0	Snowfall amounts 1 to 3 inches fell across the county. In addition, a trace of freezing rain accrual was reported.
2015-02-24	0	0	$0	Snowfall amounts of 1 to 2 inches fell across the county.
2015-02-25	0	0	$500,000	Snowfall/sleet amounts of 5 to 8 inches fell across the county. The heavy wet snow caused extensive power outages from falling trees and power lines.
2015-03-01	0	0	$0	The Piedmont Triad Airport ASOS reported 0.06 inches of freezing rain and similar amounts were reported across the county from other sources.
2016-01-22	0	0	$0	Snowfall/sleet amounts of 3 to 5 inches fell across the county.
2016-02-14	0	0	$0	Snowfall/sleet amounts of 2 to 3 inches fell across the county. In addition, a tenth to two tenths of freezing rain accrual was reported.
2017-01-06	0	0	$0	Snowfall amounts of 7 to 10 inches fell across the county.
2017-12-08	0	0	$0	Snowfall amounts of 3 to 4 inches fell across the county.
2018-01-17	0	0	$0	Six to ten inches of snow fell across the county.
2018-03-12	0	0	$0	Snowfall totals ranged from 1 inch to 5.5 inches across the county. The county average snowfall was approximately 3 inches.
2018-03-21	0	0	$0	One-half inch to one inch of snow fell across northern portions of the county.
2018-03-24	0	0	$0	One to one- and one-half inches of snow fell across northern portions of the county.
2018-12-09	0	0	$0	Snowfall amounts ranged between 10 to 14 inches across the county. One to two tenths of an inch of ice from freezing rain was also reported.
2019-01-12	0	0	$0	One-quarter to one-third of an inch of ice from freezing rain downed numerous trees across the county. At its peak, nearly 20,000 customers in the county were without power.
2019-12-13	0	0	$0	Freezing rain was reported across the county. Freezing rain amounts were less than a tenth of an inch.
2020-02-20	0	0	$0	Snowfall amounts ranged from 1 to 2 inches across the county.

Source: National Centers for Environmental Information

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.

B.5.6.3 Probability of Future Occurrences

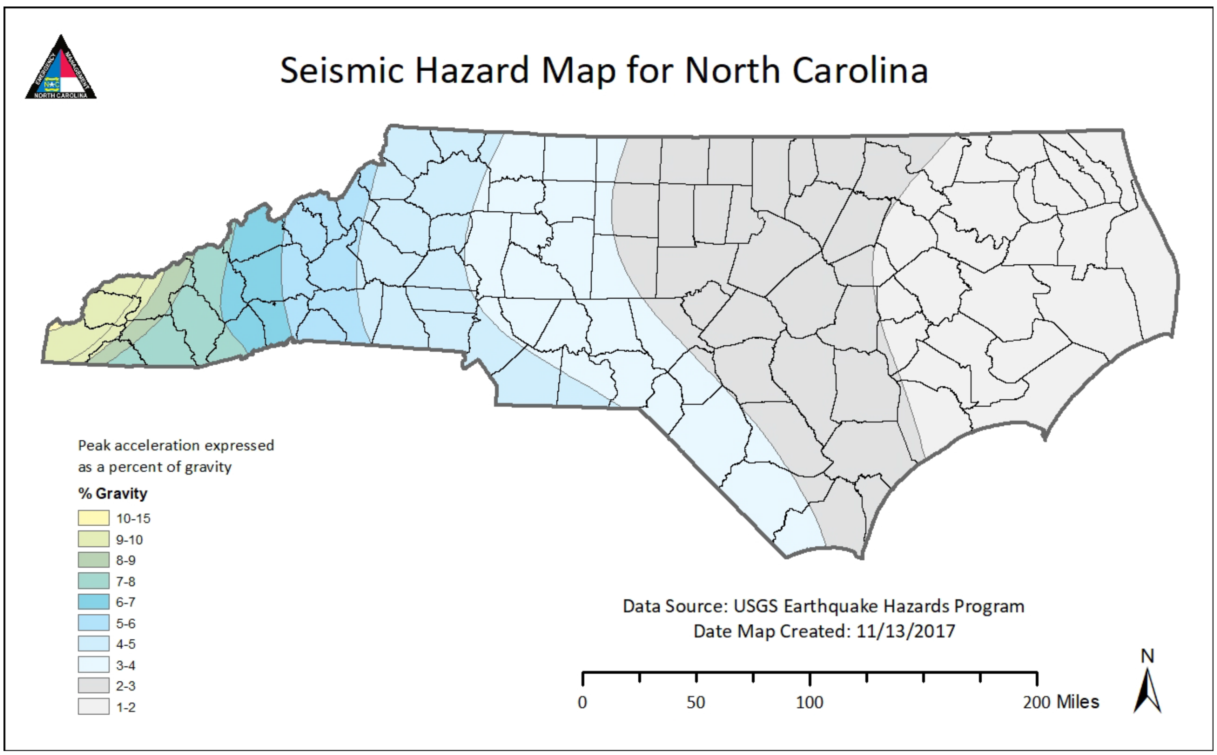
Winter storm events will remain a regular occurrence for NCA&T in the central piedmont region. According to historical information the university often experiences several winter storms events each year. Therefore, the annual probability is likely (10 to 100 percent).

B.5.7 EARTHQUAKES

B.5.7.1 Location and Spatial Extent

Approximately two-thirds of North Carolina is subject to earthquakes, with the western and southeast region most vulnerable to a very damaging earthquake. The state is affected by both the Charleston Fault in South Carolina and New Madrid Fault in Tennessee. Both of these faults have generated earthquakes measuring greater than 8 on the Richter Scale during the last 200 years. In addition, there are several smaller fault lines throughout North Carolina. **Figure B.7** is a map showing geological and seismic information for North Carolina.

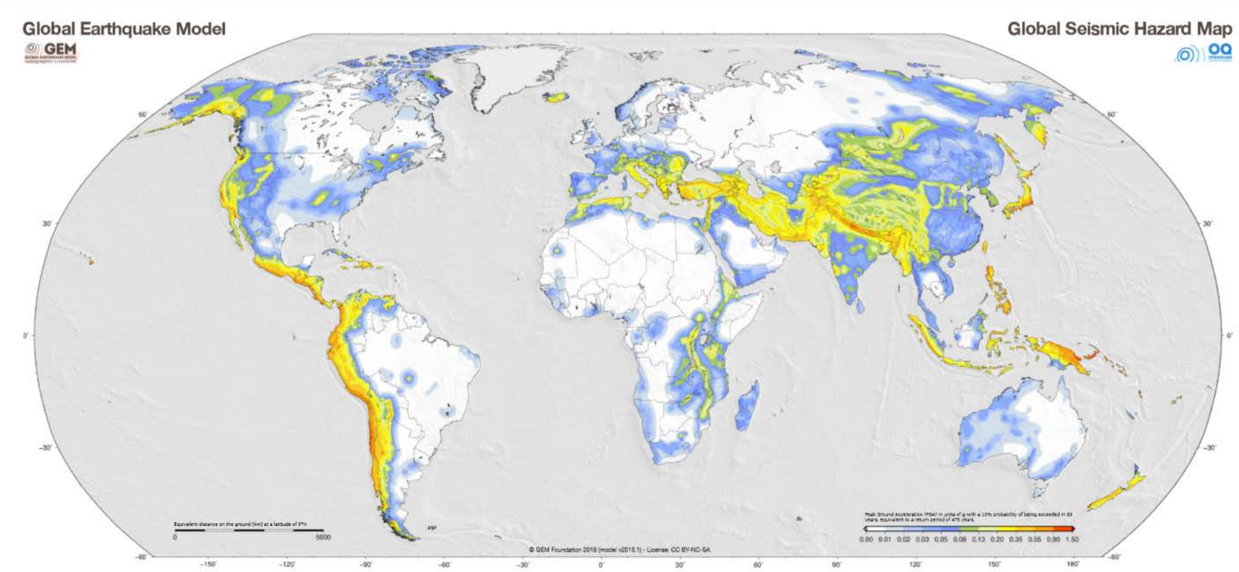
FIGURE B.7: GEOLOGICAL AND SEISMIC INFORMATION FOR NORTH CAROLINA



Source: North Carolina Geological Survey

Figure B.8 shows the intensity level associated with the world 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 campus as a whole exists within an area of moderate seismic risk.

FIGURE B.8: PEAK ACCELERATION WITH 10 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS



Source: Global Earthquake Model, 2018

B.5.7.2 Historical Occurrences

At least 6 earthquakes are known to have affected Guilford County since 1886. The strongest of these measured an IV on the Modified Mercalli Intensity (MMI) scale. **Table B.19** provides a summary of earthquake events reported by the National Geophysical Data Center between 1885 and 1985.

TABLE B.19: EARTHQUAKES IMPACTING GUILFORD COUNTY

Location	Date	Magnitude	MMI
Burlington	2/25/1978	2.2	IV
Greensboro	4/29/1852	unavailable	III
Greensboro	12/23/1875	unavailable	IV
Greensboro	2/21/1916	unavailable	III
Greensboro	3/12/1960	unavailable	IV
Greensboro	11/20/1969	4.3	IV

Source: US Earthquake Intensity Database, NOAA

A list of earthquakes that have caused damage throughout North Carolina is presented below in **Table B.20.**

TABLE B.20: EARTHQUAKES WHICH HAVE CAUSED DAMAGE IN NC

Date	Location	Richter Scale (Magnitude)	MMI (Intensity)	MMI in North Carolina
12/16/1811 - 1	NE Arkansas	8.5	XI	VI
12/16/1811 - 2	NE Arkansas	8.0	X	VI
12/18/1811 - 3	NE Arkansas	8.0	X	VI
01/23/1812	New Madrid, MO	8.4	XI	VI
02/071812	New Madrid, MO	8.7	XII	VI
04/29/1852	Wytheville, VA	5.0	VI	VI
08/31/1861	Wilkesboro, NC	5.1	VII	VII
12/23/1875	Central Virginia	5.0	VII	VI
08/31/1886	Charleston, SC	7.3	X	VII
05/31/1897	Giles County, VA	5.8	VIII	VI
01/01/1913*	Union County, SC	4.8	VII	VI
02/21/1916*	Asheville, NC	5.5	VII	VII
07/08/1926	Mitchell County, NC	5.2	VII	VII
11/03/1928*	Newport, TN	4.5	VI	VI
05/13/1957*	McDowell County, NC	4.1	VI	VI
07/02/1957	Buncombe County, NC	3.7	VI	VI
11/24/1957	Jackson County, NC	4.0	VI	VI
10/27/1959 **	Chesterfield, SC	4.0	VI	VI
07/13/1971	Newry, SC	3.8	VI	VI
11/30/1973*	Alcoa, TN	4.6	VI	VI
11/13/1976	Southwest Virginia	4.1	VI	VI
05/05/1981	Henderson County, NC	3.5	VI	VI
2020	Sparta, NC			

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).

B.5.7.3 Probability of Future Occurrences

The probability of significant, damaging earthquake events affecting the area surrounding North Carolina A&T 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 campus. The annual probability level for the campus 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, and for Guilford County the likelihood was 3-4%.

B.5.8 GEOLOGICAL

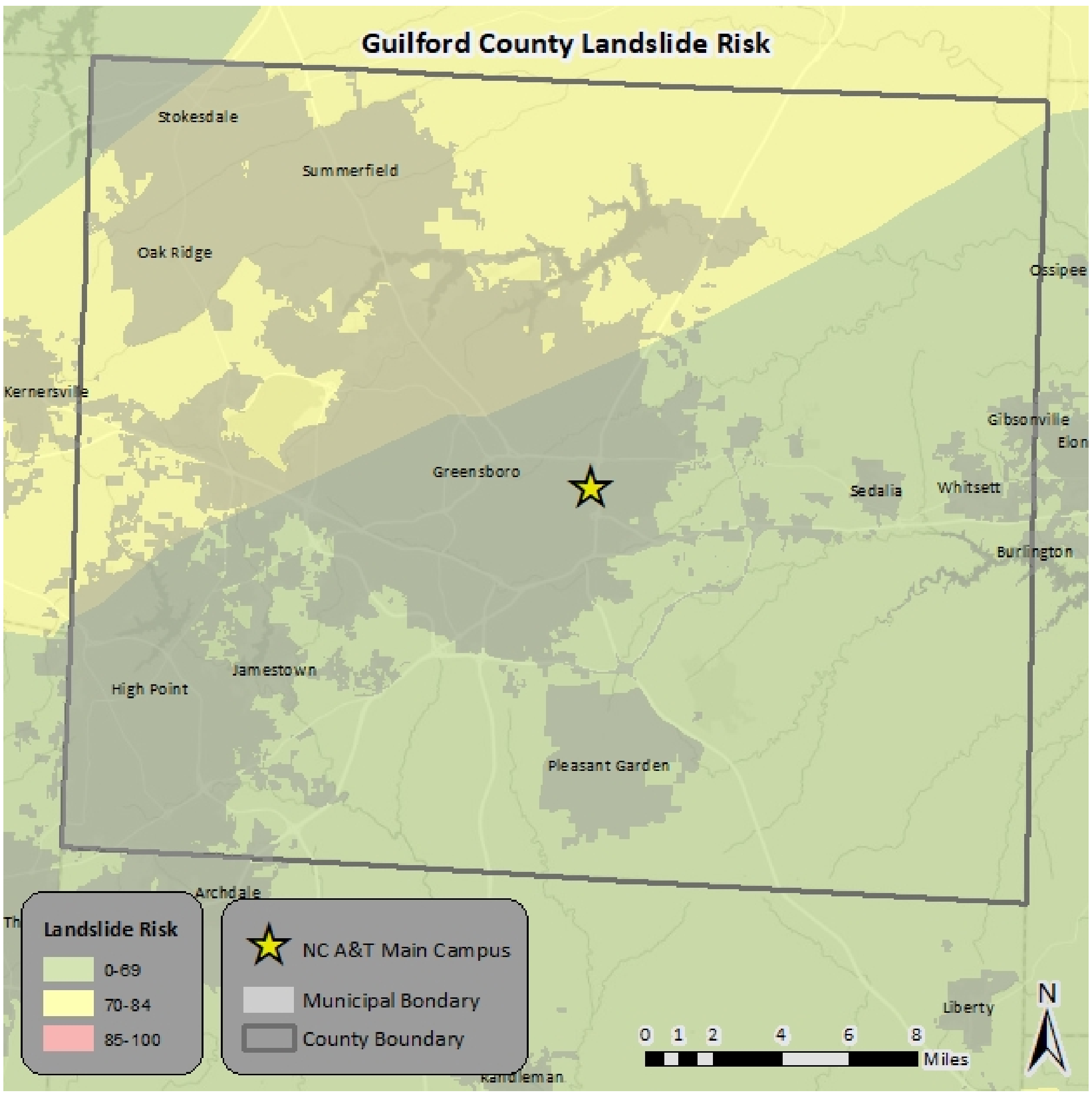
B.5.8.1 Location and Spatial Extent

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.

According to **Figure B.9** below, much of Guilford County, has a low risk to landslides.

FIGURE B.9: LANDSLIDE SUSCEPTIBILITY AND INCIDENCE MAP OF GUILFORD COUNTY

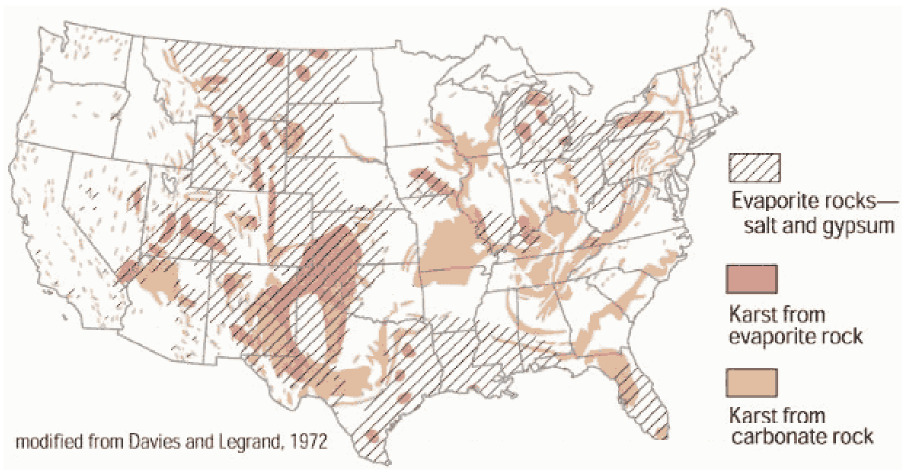


Source: United States Geological Survey

Sinkholes

Figure B.10 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 B.10: UNITED STATES GEOLOGICAL SURVEY OF KARST MODIFIED FROM DAVIES AND LEGRAND, 1972



Erosion

Erosion on the North Carolina A&T campus is typically caused by flash flooding events. Unlike coastal areas, where the soil is mainly composed of fine-grained particles such as sand, Guilford County soils have much greater organic matter content. Furthermore, vegetation also helps to prevent erosion in the area. Erosion can occur on the North Carolina A&T campus, particularly along the banks of rivers and streams, but it is not an extreme threat to any of the buildings on campus. No areas of concern were reported by the Campus Hazard Mitigation Planning Team.

B.5.8.2 Historical Occurrences

Landslides

North Carolina A&T, along with most of Guilford County as a whole, has even topography and is therefore at a low risk for landslide occurrences. There is no record of landslides impacting NCA&T.

Sinkholes

In North Carolina, most sinkholes occur in the southern coastal plain due to the high concentration of limestone. They are fairly uncommon in Guilford County.

Erosion

Most historical occurrences of erosion are seen near the coast of North Carolina, but North Carolina A&T is still susceptible to riverine erosion. Several sources were vetted to identify areas of erosion at North

Carolina A&T. This includes searching local newspapers, interviewing local officials, and reviewing previous hazard mitigation plans. Guilford County have previous mitigation actions that address erosion including bank stabilization and meeting erosion control requirements. Such actions will continue to be implemented as necessary throughout the County. Erosion was not referenced in the previous North Carolina A&T Hazard Mitigation Plan, and there was no recorded history of significant erosion events and it was found to be hazard with a negligible potential impact.

B.5.8.3 Probability of Future Occurrences

Landslides

Based on historical information and the USGS susceptibility index, the probability of future landslide events are 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 of the North Carolina A&T campus 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 in Guilford County. While many sinkholes have been relatively small, it is still unlikely (between 1 and 33.3 percent annual probability) that the campus will continue to be affected in the future.

Erosion

Erosion remains a natural, dynamic, and continuous process for North Carolina A&T, 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*.

B.5.9 DAM FAILURE

B.5.9.1 Location and Spatial Extent

The North Carolina Division of Energy, Mineral and 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 B.21** explains these classifications.

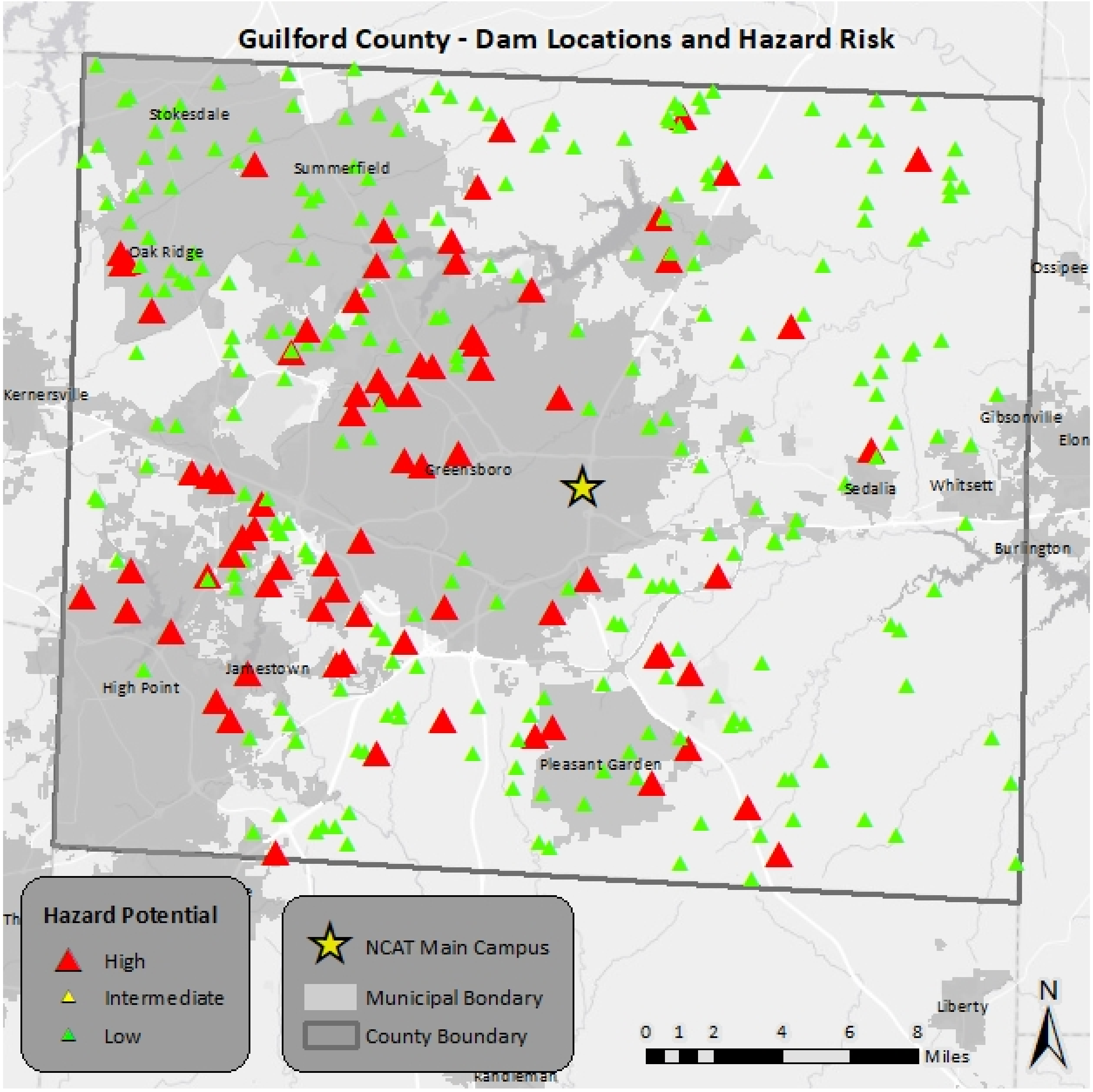
TABLE B.21: NORTH CAROLINA DAM HAZARD CLASSIFICATIONS

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 Management, there are 320 dams in Guilford County. **Figure B.11** shows the dam location and the corresponding hazard ranking for each. Of these dams, 76 are classified as high hazard potential. These high hazard dams are listed in **Table B.22**. According to a consensus of the Campus Hazard Mitigation Planning Team, there is an extremely low possibility that any of these state-recognized dams would cause any damage whatsoever to North Carolina A&T should a dam breach or failure occur, despite the hazard classifications assigned to these dams by the state.

FIGURE B.11: GUILFORD COUNTY DAM LOCATION AND HAZARD RANKING



Source: North Carolina Division of Land Resources

TABLE B.22: GUILFORD COUNTY HIGH HAZARD DAMS

Dam Name	Hazard Potential	Surface Area (acres)	Max Capacity (Ac-ft)	State Regulated?
Guilford County				
Barker-Frazier Excv Inc Dam	High	4.4	45	Y
Blaylock Lake Dam	High	12.0	96	N
Odom Dam	High	3.0	36	N
Smith Dam	High	2.0	12	N
Hutton Dam	High	4.2	37	N
Church of God Of Prophecy Dam	High	2.0	14	Y
Hobbs Lake Dam	High	7.4	69	Y
Ridgewood Farm Dam	High	6.0	37	Y
Hillside Lake Dam	High	10.0	80	N
Ski Lake Dam	High	4.5	45	Y
Hillsdale Lake Dam	High	20.0	200	Y
Lake Higgins Dam	High	226.0	5115	Y
Lake Brandt Dam	High	817.0	18391	Y
Lake Jeanette Dam	High	272.0	8042	N
Richardson Lake Dam	High	16.0	137	N
Cedar Hollow Dam	High	14.5	384	Y
Brooks Lake Dam	High	32.0	346	Y
Lake Townsend Dam	High	1635.0	38285	Y
Lake Herman Dam	High	12.0	120	N
Buckhorn Lake Dam	High	7.0	56	N
Lynwood Lake Dam	High	52.0	857	Y
Aydelette Lake Dam	High	15.0	143	N
Rounda Dam	High	14.0	231	N
Benjamin Dam	High	6.0	80	Y
Lake Hamilton Dam	High	10.7	110	Y
Buffalo Lake Dam	High	76.0	868	N
Jefferson Standard Country Club Dam	High	20.4	231	Y
Friendly Lake Dam	High	8.0	58	Y
Koger Properties Dam	High	6.0	50	Y
Fairfield Lake Dam	High	23.0	276	Y
Adams Lake Dam	High	12.0	96	N
Dogwood Lake Dam	High	8.3	125	Y
Uwharrie Lake Dam	High	15.0	174	Y
Oak Hollow Lake Dam	High	690.0	24500	Y
City Lake Dam	High	287.0	11694	Y
Linthicum Lake Dam	High	6.0	33	N
Wood Lake Dam	High	12.0	90	Y

Dam Name	Hazard Potential	Surface Area (acres)	Max Capacity (Ac-ft)	State Regulated?
Forest Oaks Lake Dam	High	18.0	222	N
Teague Lake Dam	High	8.0	80	Y
Sparger Lake Dam	High	1.5	9	Y
Lower Colonial Dam	High	8.0	64	N
Pilot Life Dam	High	8.0	99	N
Piedmont Centre Dam	High	5.0	50	N
Jamesford Meadows Dam	High	2.8	29	Y
Deep River Pointe-Lower Dam	High	4.5	31	Y
Owens Dam	High	7.2	105	N
Welborn Dam	High	4.2	34	N
Roth Dam	High	8.0	64	N
Gibson Dam	High	3.0	19	N
Guilford Technical Institute Dam	High	2.5	41	N
Lakeview Farm Dam	High	4.4	37	N
Pine Lake Dam	High	1.5	9	N
Pringle Dam	High	3.0	20	N
Northline Corporation Dam	High	7.9	94	Y
Price Dam	High	4.0	32	N
Lake Windemere Dam	High	3.0	31	N
Moose Lodge Dam	High	3.5	38	N
Mallard Dam	High	3.0	27	N
Cathedral of His Glory Dam	High	2.5	19	N
Green Dam	High	4.7	38	Y
Lakota Farm Dam	High	6.4	75	N
Lynco Dam	High	7.0	89	Y
Foster Sikes Dam	High	7.7	89	N
Hagan Stone Park Dam	High	10.0	128	N
John Painter Dam	High	8.0	56	N
Knight Dam	High	2.0	21	Y
Old Deep River Golf Course Dam	High	3.0	20	N
Brookway Dam	High	1.0	6	N
Piedmont Lake Dam	High	9.0	95	Y
Davis Lake Dam	High	23.0	310	Y
Jefferson Square Det. Pond Dam	High	0.5	1	Y
Innkeeper Detention Pond	High	0.2	1	Y
Donald Cox Dam	High	2.0	13	N
Cardinal Lake Dam	High	2.5	19	N
AMP Detention Dam	High	4.0	27	Y
Bridford Apartments Dam	High	2.0	24	Y

Source: North Carolina Division of Land Resources

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

B.5.9.2 Historical Occurrences

According to information from the North Carolina Division of Energy, Mineral and Land Resources, there has only been one dam breached in Guilford County. There are no reports of death, injury, or property damage with any of this event. Further, there are no known levees in Guilford County.

B.5.9.3 Probability of Future Occurrence

Given the current dam inventory and historic data, a dam breech is possible (between 1 and 10 percent annual probability) in the future. However, with regular monitoring, these events can be prevented as has been demonstrated in the past. Inundation by failure of the Phillips Lake Dam would cause catastrophic damage, including loss of life and injuries, especially to those areas located along the Catawba River. In addition to local devastation, the region as a whole would be impacted.

Inventories of statewide dam inundation data is an area that NCEM-RM is currently working hard to improve. At this time, there is geospatial data in final quality control review for 19 dams in North Carolina and that number is expected to increase significantly over the next several years. Additionally,

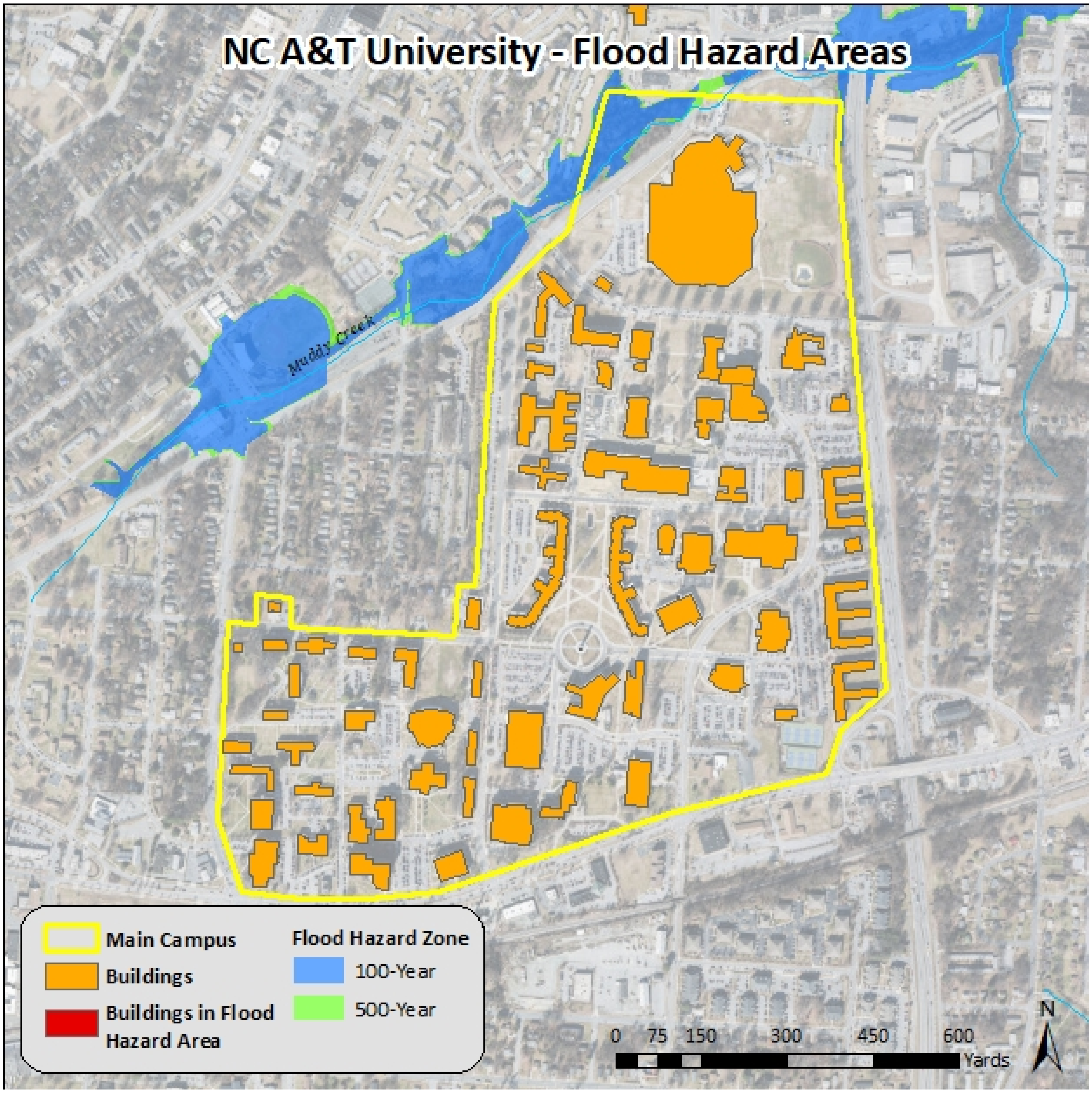
NCEM is currently working with the USACE to acquire inundation data for 9 dams under the Corps' management. As this data becomes available, detailed assessments can be run to better determine vulnerability to dam failures. The 2025 update of this plan may include a much more robust analysis of dam failure vulnerability at the County level.

B.5.10 FLOODING

B.5.10.1 Location and Spatial Extent

There are areas on the North Carolina A&T campus that are susceptible to flooding from Muddy Creek. Special flood hazard areas on the North Carolina A&T campus were mapped using Geographic Information System (GIS) and FEMA Digital Flood Insurance Rate Maps (DFIRM). This includes the 1-percent annual chance floodplain (100-year), and the 0.2-percent annual chance floodplain (500-year). **Figure B.12** illustrates the location and extent of currently mapped special flood hazard areas for the campus based on best available FEMA DFIRM data from October of 2018. It is important to note that while FEMA digital flood data is recognized as best available data for planning purposes, it does not always reflect the most accurate and up-to-date flood risk. Flooding and flood-related losses often do occur outside of delineated special flood hazard areas.

FIGURE B.12: SPECIAL FLOOD HAZARD AREAS ON THE NORTH CAROLINA A&T CAMPUS



Source: Federal Emergency Management Agency

Of the 123 buildings on the main campus, none were found to lie in a special flood hazard area.

B.5.10.2 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 100 events throughout Guilford County since 1996[9]. A summary of major flooding events is presented in **Table B.23**. A summary of flood occurrences in Guilford County are presented in **Table B.24**. These events accounted for over $18.1 million (2020 dollars) in property damage throughout the county.

TABLE B.23: MAJOR FLOOD OCCURRENCES

Area	Date	Type	Property Damage	Crop Damage	Description
High Point	3-Sep-96	Flash Flood	$20,000	$0	A quick five inches of rain in the Triad produced serious street and highway flooding. Several cars were flooded.
Greensboro	17-Aug-03	Flash Flood	$12,000	$0	Numerous roads were flooded around the Piedmont Triad Airport, including New Gordon Road, and Bryant Road. An office was damaged by flooding.
(GSO) Greensboro RGNL	27-Aug-08	Flash Flood	$30,000	$0	Major flooding occurred in portions of Greensboro. Wendover Avenue was closed near Lathan Park and near Bridford Road. The Ashley Creek Apartments along Buffalo Creek experienced flooding and evacuations were necessary. Numerous other roads in the city limits were also closed due to flooding. The remnants of Hurricane Fay which made landfall along the Louisiana coast moved northeast across central North Carolina producing several weak tornadoes along with significant flash flooding.
Greensboro May Arpt	27-Aug-08	Flash Flood	$150,000	$0	Law enforcement reported major flooding over eastern Guilford county. Blakeshire Road was washed out. Numerous other roads were closed due to flooding including Highway 61 near Cone Club Road, Ingle Road, Bethel Church Road and Brightwood Church Road.
Greensboro	3-Jun-09	Flash Flood	$2,000,000	$0	Numerous streets were closed in downtown Greensboro with as many as 50 to 100 water rescues performed, mainly from stalled out vehicles. Multiple buildings were flooded, with at least 10 to 15 on the UNC-Greensboro Campus alone. In addition, as many as two dozen businesses and government buildings were also flooded. One fatality occurred when a woman lost control of a moped and went into a creek. A police officer rescued the woman, only to have her jump back into the creek in an attempt to recover her moped.
Hamilton Lakes	9-Jul-12	Flash Flood	$100,000	$0	Heavy rainfall between 2.5 to 3.0 inches resulted in multiple road closures with 20 to 30 cars flooded on Interstate 40 between High Point Road and Wendover Road. Flood waters also overtook some apartments on Wendover Avenue. Monetary damages were estimated.
Guilford	10-Jul-13	Flash Flood	$50,000	$0	Flooding was reported in the West Wendover area, Big Tree Way, and along Interstate 40. Crews had to rescue cars stalled in high water. Flood waters displaced residents at Westborough Apartment Complex, Colonial Apartments, and Ashley Creek Apartments. Monetary damages were estimated.

[9] These events are only inclusive of those reported by NCEI. It is likely that additional occurrences have occurred and have gone unreported.

Area	Date	Type	Property Damage	Crop Damage	Description
Broadview	21-Jul-13	Flash Flood	$20,000	$0	Flood waters from North Buffalo Creek closed several roads in the area. Latham Park was also closed due to high flood waters from nearby North Buffalo Creek. Flooding was reported near the intersection of North Church Street and East Cone Blvd. There was a water rescue on Green Valley road near Westover Terrace. A car flooded and stuck under Benjamin Parkway at Green Valley. Bryan Blvd was closed at Holden Road with reports of several feet of water on the road.
High Point	29-Sep-15	Flood	$500,000	$0	Numerous roads were closed due to flooding, which includes Elm, Lindsay, Gatewood, Ferndale, Chestnut, Green, Orlando and Ray. Emergency responders performed several water rescues. Water also entered into the basement of several homes. Monetary value of property damage was estimated.
Sedgefield	19-Jun-17	Flash Flood	$5,000	$0	Heavy rainfall resulted in flash flooding in the Greensboro area. Several roads were closed due to flash flooding, including Yanceyville Street at East Cornwallis Drive, South Holden Road at Center Street, East Cone Boulevard between Church Street and Yanceyville Street and on Shelby Drive at Ashebrook Drive. A water rescue was needed when car became stranded in flood waters on McKnight Mill Road in North Greensboro.
Guilquarry	2-Aug-18	Flash Flood	$10,000	$0	A private roadway near Stokesdale was washed out due to flash flooding.
Deep River	2-Aug-18	Flash Flood	$50,000	$0	Flash flooding resulting in the closure of several roads in the city of High Point and surrounding areas. Road closures included Chester Ridge Drive, Skeet Club Road, Piedmont Parkway, and North Main Street.
High Point Midway Arpt	17-Sep-18	Flood	$14,630,000	$5,000,000	Torrential rainfall of 6 to 8 inches caused widespread flooding across the county, which caused moderate flooding along North Buffalo and South Buffalo Creeks, as well as other creeks and streams throughout the county. Flooding damaged approximately 119 structures throughout the county, destroying 7 and resulting in over $14.63 million in property damage. Numerous roads were closed due to flooding. Numerous homes and businesses were flooded as well. While final losses on crops are not yet tallied, estimates around $5 million or more are possible.
Guilquarry	11-Oct-18	Flash Flood	$500,000	$0	Flash flooding from heavy rainfall of 4 to 6 inches closed several roads across the county. The roads include Wendover Avenue near Market Street and Gate City Boulevard near Elm Street. Additionally, North Buffalo Creek and Horsepen Creek both came out of their banks, flooding Rankin Mill Road and US 220, respectively. Also, Horse Pen Creek Road from Jessup Grove Road to Drawbridge Parkway was closed after a section of road washed out.

Area	Date	Type	Property Damage	Crop Damage	Description
Pinecroft	7-Jul-19	Flash Flood	$10,000	$0	Heavy rain from training thunderstorms resulted in flash flooding in downtown Greensboro. Several vehicles became trapped in flood waters and multiple water rescues were performed. Flooded roads included Gate City Boulevard, West Wendover Avenue, and Maplewood Lane near Pinecroft Road. Additionally, Stream gauges along South Buffalo Creek went into flood, indicating the creek overflowing its banks.
Guilford	1-Aug-19	Flash Flood	$10,000	$0	Heavy rain resulted in flash flooding in southwest areas of Greensboro. Several vehicles went under water and a couple of water rescues were needed at West Wendover Avenue and Big Tree Way. Several vehicles were also under water at Guilford College Road and Interstate 73 North. Additionally, South Buffalo Creek near Pomona and Merritt Street rose above flood stage around 9:25 PM and remained in flood until approximately 11:10 PM.
Greensboro	19-Aug-19	Flash Flood	$10,000	$0	Heavy rainfall over the cities of Greensboro and High Point resulted in flash flooding across both cities. Multiple water rescues were performed in High Point near the intersection of North Elm Street and Lindsay Street. Several water rescues were also performed across the city of Greensboro, with the worst flooding along Gate City Boulevard.

Source: National Centers for Environmental Information

TABLE B.24: SUMMARY OF FLOOD OCCURRENCES

Location	Number of Occurrences	Deaths/Injuries	Property Damage (2020)
Archdale	0	0/0	$0
Burlington	0	0/0	$0
Gibsonville	0	0/0	$0
Greensboro	27	0/0	$2,022,000
High Point	10	0/0	$520,000
Jamestown	1	0/0	$0
Kernersville	0	0/0	$0
Oak Ridge	1	0/0	$0
Pleasant Garden	2	0/0	$0
Sedalia	0	0/0	$0
Stokesdale	0	0/0	$0
Summerfield	6	0/0	$0
Whitsett	0	0/0	$0
Unincorporated Areas	53	0/0	$15,565,000
Guilford County Total	**100**	**0/0**	**$18,107,000**

Source: National Environmental Information Center

B.5.10.3 Probability of Future Occurrences

Flood events will remain a threat to North Carolina A&T, 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). It can be inferred from the floodplain location maps, previous occurrences, and repetitive loss properties that risk varies throughout the North Carolina A&T campus.

B.5.11 WILDFIRES

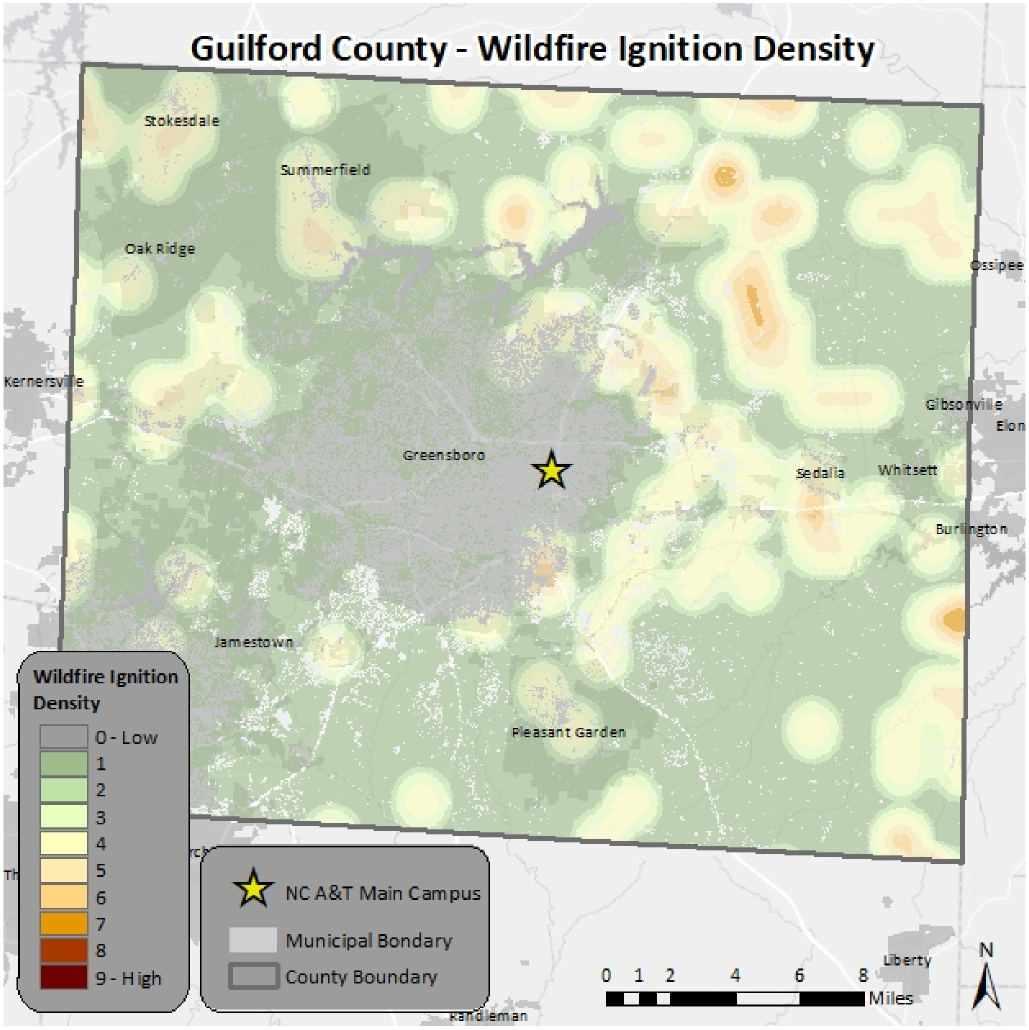
B.5.11.1 Location and Spatial Extent

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

B.5.11.2 Historical Occurrences

Figure B.13 shows the Wildfire Ignition Density in the North Carolina A&T 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 B.13: WILDFIRE IGNITION DENSITY IN GUILFORD COUNTY

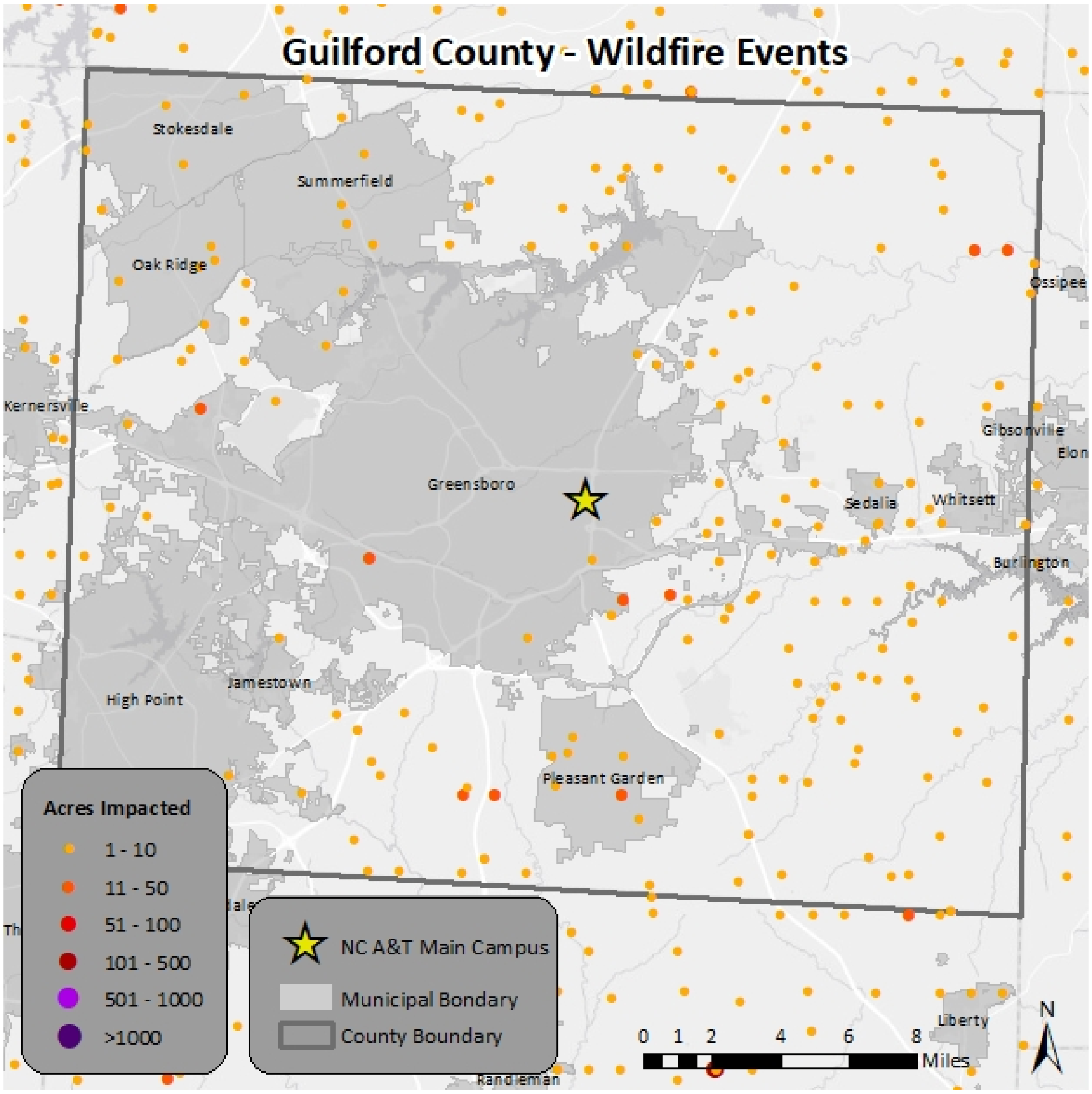


Source: Southern Wildfire Risk Assessment

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 314 events that impacted an area greater than 1 acre have occurred throughout Guilford County since January 27, 2001[10]. **Figure B.14** displays wildfire events in Guilford County.

[10] These events are only exclusive of those reported by NASFI. It is likely that additional occurrences have occurred and have gone unreported.

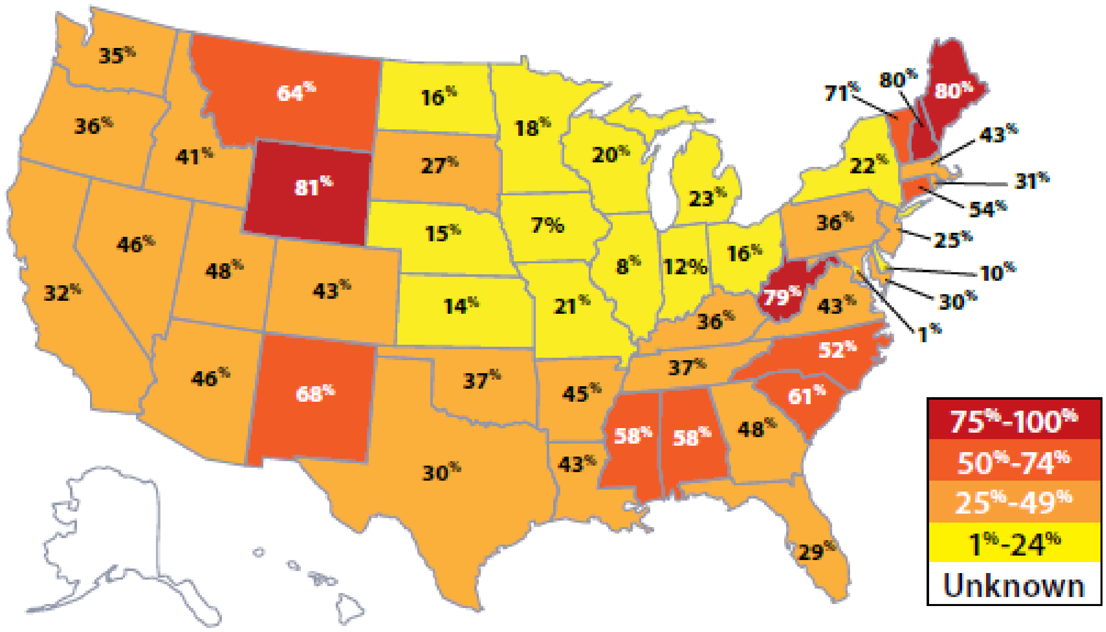
FIGURE B.14: WILDFIRE EVENTS IN GUILFORD COUNTY



Source: NASFI

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 B.15** 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.

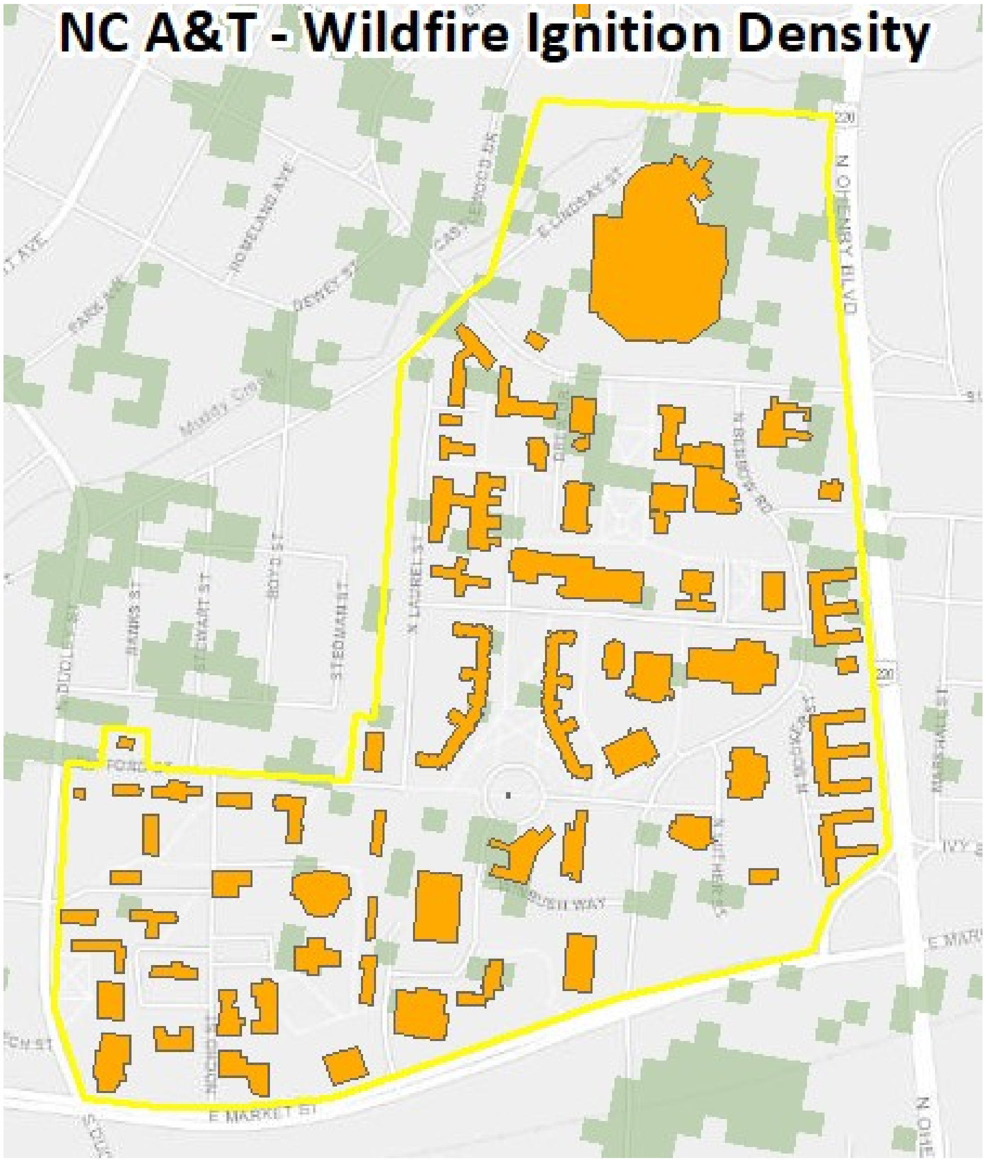
FIGURE B.15: % OF HOMES IN THE WILDLAND URBAN INTERFACE



Source: US Department of Agriculture

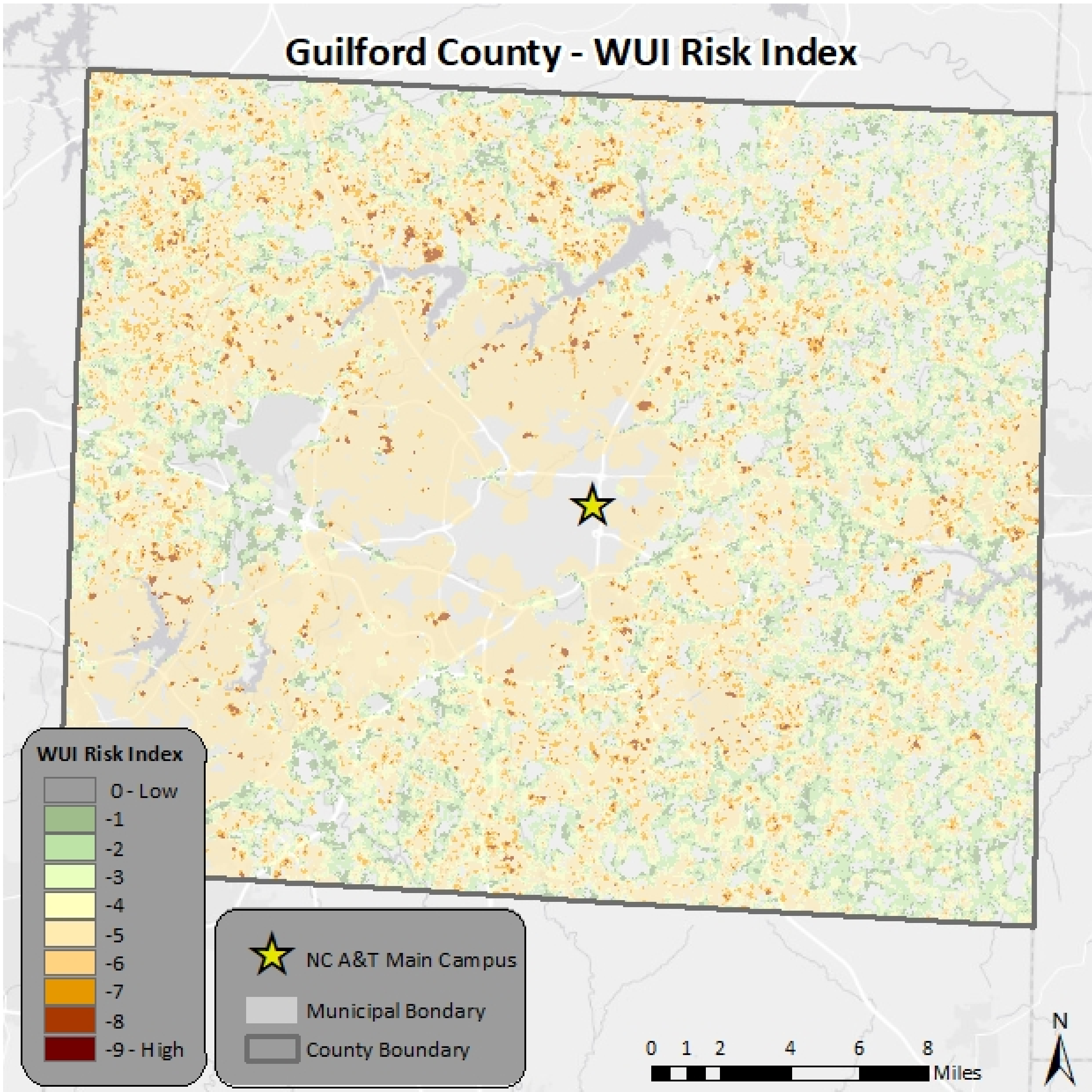
Below, **Figure B.16** displays the Wildfire Ignition Density specifically for North Carolina A&T. **Figure B.17** shows the WUI Risk Index for Guilford County.

FIGURE B.16: NCAT CAMPUS WILDFIRE IGNITION DENSITY



Source: Southern Wildfire Risk Assessment

FIGURE B.17: GUILFORD COUNTY WILDFIRE URBAN INTERFACE RISK INDEX



Based on data from the North Carolina Division of Forest Resources from 2001 to 2018, Guilford County experienced an average of 17 wildfires annually which burn a combined 41 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.

B.5.11.3 Probability of Future Occurrences

Wildfire events will be an ongoing occurrence in the North Carolina A&T. 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 North Carolina A&T for future wildfire events are likely (10 to 100 percent annual probability).

B.5.12 INFECTIOUS DISEASE

B.5.12.1 Location and Spatial Extent

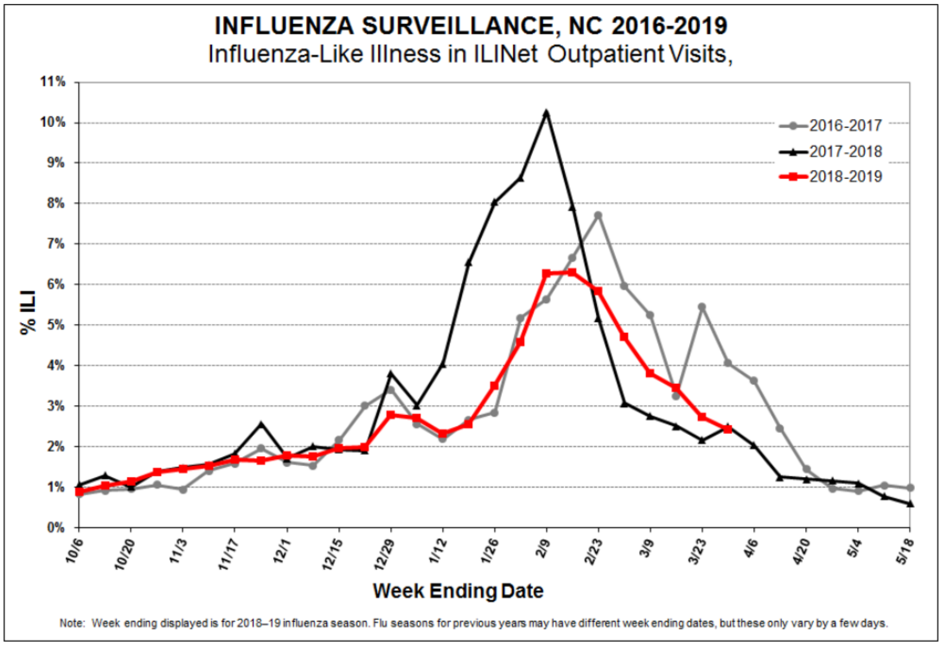
Extent is difficult to measure for an infectious disease event as the extent is largely dependent on the type of disease and on the effect that it has on the population. Extent can be somewhat defined by the number of people impacted, which depending on the type of disease could number in the tens of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

B.5.12.2 Historical Occurrences

Infectious Disease

Influenza is historically the most common infectious disease that has occurred in Guilford County. Cases of the flu tend to occur in the late fall to early winter months. In recent years, cases of the influenza and influenza-like illnesses have been reported in hospitals. As seen in **Figure B.18** below, 172 people throughout North Carolina died from the flu between 2018 and 2019.

FIGURE B.18: 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

Starting in 2020, the COVID-19 infectious disease pandemic began to impact North Carolina and Guilford County. The NC Department of Health and Human Services has been actively monitoring and tracking cases since the first case arrived in the State. A Presidential disaster declaration was declared for North Carolina on March 24, 2020 for the COVID-19 pandemic. **Table B.25** provides a summary of confirmed cases of COVID–19 in Guilford County as of the date of the final version of this plan in 2021. The COVID-19 pandemic is still evolving even though vaccines have been created that are slowing the spread. The pandemic unfolded as this plan was being developed, so the information below presents only a small sample of the pandemic's impacts on Guilford County. On April 27, 2020, the UNC System made the decision to postpone in-person classes for the remainder of the school year. As a result, NCA&T and all other universities in North Carolina, shifted to online courses. Due to Executive Order 135, which extended the existing statewide stay-at-home order through May 8, 2020; college campuses were asked to vacate any on-campus university housing.

TABLE B.25: SUMMARY OF CONFIRMED COVID-19 CASES IN GUILFORD COUNTY

Location	Number of Cases	Number of Deaths*
Guilford County	**47,358**	**701**

Source: North Carolina Department of Health and Human Services as of 5/13/21

** Deaths reflect deaths in persons with laboratory-confirmed COVID-19 reported by local health departments to the 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[11].

B.5.12.3 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 North Carolina A&T will experience an outbreak of infectious diseases in the future.

Technological Hazards

B.5.13 HAZARDOUS SUBSTANCES

B.5.13.1 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 collection information from industrial facilities on the releases and transfers of certain toxic agents. This information is then reported in the Toxic Release Inventory (TRI). TRI sites indicate where such activity is occurring. Guilford County has record of 5,547 Facility Registry Services (HAZMAT) Sites in the County.

B.5.13.2 Historical Occurrences

The U.S. Department of Transportation Pipeline and Hazard 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.

[11] https://www.ncdhhs.gov/news/press-releases/nc-prepared-zika-virus-risk-local-virus-carrying-mosquitoes-low

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.

The Pipeline and Hazardous Materials Safety Administration (PHMSA) is an agency of the United States Department of Transportation that was established in 2004. The PHMSA maintains a database of hazardous materials incidents for communities across the United States. Summary results of their data for events that have occurred in Guilford County can be found in **Table B.26.**

TABLE B.26: SUMMARY OF HAZMAT INCIDENTS IN GUILFORD COUNTY

Location	Incidents Reported	Injuries	Fatalities	Type	Costs
Archdale	0	0	0	N/A	$0
Burlington	3	0	0	Highway	$253,711
Gibsonville	0	0	0	N/A	$0
Greensboro	41	0	1	Highway/Rail	$2,056,977
High Point	3	0	0	Highway	$0
Jamestown	3	0	0	Highway/Rail	$328,600
Kernersville	5	1	0	Highway	$159,163
Oak Ridge	0	0	0	n/a	$0
Pleasant Garden	0	0	0	N/A	$0
Sedalia	0	0	0	N/A	$0
Stokesdale	0	0	0	N/A	$0
Summerfield	0	0	0	N/A	$0
Whitsett	0	0	0	N/A	$0
Unincorporated Areas	0	0	0	n/a	$0
Guilford County Total	**55**	**1**	**1**		**$2,798,451**

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

B.5.13.3 Probability of Future Occurrence

Given the location of toxic release inventory sites in Guilford County, it is possible that a hazardous material incident may occur. University officials are mindful of this possibility and take precautions to prevent such an event from occurring.

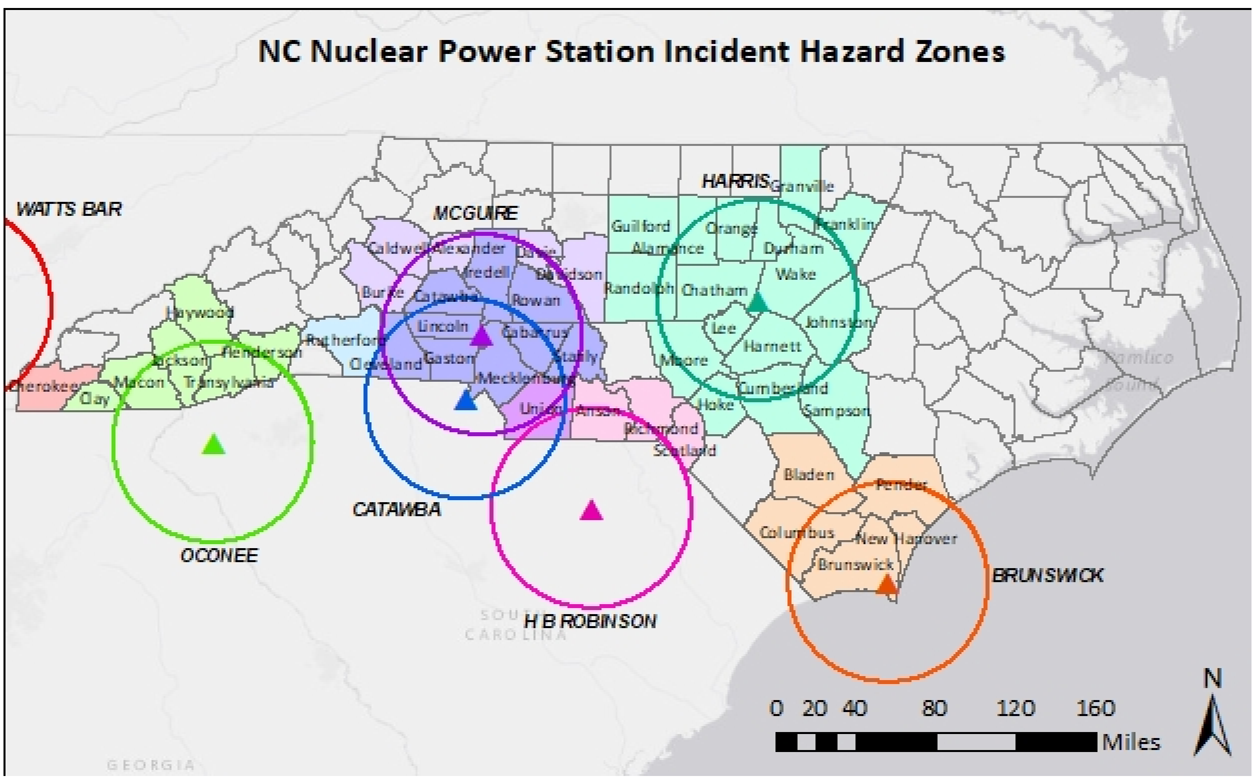
B.5.14 RADIOLOGICAL EMERGENCY – FIXED NUCLEAR FACILITIES

B.5.14.1 Location and Spatial Extent

Guilford County and NC A&T are both at risk to a nuclear accident. However, areas in the Southeast of Guilford County are the only areas that fall within a 50-mile radius of a fixed nuclear facility. 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 miles 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.

The southeastern section of Guilford county only falls within the 50-mile radius of Sharon Harris Nuclear station, as seen in **Figure B.19** below.

FIGURE B.19: NORTH CAROLINA NUCLEAR POWER STATIONS AND INCIDENT HAZARD ZONES



Source: International Atomic Energy Agency

B.5.14.2 Historical Occurrences

Although there have been no major nuclear events at Sharron Harris Nuclear Plant, 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.

B.5.14.3 Probability of Future Occurrences

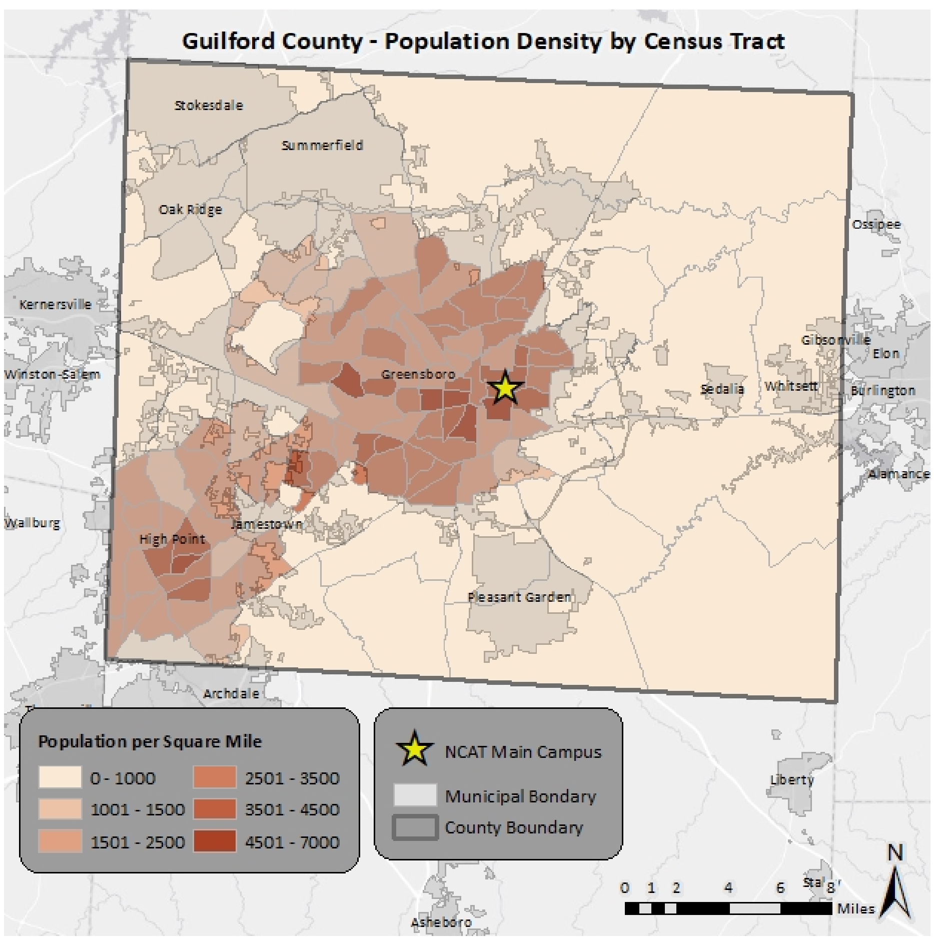
A nuclear event is a very rare occurrence in the United States due to the intense regulation of the industry. There have been incidents in the past, but it is considered unlikely (less than 1 percent annual probability).

B.5.15 TERRORISM

B.5.15.1 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 B.20** displays the population density in Guilford County using census tract levels.

FIGURE B.20: POPULATION DENSITY MAP



Source: US Census Bureau

Furthermore, the most recent population counts of each participating county and jurisdictions can be seen in **Table B.21** below.

TABLE B.21: 2018 POPULATION ESTIMATES FOR GUILFORD COUNTY

Location	2018 Population Estimate
Archdale	11,415
Burlington	49,963
Gibsonville	6,410
Greensboro	269,666
High Point	104,371
Jamestown	3,382
Kernersville	23,123
Oak Ridge	6,185
Pleasant Garden	4,907
Sedalia	678
Stokesdale	5,458
Summerfield	11,278
Whitsett	628
North Carolina A&T	12,142
Unincorporated Areas	39,710
Guilford County Total	**537,174**

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

B.5.15.2 Historical Occurrences

No extreme cases of terror attacks have previously affected Guilford County or North Carolina A&T. However, as the population in the area continues to increase, so does the chance of an attack.

B.5.15.3 Probability of Future Occurrence

Neither Guilford County nor North Carolina A&T have experienced a 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.

B.5.16 CYBER

B.5.16.1 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. North Carolina A&T is susceptible to cyber-attacks.

B.5.16.2 Historical Occurrences

In North Carolina, 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. **Table B.22** displays the North Carolina Cybercrimes and Victim Counts in 2018.

TABLE B.22: NORTH CAROLINA CYBERCRIMES AND VICTIM COUNTS IN 2018

Crime Type by Victim Count			
Crime Type	*Victim Count*	*Crime Type*	*Victim Count*
Advanced Fee	436	Identity Theft	330
BEC/EAC	430	Investment	47
Charity	11	Lottery/Sweepstakes/Inheritance	213
Civil Matter	15	Malware/Scareware/Virus	49
Confidence Fraud/Romance	432	Misrepresentation	148
Corporate Data Breach	39	No Lead Value	246
Credit Card Fraud	306	Non-payment/Non-Delivery	1,647
Crimes Against Children	28	Other	172
Denial of Service/TDos	28	Overpayment	406
Employment	391	Personal Data Breach	1,125
Extortion	1,219	Phishing/Vishing/Smishing/Pharming	947
Gambling	4	Ransomware	29
Government Impersonation	255	Re-shipping	31
Hacktivist	2	Real Estate/Rental	286
Harassment/Threats of Violence	330	Spoofing	430
Health Care Related	9	Tech Support	361
IPR/Copyright and Counterfeit	30	Terrorism	2
Descriptors*			
Social Media	902	Virtual Currency	790

Source: FBI Internet Crime Compliant Center, 2018

B.5.16.3 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 at North Carolina A&T, and it is considered likely (between 10 and 100 percent annual probability) to experience one in the near future.

B.5.17 ELECTROMAGNETIC PULSE

B.5.17.1 Location and Spatial Extent

An EMP can happen in any location, and they are relatively unpredictable. Due to advancing technologies, densely populated areas may be more prone to damages from an EMP. Therefore, Greensboro and the North Carolina A&T campus may be more susceptible.

B.5.17.2 Historical Occurrences

There have been no reports of EMP occurrences at North Carolina A&T.

B.5.17.3 Probability of Future Occurrences

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

B.5.18 CONCLUSIONS ON HAZARD RISK

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

B.5.18.1 Hazard Extent

Table B.29 describes the extent of each natural hazard identified for North Carolina A&T. The extent of a hazard is defined as its severity or magnitude, as it relates to the planning area.

TABLE B.29 EXTENT OF NORTH CAROLINA A&T 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. According to the North Carolina Drought Monitor Classifications, the most severe drought condition is Exceptional. Guilford County has received this ranking (three times) over the nineteen-year reporting period (2000-2019).
Excessive Heat	The extent of excessive heat can be defined by the maximum temperature reached. The highest temperature recorded in Guilford County is 106 degrees Fahrenheit (reported on July 26, 1926).
Hurricane and Coastal Hazards	Hurricane extent is defined by the Saffir-Simpson Scale which classifies hurricanes into Category 1 through Category 5. The greatest classification of hurricane to traverse directly through Guilford County was an unnamed Tropical Storm in 1893 which carried tropical force winds of 65 knots upon arrival.

Tornadoes/Thunderstorms	Tornadoes: Tornado hazard extent is measured by tornado occurrences in the US provided by FEMA as well as the Fujita/Enhanced Fujita Scale. The greatest magnitude reported in Guilford County was an F2 (reported in June 16, 1954). Thunderstorms: Thunderstorm extent is defined by the number of thunder events and wind speeds reported. According to a 64-year history from the National Centers for Environmental Information, the strongest recorded wind event in Guilford County was reported on July 15, 1976 at 84 knots (approximately 96 mph). It should be noted that future events may exceed these historical occurrences. Lightning: According to the Vaisala flash density map, North Carolina A&T 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. Hailstorms: Hail extent can be defined by the size of the hail stone. The largest hail stone reported in Guilford County was 2.75 inches (reported on April 2, 1983). It should be noted that future events may exceed this.
Severe Winter Weather	The extent of winter storms can be measured by the amount of snowfall received (in inches). The greatest 24-hour snowfall was reported in Guilford County was 20 inches reported on March 2, 1927.
Earthquakes	Earthquake extent can be measured by the Richter Scale and the Modified Mercalli Intensity (MMI) scale and the distance of the epicenter North Carolina A&T. According to data provided by the National Geophysical Data Center, the greatest MMI to impact Guilford County was IV (strong) with a correlating Richter Scale measurement of approximately 4.3 (reported on November 20, 1969). The epicenter of this earthquake was located between 236 and 284 km away.
Geological	Landslide: As noted above in the landslide profile, the landslide data provided by the North Carolina Geological survey is incomplete. This provides a challenge when trying to determine an accurate extent for the landslide hazard. However, when using the USGS landslide susceptibility index, extent can be measured with incidence, which is low throughout most of Guilford County. There is also at least moderate susceptibility throughout a majority of the region. Sinkhole: The central piedmont part of North Carolina and North Carolina A&T have a moderate susceptibility to sinkholes; however, there are no historical records of sinkholes in Guilford County.

<table>
<tr><td></td><td><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 Guilford County or North Carolina A&T.</td></tr>
<tr><td>Dam Failure</td><td>Dam failure extent is defined using the North Carolina Division of Land Resources criteria. Of the 320 dams in Guilford County, 76 are classified as high-hazard.</td></tr>
<tr><td>Flooding</td><td>Flood extent can be measured by the amount of land and property in the floodplain as well as flood height and velocity. Flood depth and velocity are recorded via United States Geological Survey stream gages throughout the region. While a gauge does not exist on North Carolina A&T's campus, there is one at or near many areas. The greatest peak discharge recorded for the area was reported on September 22, 1979. Water reached a discharge of 9,140 cubic feet per second and the stream gage height was recorded at 20.12 feet. Additional peak discharge readings and gage heights are in the table below.
<table>
<tr><th>Location/Jurisdiction</th><th>Date</th><th>Peak Discharge (cfs)</th><th>Gage Height (ft)</th></tr>
<tr><td>Guilford County</td><td></td><td></td><td></td></tr>
<tr><td>North Buffalo Creek Near Greensboro, NC</td><td>February 28, 1929</td><td>9,140</td><td>20.12</td></tr>
</table></td></tr>
<tr><th colspan="2">Other Hazards</th></tr>
<tr><td>Wildfires</td><td>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 Guilford County.

The greatest number of fires to occur in any year was 37 in 2011.
The greatest number of acres in a single year occurred in 2007 when 108 acres were burned.
The largest acres burned in a single incidence occurred on June 26, 2007 when 40 acres were burned.

Although this data lists the extent that has occurred, larger more frequent wildfires are possible throughout Guilford County.</td></tr>
<tr><td>Infectious Disease</td><td>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 North Carolina A&T is susceptible to infectious diseases such as the flu, which kills hundreds of people annually.

As of November 1, 2020, the number of COVID-19 cases in Guilford County was 12,027 and the number of deaths related to COVID-19 was 210. On April 27, 2020, the UNC System made the decision to postpone in-person classes for the remainder of the school year. As a result, NCAT and all other</td></tr>
</table>

	universities in North Carolina, shifted on online classes. There is no tangible way of determining dollar losses due to the pandemic in Guilford County.
Technological Hazards	
Hazardous Materials Incident	According to USDOT PHMSA, the largest hazardous materials incident reported in Guilford County is 100 LGA released on the highway on March 27, 1976. It should be noted that larger events are possible.
Radiological Emergency – Fixed Nuclear Facilities	Although there is no history of a nuclear accident at the Sharron Harris Nuclear Stations, other events across the globe and in the United States in particular indicate that 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 Sharron Harris is possible.
Terrorism	Although no severe terrorism attacks have been reported at North Carolina A&T, the entire campus 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 for North Carolina A&T. Technology usage, however, is increasing. A cyber-attack could potentially devastate the campus and could have lasting negative impacts.
Electromagnetic Pulse	Electromagnetic Pulse (EMP) occurrences have not taken place at North Carolina A&T, 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.

B.5.18.2 Priority Risk Index

In order to draw some meaningful planning conclusions on hazard risk for North Carolina A&T, the results of the hazard profiling process were used to generate hazard classifications according to a "Priority Risk Index" (PRI). The purpose of the PRI is to categorize and prioritize all potential hazards for North Carolina A&T 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 North Carolina A&T to consider as part of their proposed mitigation strategy.

The prioritization and categorization of identified hazards for North Carolina A&T 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 North Carolina A&T Campus Hazard Mitigation Planning Team in gaining consensus on the determination of those hazards that pose the most significant threat to the campus 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 at North Carolina A&T 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[12], as summarized in **Table B.30**. 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:

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

According to the weighting scheme and point system applied, the highest possible value for any hazard is 4.0. When the scheme is applied for North Carolina A&T, the highest PRI value is 3.3 (Severe Winter Weather). Prior to being finalized, PRI values for each identified hazard were reviewed and accepted by the members of the North Carolina A&T Campus Hazard Mitigation Planning Team.

TABLE B.30: PRIORITY RISK INDEX FOR THE NORTH CAROLINA A&T

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	3	

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

PRI Category	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
		facilities for more than one week.		
	Catastrophic	High number of deaths/injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for 30 days or more.	4	
Spatial Extent	Negligible	Less than 1% of area affected	1	20%
	Small	Between 1 and 10% of area affected	2	
	Moderate	Between 10 and 50% of area affected	3	
	Large	Between 50 and 100% of area affected	4	
Warning Time	More than 24 hours	Self-explanatory	1	10%
	12 to 24 hours	Self-explanatory	2	
	6 to 12 hours	Self-explanatory	3	
	Less than 6 hours	Self-explanatory	4	
Duration	Less than 6 hours	Self-explanatory	1	10%
	Less than 24 hours	Self-explanatory	2	
	Less than one week	Self-explanatory	3	
	More than one week	Self-explanatory	4	

B.5.18.3 Priority Risk Index Results

Table B.31 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 Campus Hazard Mitigation Planning Team. The results were then used in calculating PRI values and making final determinations for the risk assessment.

TABLE B.31: SUMMARY OF PRI RESULTS FOR THE NORTH CAROLINA A&T

Hazard	Sub hazard(s) Assessed	Category/Degree of Risk					
		Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Natural Hazards							
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		Likely	Limited	Large	More than 24 hours	Less than 24 hours	2.3
Tornadoes/ Thunderstorms	Hailstorm, Lightning	Highly Likely	Critical	Moderate	Less than 6 hours	Less than 6 hours	3.2
Severe Winter Weather		High Likely	Critical	Large	More than 24 hours	Less than one week	3.3
Earthquakes		Possible	Minor	Moderate	Less than 6 hours	Less than 6 hours	2
Geological	Landslide, Sinkholes, Erosion	Possible	Limited	Small	Less than 6 hours	Less than 6 hours	2.3
Dam Failure		Unlikely	Critical	Moderate	More than 24 hours	Less than 6 hours	2
Flooding		Likely	Limited	Moderate	6 to 12 hours	Less than 24 hours	2.6
Other Hazards							
Wildfires		Likely	Minor	Small	Less than 6 hours	Less than 1 week	2.3
Infectious Disease		Possible	Critical	Negligible	Less than 6 hours	Less than 1 week	2.4
Technological Hazards							
Hazardous Substances		Unlikely	Limited	Small	Less than 6 hours	Less than 24 hours	1.9
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

B.5.19 FINAL DETERMINATIONS

The conclusions drawn from the hazard profiling process for North Carolina A&T, including the PRI results and input from the Campus 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 at North Carolina A&T. It should be noted that although some hazards are classified below as posing low risk, their occurrence of varying or unprecedented magnitudes is still possible in some cases and their assigned classification will continue to be evaluated during future plan updates.

Table B.32 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 North Carolina A&T Campus Hazard Mitigation Planning Team.

TABLE B.32: 2020 CONCLUSIONS ON HAZARD RISK FOR NORTH CAROLINA A&T

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

B.6 Capability Assessment

The purpose of conducting a capability assessment for an institution of higher learning is to determine the ability of the institution to implement a comprehensive mitigation strategy and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs, or projects[13]. 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 the university's regulatory framework, level of administrative and technical support, access to fiscal resources, and current political climate.

A capability assessment is generally based upon two primary components: 1) an inventory of the university's relevant plans, programs and policies already in place and 2) an analysis of the university's capacity to carry them out. Careful examination of campus capabilities will detect any existing gaps, shortfalls, or weaknesses with ongoing 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 university, which should continue to be supported and enhanced through future mitigation efforts.

The capability assessment completed for NCA&T 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.

Capability Assessment Findings and Conclusion

Collectively, NCAT's administrative, technical and fiscal capabilities are high. NCA&T's high capability will help ensure that the Mitigation Strategy is effectively carried out and that hazard risk reduction for the campus is an attainable goal. 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 Campus Hazard Mitigation Planning Committee considered not only their level of hazard risk, but also their existing capability to minimize or eliminate that risk.

[13] While the Final Rule for implementing the Disaster Mitigation Act of 2000 does not require a local capability assessment to be completed for hazard mitigation plans, it is a critical step in developing a mitigation strategy that meets the needs of the campus while taking into account their own unique abilities. The Rule does state that a 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)).

B.7 Mitigation Strategy

The Mitigation Action Plan, or MAP, provides a functional plan of action for each building at the North Carolina A&T State University. It is designed to achieve the mitigation goals established in Section 4 of the main plan, Mitigation Strategy, and will be maintained on a regular basis according to the plan maintenance procedures established in Section 5 of the main plan, Plan Maintenance.

Each proposed mitigation action has been identified as an effective measure (policy or project) to reduce hazard risk to the buildings on NCA&T's campus. 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's 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. 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.

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 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.
- Relative Cost
- Identification of University Department Responsible for each action
- Implementation Schedule—Date by which the action should be completed. More information is provided when possible.
- Implementation Status (2021)—Indication of completion, progress, deferment, or no change since the previous plan. If the action is new, that will be noted here.

All of the mitigation actions in this section have been assigned to Emergency Management and Facilities staff to ensure their implementation. Other University Departments will be consulted for input on an as-needed basis.

For the update of this plan, the NCA&T Campus Hazard Mitigation Planning Team participated in three activities related to the mitigation strategy for the university. Those activities included the following:

1. Review and reapproval of previous mitigation goals for the UNC Western Campuses. All eight of the campuses in the Western region decided to leave the previous mitigation goals in place and unchanged.
2. Review and update of existing mitigation actions. The Campus Hazard Mitigation Planning Team reviewed each existing action to determine if it was still relevant, if the prioritization of the action remained the same and to provide an update on the status of implementation for the actions.
3. Identification of any new mitigation actions as determined necessary. The Campus Hazard Mitigation Team identified several new actions for inclusion in the plan. New mitigation actions for this update are marked as such in the Mitigation Action Plan.

The Mitigation Action Plan for NCAT is found on the following pages.

Campus wide Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Emergency Services							
CW-ES-1	Evaluate and enhance campus wide mass notification capabilities	All Hazards	Moderate	Unknown	Emergency Management, Facilities	2026	New action for the 2021 plan update
CW-ES-2	Provide additional preparedness training campus wide	All Hazards	Moderate	Unknown	Emergency Management, Facilities	2026	New action for the 2021 plan update
CW-ES-3	Evaluate and enhance campus wide emergency phone system	All Hazards	Moderate	Unknown	Emergency Management, Facilities	2026	New action for the 2021 plan update
CW-ES-4	Evaluate and enhance campus emergency operations center capabilities and locations	All Hazards	Moderate	Unknown	Emergency Management, Facilities	2026	New action for the 2021 plan update
Property Protection							
CW-PP-1	As feasible and as funding is available, install generators/back-up power, for critical facilities campus wide	All Hazards	Moderate	$25,000-$100,000 per generator	Emergency Management, Facilities	2026	New action for the 2021 update.

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
	Public Education and Awareness						
CW-PEA-1	Provide additional preparedness training campus wide	All Hazards	Moderate	Unknown	Emergency Management, Facilities	2026	New action for the 2021 plan update
CW-PEA-2	Update campus wide Building Emergency Plans and continued program training	All Hazards	Moderate	Unknown	Emergency Management, Facilities	2026	New action for the 2021 plan update

Aggie Village #3 Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Property Protection							
AV3-PP-1	Anchor life safety generator and all vital equipment to its foundation in compliance with building code. Also clear debris away from foundation preventing moisture from speeding the corrosion process.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms, Severe Winter Weather	High	None	Emergency Management, Facilities	Completed	Action completed. The generator is anchored and the debris has been cleared
AV3-PP-2	Remove previous roof flashing and correctly reinstall to prevent water intrusion.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms, Severe Winter Weather	High	None	Emergency Management, Facilities	Completed	Action completed. Roof flashing has been removed.
AV3-PP-3	Replace foam caulking between metal panels where needed.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms, Severe Winter Weather	Low	NA	Emergency Management, Facilities	Action to be deleted.	Action to be deleted because the current university staff are unsure of where the original plan writers intended for this to occur. No such problems found by the current staff.
Emergency Services							
AV3-ES-1	Install larger emergency generator capable of providing a minimum level of cold weather environmental control.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms, Severe Winter Weather	Low	NA	Emergency Management, Facilities	Action to be deleted.	Action to be deleted. Installed battery emergency lighting. Generator not sufficient to complete onsite.

Carver Hall Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Emergency Services							
CH-P-1	Install an emergency generator	All Hazards	High	TBD	Emergency Management, Facilities	2026	New action for the 2021 plan update

Corbett Sports Center Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Prevention							
CSC-P-1	Install an emergency generator capable of providing an acceptable level of climate control in the event of a power outage.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms, Severe Winter Weather	Low	NA	Emergency Management, Facilities	Action completed	Action completed. Generator installed for emergency lighting.
CSC-P-2	Remove loose debris from the roof to protect pedestrians from airborne debris.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms	Moderate	NA	Emergency Management, Facilities	Action completed	Action completed. Loose debris removed/secured.
Property Protection							
CSC-PP-1	Anchor mechanical equipment to the foundation in compliance with the building code.	Hurricane and Coastal Hazards Tornadoes/Thunderstorms, Earthquake	Low	NA	Emergency Management, Facilities	Action completed	Action completed. Mechanical equipment anchored.
CSC-PP-2	Anchor loose cable on the roof deck to prevent wind damage.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms	Low	NA	Emergency Management, Facilities	Action completed	Action completed. Loose cables anchored.
CSC-PP-3	Repair structural concrete that has deteriorated and re-seal pool to prevent further reinforcing damage.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms, Severe Winter Weather	Moderate	$25,000 - $100,000	Emergency Management, Facilities	2022	Partially repaired/under design for complete renovation for full operational capacity in 2022

DeHuguley Building Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Prevention							
DHB-P-1	Correctly anchor the diesel storage tank, used oil tank, air compressor, HVAC compressor, and other vital equipment to the foundation in compliance with the building code.	Hurricane and Coastal Hazards, Earthquake	Moderate	$5,000 - $25,000	Emergency Management, Facilities	2021	Plans in place to complete in Summer 2021
DHB-P-2	Anchor stacked flammable storage lockers to the wall to prevent crushing injury. The shelving in the storage room should be braced together to prevent toppling.	Earthquake	Moderate	NA	Emergency Management, Facilities	Action completed	Action completed. Storage lockers anchored.
DHB-P-3	Have structural engineer determine if the loose column in the courtyard is necessary for structural integrity. If it is necessary it should be attached to the structure.	Earthquake, Hurricane and Coastal Hazards, Tornadoes/Thunderstorms	Low	Unknown	Emergency Management, Facilities	Action to be deleted.	Action to be deleted. Unable to complete due to lack of information. Current university staff is unsure what column the previous plan authors had in mind for this action.
DHB-P-4	Remove tree adjacent to the emergency generator to prevent damage from falling limbs and also to prevent the possibility of fire from hot exhaust gases igniting leaves.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms, Severe Winter Weather, Wildfire	Moderate	NA	Emergency Management, Facilities	Action completed.	Action completed. Tree removed.

Electric Switching Station Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Prevention							
ESS-P-1	Maintain spare parts for switches to reduce the length of service disruptions in the event of a switch failure.	All	Low	NA	Emergency Management, Facilities	Action completed.	Action completed. Spare parts restocked.
ESS-P-2	Replace roof and add an additional drain or scuppers to reduce the possibility of damage from roof flooding.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms, Severe Winter Weather	Moderate	$25,000 - $100,000	Emergency Management, Facilities	2022	Under design for 2022
ESS-P-3	Prune trees adjacent to the switch building and transformer yard to reduce the possibility of damage during wind or ice event.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms, Severe Winter Weather	Moderate	NA	Emergency Management, Facilities	Action completed	Action completed. Trees pruned.
ESS-P-4	Install drainage features around basement entrances of Hines Hall to reduce the possibility of flooding and electric service disruption.	Flood	Moderate	NA	Emergency Management, Facilities	Action completed	Action completed. Drainage installed.
Property Protection							
ESS-PP-1	Seal cracks and waterproof masonry walls to eliminate water intrusion.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms, Flood	Moderate	$5,000 - $25,000	Emergency Management, Facilities	2026	Action not yet completed. Currently under design.

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
ESS-PP-2	Ensure transformer anchorage meets code requirements, or is brought up to code requirements.	Earthquake, Hurricane and Coastal Hazards, Tornadoes/Thunderstorms	Low	NA	Emergency Management, Facilities	Action completed	Action completed. Transformer anchorage is up to code.
Emergency Services							
ESS-ES-1	Install a fire alarm system into the electric switchgear facility.	Wildfire	High	$5,000 - $25,000	Emergency Management, Facilities	2026	Action not yet completed. Currently under design.

Fort IRC/ Campus Data Network Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Prevention							
FIRC-P-1	Establish redundant internet connection for The Campus Network	All	Low	Unknown	Emergency Management, Facilities	2026	In progress at this time.
FIRC-P-2	Enhance the Campus Network to increase the availability of redundant paths in the event the primary data center is damaged. The disaster recovery data center should have adequate emergency power.	All	Low	NA	Emergency Management, Facilities	Completed	Completed
Property Protection							
FIRC-PP-1	Relocate the data center to a building above grade and away from flood prone areas.	Flood	Moderate	Unknown	Emergency Management, Facilities	2026	Under advisement for capital improvement plan
FIRC-PP-2	Correctly anchor all mechanical equipment to its foundation or structure.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms	Low	NA	Emergency Management, Facilities	Completed	Action Completed
FIRC-PP-3	Clean and seal corroding reinforcing steel. Cracks in concrete should be epoxy injected to prevent water intrusion.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms, Flood	Moderate	NA	Emergency Management, Facilities	Completed	Action Completed.

General Classroom Building and Lab

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Property Protection							
GCBL-PP-1	The building should receive an emergency generator capable of powering the emergency operations center and all supporting mechanical and network systems.	High Wind/Tornado, Severe Winter Weather	Moderate	>$100,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.
GCBL-PP-2	All mechanical equipment should be anchored to its foundation or the structure in compliance with the building code. A (High Wind/ Tornado, Winter Weather)	High Wind/Tornado, Severe Winter Weather	Moderate	<$5,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.
Emergency Services							
GCBL-ES-1	The emergency operations center should be wired with an adequate number of voice and data ports to enable emergency operations. The voice ports should preferably connect directly to AT&T rather than through the campus VOIP system.	High Wind/Tornado, Severe Winter Weather	Moderate	$25,000-$100,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.

Marteena Hall

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Property Protection							
MH-PP-1	The network hub should be enclosed in a solid-walled partition with independent HVAC systems, all powered by the emergency generator.	High Wind/ Tornado, Winter Weather	Moderate	$25,000-$100,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.
MH-PP-2	A fire detection node should be added to the mechanical room.	High Wind/ Tornado, Winter Weather	Moderate	$5,000-$25,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.
MH-PP-3	All mechanical equipment should be anchored to a foundation or the building in compliance with the building code.	High Wind/ Tornado, Winter Weather	Moderate	<$5,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.
MH-PP-4	The cooling tower should be replaced.	High Wind/ Tornado, Winter Weather	Moderate	>$100,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.
MH-PP-5	The cause of water intrusion through the façade should be identified and corrected to prevent further damage.	High Wind/ Tornado, Winter Weather	Moderate	$25,000-$100,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Structural Projects							
MH- SP-1	Water/sewer lines should be rerouted so that they do not pass above the hub's electronic equipment.	High Wind/ Tornado, Winter Weather	Moderate	$5,000-$25,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.
MH-SP-2	Antennae wires on the roof deck should be anchored to prevent them from becoming airborne. A	High Wind/ Tornado, Winter Weather	Moderate	<$5,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.

T.E. Neal Heating Plant

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Property Protection							
NHP-PP-1	All mechanical equipment should be anchored to a foundation or the structure in compliance with the building code.	High Wind/ Tornado, Winter Weather	Moderate	$5,000-$25,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.
NHP-PP-2	The source of water intrusion in the basement should be identified and corrected. There should be backup sump pumps available in the event that the primary dewatering pumps fail.	High Wind/ Tornado, Winter Weather	Moderate	$5,000-$25,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.
NHP-PP-3	A fire alarm system should be implemented into the facility.	High Wind/ Tornado, Winter Weather	Moderate	>$100,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.
Structural Projects							
NHP-SP-1	As steam lines are replaced, the network should be modified to permit back feeding around damaged sections of steam line.	High Wind/ Tornado, Winter Weather	Moderate	>$100,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.
NHP-SP-2	An additional water source for makeup water should be identified. This could be in the form of a stub-in to permit a tanker to supply water in the	High Wind/ Tornado, Winter Weather	Moderate	$25,000-$100,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
	event that the city connection is severed.						
NHP-SP-3	A fence and gate should be installed around the fuel storage compound to keep out trespassers.	(High Wind/ Tornado, Winter Weather)	Moderate	$25,000-$100,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.

Ward Hall

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Property Protection							
WH-PP-1	Ward Hall should have a redundant connection to the campus network that bypasses the hub in Marteena Hall. The building should have an additional connection directly to the internet to facilitate mass notification in the event of a failure at Fort IRC. D	High Wind/ Tornado, Winter Weather	Moderate	>$100,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.
WH-PP-2	The windows in the dispatch center should be reinforced with laminate film to reduce the potential for breaching by windborne debris. B	High Wind/ Tornado, Winter Weather	Moderate	$5,000-$25,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.
WH-PP-3	All mechanical equipment should be anchored to its foundation in compliance with the building code. A	High Wind/ Tornado, Winter Weather	Moderate	<$5,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.
Structural Projects							
WH-SP-1	The building should have a new roof installed with proper slope and drains to prevent ponding water. At minimum the roof drains should be cleaned more frequently to prevent clogging. C	High Wind/ Tornado, Winter Weather	Moderate	$25,000-$100,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.
Prevention							

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
WH-P-1	The University should work to establish street addresses for campus buildings to facilitate coordination with municipal emergency responders. C	High Wind/ Tornado, Winter Weather	Moderate	$25,000-$100,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.

Williams Cafeteria

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Property Protection							
WC-PP-1	The cause of masonry wall cracking should be identified and remedied.	High Wind/ Tornado, Winter Weather	Moderate	$5,000-$25,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.
WC-PP-2	The chiller and all vital mechanical equipment should be attached to its foundation or the structure in compliance with the building code.	High Wind/ Tornado, Winter Weather	Moderate	<$5,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.
WC-PP-3	Cracked areas of roof flashing should be repaired to prevent moisture intrusion.	High Wind/ Tornado, Winter Weather	Moderate	$5,000-$25,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.
Emergency Services							
WC-ES-1	Provide an emergency generator capable of sustaining freezer temperatures, food preparation activities, and a minimum of climate control.	High Wind/ Tornado, Winter Weather	Moderate	>$100,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.
Structural Projects							
WC-SP-1	Additional drainage should be added to the loading dock area. The drainage main running under the roadway should be replaced with a larger pipe to prevent the street from flooding.	(High Wind/ Tornado, Winter Weather)	Moderate	>$100,000	Emergency Management and Facilities	2026	This action has been deferred until the 2026 update pending staff time and funding to facilitate implementation.

Annex C University of North Carolina at Asheville

This section provides planning process, campus profile, hazard risk, vulnerability, capability, and mitigation action information specific to University of North Carolina at Asheville (UNCA). This section contains the following subsections:

- C.1 Planning Process Details
- C.2 Campus Profile
- C.3 Asset Inventory
- C.4 Hazard Identification
- C.5 Hazard Profiles, Analysis, and Vulnerability
- C.6 Capability Assessment
- C.7 Mitigation Action Plan

C.1 Planning Process Details

The update of the campus hazard mitigation plan was conducted by a Campus Hazard Mitigation Planning Team comprised of university staff and faculty. The committee followed a planning process prescribed by FEMA and participated in a series of meetings to update the plan. Details about the meetings held by the committee are provided below.

TABLE C.1: UNC ASHEVILLE CAMPUS HAZARD MITIGATION PLANNING COMMITTEE

LAST NAME	FIRST NAME	TITLE	ATTENDED FIRST MEETING	ATTENDED SECOND MEETING
Acker	Melissa	Grounds Manager	X	X
Barnwell	Vollie	Director of Housing	X	X
Boyce	Eric	Police Chief	X	X
Bryson	Suzanne	Internal Audit Enterprise Risk Management	X	X
Cowdry	Scott	Chief Information Officer		X
Gibson	Kevin	EHS Professional	X	X
Holt	Herman	Dean of Natural Sciences		X
Kauer	Kim	EHS Professional		X
Krumpe	Keith	Senior Admin and Space Planner		X

LAST NAME	FIRST NAME	TITLE	ATTENDED FIRST MEETING	ATTENDED SECOND MEETING
Ledbetter	Taylor	Facilities Manager – Athletics	X	
Oskins	Ed	Director Trades Manager	X	X
Sweeny	Stan	Director SAIL		X
Todd	David	AVC Campus Operations	X	X
Weldon	David	Director of Emergency Management	X	X

* Primary Point of Contact

February 11, 2020 – UNCA Campus Hazard Mitigation Planning Committee Meeting (Weizenblatt Hall Conference Room)

Prior to the official kickoff meeting with the project consultant, the UNCA Campus Hazard Mitigation Planning Team met to discuss the current/existing hazard mitigation plan and to discuss strategies for the plan update and the kickoff meeting.

February 18, 2020 – Kickoff Meeting

ESP Associates' Project Manager, Nathan Slaughter, 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 Campus Hazard Mitigation Planning Team and began by having attendees introduce themselves. The 9 attendees included faculty and staff from various departments at the University. 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 was managing the planning effort and had assigned ESP Associates, Inc. to manage the update.

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 on campus (buildings, infrastructure 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 a discussion about various mitigation techniques. He briefly explained the six different categories of mitigation techniques: emergency services, prevention, natural resource protection, structural projects, public education and awareness, and property protection. The attendees were then asked what types of mitigation projects would be needed the most at UNCA if FEMA funding was available. This helped demonstrate how priorities in mitigation actions should be considered for the plan.

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

- Coordinate between the eight participating campuses to update the existing plan,
- Update the plan to demonstrate progress and reflect current conditions,
- Complete the update in a timely manner because the existing plan expired in October of 2017,
- Increase public awareness and education,
- Maintain grant eligibility for participating campuses, and
- Maintain compliance with State and Federal requirements.

Mr. Slaughter reviewed the list of participating campuses with the group. He also explained the project tasks to be accomplished. These included the planning process, risk assessment, capability assessment, mitigation strategy, mitigation action plan, and plain maintenance procedures.

He explained that the project as being managed by a Campus Hazard Mitigation Steering Committee that had one representative from each of the eight campuses. For UNC Asheville, that representative was David Weldon, Director of Emergency Management. He explained that the group currently in the room would be known as the Campus Hazard Mitigation Planning Team.

Mr. Slaughter explained that this update would expand the scope of the plan to not only address natural hazards, as was previously done for the existing plan, but that it would also address manmade/technological hazards as well. This was done to ensure alignment with the State of North Carolina's Hazard Mitigation Plan.

Mr. Slaughter explained that the plan would address campus vulnerability, where feasible, to identify specific types and numbers of campus assets that are at risk to the identified hazards. He said that an attempt would be made to address other types of vulnerability as well to include social, economic and environmental vulnerabilities.

He then discussed the capability assessment and how the plan would include a discussion on the University's capability to address their hazard vulnerability through mitigation. Next, he discussed the mitigation strategy and explained how that section of the plan would be reviewed and updated as required by FEMA.

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

Mr. Slaughter then reviewed the roles and responsibilities of ESP Associates, Inc, the campus leads and stakeholders. The presentation concluded with a discussion of the next steps to be taken in the project development. He explained that a Hazard Mitigation Public Survey was being developed and that it would be distributed soon. The next campus HMPT meeting was discussed and would be held sometime in the Spring or Summer of 2020. The purpose of the second meeting would be to discuss the findings of the risk and capability assessments and to begin updating existing mitigation actions and identify new goals.

October 29, 2020 – Mitigation Strategy Meeting – Zoom Meeting

Following a hiatus in the planning process caused by the onset, response and initial recovery from the COVID 19 pandemic, the UNCA Campus Hazard Mitigation Planning Team held an online Mitigation Strategy Meeting on October 29, 2020.

Mr. Slaughter began the meeting with brief introductions and an overview of the agenda for the day. He provided a brief refresher on the definition of mitigation and a recap of the Disaster Mitigation Act of 2000, the key objectives of the project and the project schedule (which remained somewhat delayed because of the COVID-19 pandemic, but still on track for completion of the final plan).

He then began providing more detailed information about the hazards that impact the University. He started by recapping the number of hazard events experienced since the previous plan and discussed the presidential disaster declarations that have been experienced since the previous update. These included one declaration for severe winter storms and flooding, one for severe storms, flooding, landslides and mudslides and the COVID-19 pandemic. He provided summary stats and slides for the following hazards: drought, hail, hurricanes and tropical storms, lightning, severe thunderstorms, tornadoes, flood, wildfire, winter storms and freeze, dam failure, earthquake, landslides, excessive heat, hazardous materials incident, public health hazards/infectious disease, cyber nuclear power plants, electromagnetic pulse and terrorism.

Mr. Slaughter provided an overview of the Priority Risk Index. The PRI is a quantitative scoring of hazards which is used to focus in on the hazards of greatest concern for the University. Using the PRI, the following hazards were considered the be highest risk for the University: severe winter weather, tornadoes/thunderstorms, flood, landslide and cyber.

The UNCA Campus Hazard Mitigation Planning Team offered the following comments on the hazard identification:

- Mircrobursts (wind shear) have caused issues on campus
- Dam failure is not a concern for the campus, move down in the overall hazard rankings
- There are 3 stormwater collection areas that could be breached and could take out a main road on campus
- There are two university buildings located on the French Broad river (STEAM studio at RAMP Studios and 838 Riverside Dr) that are vulnerable to flooding.
- There are no major hazmat concerns on campus although there are some stored at Sikes Hall; however, location along road, rail and air routes have the potential to put the campus at risk to external events. Highway 19/23 is considered to be a huge risk to the campus. Also, Silverline Plastics which is adjacent to campus also poses a potential hazmat risk.
- Terrorism is a hazard of concern and should be bumped up to moderate risk for the campus.
- Drought can be devastating for a campus (athletics)
- Move infectious disease up in the overall hazard rankings
- The track is prone to flooding
- Reed Creek flooding could shut down the entrance to campus and Edgewood Rd would then be the only entrance to campus – if Founders Dr floods, it can provide many problems for the campus

- Localized land sliding has occurred in the past on Campus Dr.

Following the hazard identification and PRI review, Mr. Slaughter reviewed the listing of key assets from the prior plan and discussed the need to update that ranking. He also mentioned that social vulnerability would be included in the plan to some extent and he presented slides on social vulnerability for Buncombe County.

There was also a brief discussion about the capability assessment that would be included in the plan for the University. He mentioned how that assessment would be conducted and what it would try to capture (administrative, technical, fiscal, and political capabilities of the University).

University staff indicated that several million dollars of work has been done on campus to mitigate flooding. Examples include removal of obstructions and daylighting the creek. New buildings in the floodplain have foundations that are above the BFE

The remainder of the meeting was spent discussing the Mitigation Strategy. Mr. Slaughter gave an overview of the process for updating the Mitigation Strategy and presented the existing mitigation goals for the UNC Western Campuses regional plan. He asked the UNCA Campus Hazard Mitigation Planning Team to review the goals to determine whether or not they still reflect current vulnerabilities and current mitigation priorities. The committee members agreed that the goals were no longer relevant and new goals and associated objectives were developed, voted upon and accepted. It should be noted that these goals and objectives also align with those found in the UNC Eastern Campuses Hazard Mitigation Plan.

Mr. Slaughter then indicated that Campus Hazard Mitigation Planning Team would need to provide a status update for their existing mitigation actions (completed, deleted, or deferred) and a brief discussion of how that determination was made. Mr. Slaughter also discussed the Mitigation Action Worksheets to be completed for any new mitigation actions. Mr. Slaughter then presented sample mitigation actions for the committee members to consider to include in their plan update.

Mr. Slaughter mentioned the need to conduct public outreach measures to meet FEMA requirements and indicated that a public survey would be sent out soon and an online public meeting for the entire UNC Western Campuses region would be conducted before the plan was finalized.

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

Involving the Public

Because this plan update was developed during the COVID-19 pandemic, the planning teams had to get creative in order to solicit feedback from the public about the plan and their thoughts on hazard mitigation. A public survey instrument was developed to provide an opportunity for the public to provide comment on their concerns about hazard impacts on the campuses and their thoughts on how mitigation could help reduce vulnerability. The public survey was distributed by each campus through different means to outreach to faculty, staff and students.

For UNCA, 28 public survey responses were received and the results from those surveys were shared with the Campus Hazard Mitigation Planning Team. Feedback from the surveys was reviewed and considered for inclusion in this plan, as applicable, where determined to be relevant. A summary of the responses can be found in **Appendix B** and detailed survey responses can be obtained through North Carolina Emergency Management, Hazard Mitigation Planning staff.

C.2 Campus Profile

This section of the Plan provides a general overview of the UNC Asheville campus and surrounding area.

C.2.1 Geography and the Environment

UNC Asheville is located in Asheville, North Carolina which is a city in the western part of the Blue Ridge Mountains. At an elevation of 2,134 feet the campus is not as far up in the mountains as other UNC School system campuses such as University of North Carolina at Asheville. Asheville is known for a vibrant arts scene and historic architecture, including the dome-topped Basilica of Saint Lawrence. The vast 19th-century Biltmore estate displays artwork by masters like Renoir. The Downtown Art District is filled with galleries and museums, and in the nearby River Arts District, former factory buildings house artists' studios. With the location of Asheville, it not only offers an urban setting, just minutes away from downtown are rural areas that are as beautiful as anywhere in the Blue Ridge Mountains. UNC Asheville's campus covers almost 400 acres which includes the main campus and other outlying properties. The main campus consists of residence halls, academic buildings, athletic and recreational facilities, libraries, a conference center, student apartments, auditoriums, and research centers. Located off campus are recreational areas. Asheville benefits from all the mountains have to offer as well as the vibe of a city. From hiking on the Blue Ridge Parkway to kayaking down the multiple Rivers in the area, there are many adventures to undergo. An orientation map of the University of North Carolina at Asheville can be seen in **Figure C.1** and a map of the main-campus can be seen in **Figure C.2**.

FIGURE C.1: UNIVERSITY OF NORTH CAROLINA AT ASHEVILLE LOCATOR MAP

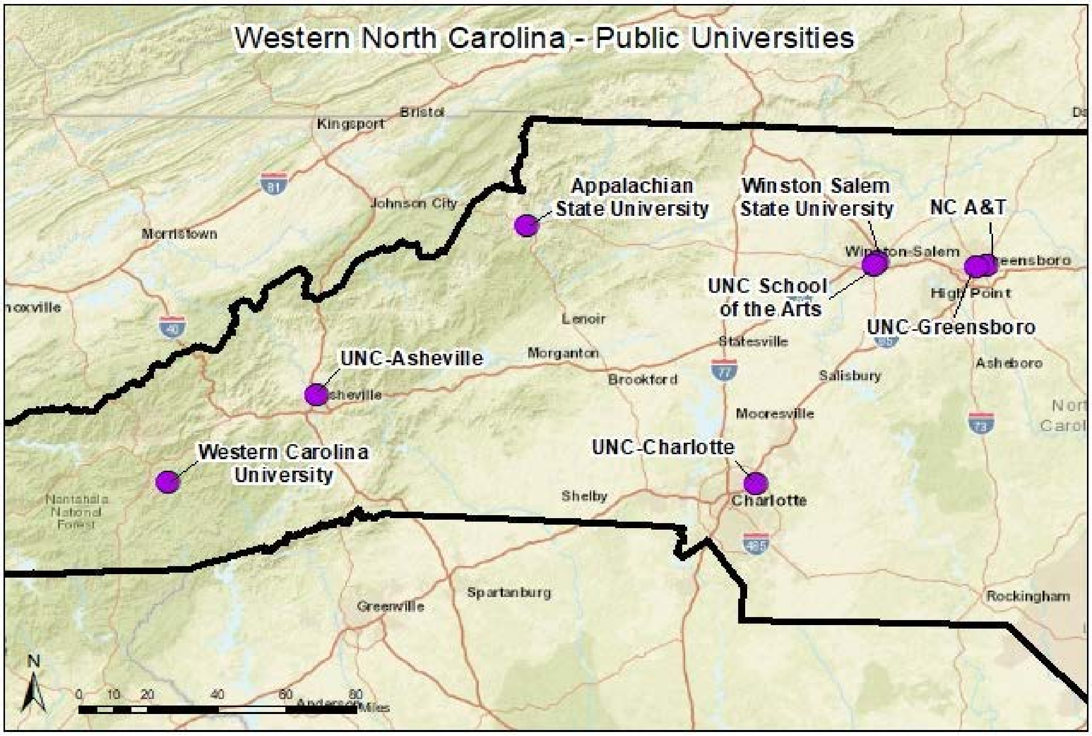
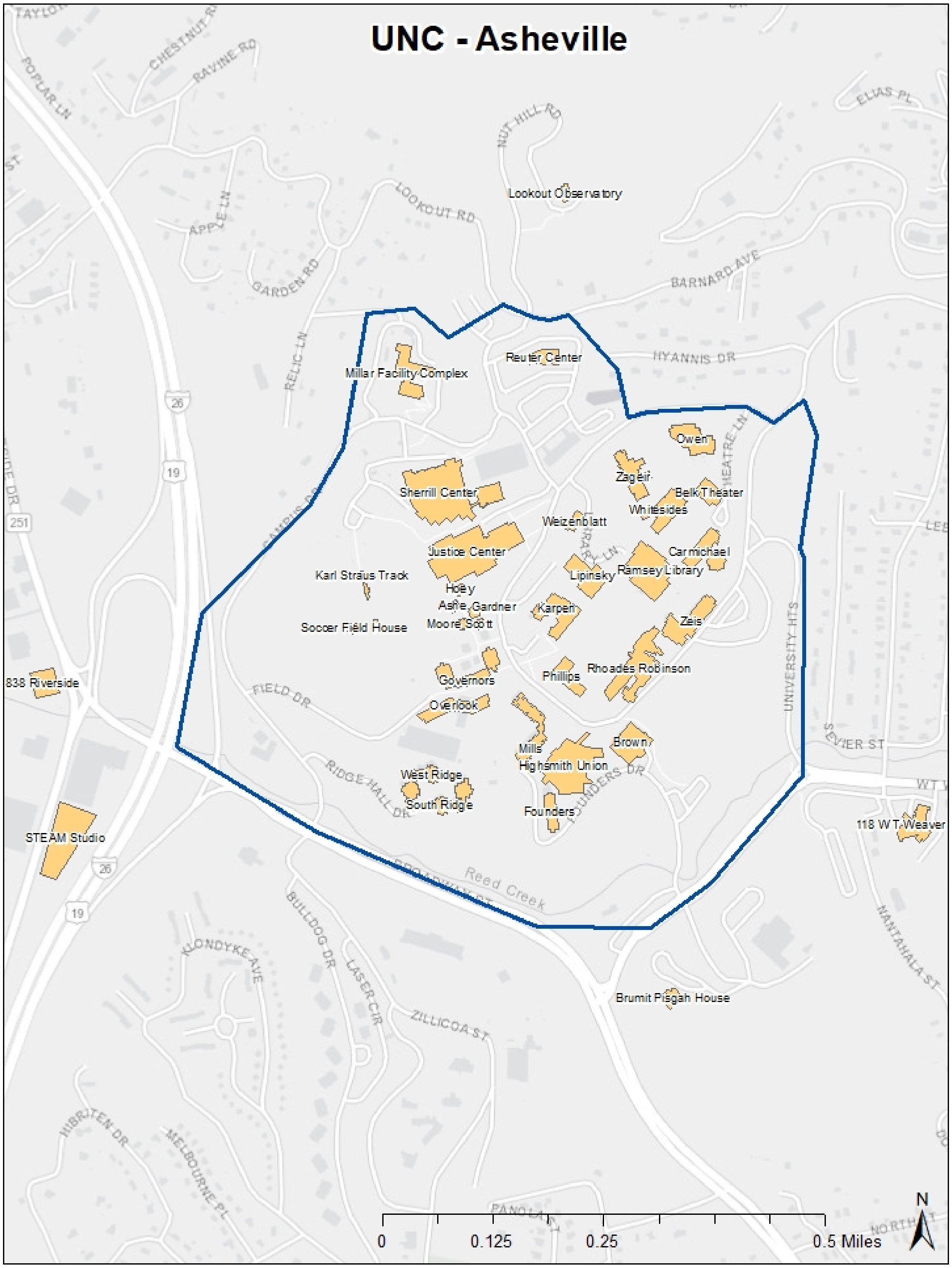


FIGURE C.2: UNCA MAIN CAMPUS MAP

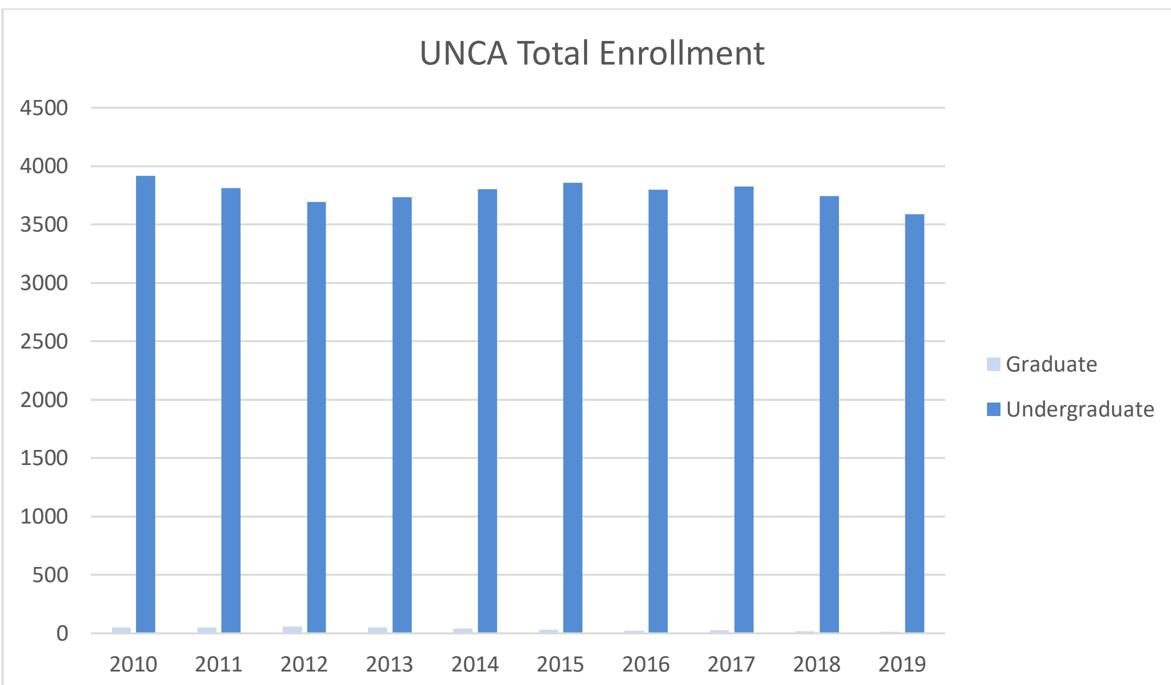


The Asheville area has a climate resembling the Piedmont region within the Southeastern U.S., but with noticeably cooler temperatures due to high elevation. During the summer months, the average high temperature in this area is around 74 °F. Summers are considerably less humid than in other parts of the Carolinas. Winters are longer, harsher, and colder, with frequent sleet and snowfall, and blizzard-like conditions. The daily average temperature in January is 37 °F. Asheville precipitation is relatively spread out, summer months being slightly wetter, and averages almost 50 inches of rainfall annually. Snowfall is sporadic and can accumulate to almost 10 inches annually; however, large storms are possible and in 1969, 48 inches of snow was recorded during the winter season.

C.2.2 Population and Demographics

UNC Asheville has grown steadily over the years since the university had been in 1927. Recently, growth has reached a plateau, and even slightly dropped off in the past 3 years. Within the past three years UNC Asheville has seen an average annual population decline rate of 1.1%. The majority of students attending this university are White representing slightly more than 80% of the student population, with the second most prevalent ethnicity being Hispanic or of Latino descent representing nearly 5%. Pacific Islander's make up the least represented group for this University consisting of .1% of the total student population. The enrollment trends over the past ten years can be seen in **Table C.2**.

TABLE C.2 ENROLLMENT TOTALS



For a breakdown of enrollment demographics please see **Table C.3** below.

TABLE C.3 ENROLLMENT DEMOGRAPHICS (2019)

Race/Ethnicity	Enrollment (Fall 2019)	Percentage
White	2,682	74.5%
Hispanic or Latino	300	8.33%
Black or African American	187	5.19%
Two or More Races	147	4.08%
Asian	72	2.00%
Nonresident Alien	46	1.27%
American Indian or Alaska Native	16	0.44%
Native Hawaiian or Other Pacific Islander	3	0.08%
Unknown	147	4.08%

Source: UNC System – Interactive Data Dashboards

C.3 Asset Inventory

An inventory of assets was compiled to identify the total count and value of property exposure on the UNCA campus. This asset inventory serves as the basis for evaluating exposure and vulnerability by hazard. Assets for analysis include buildings, critical facilities, and critical infrastructure.

C.3.1 Building Inventory

This section provides total building exposure for the campus, which was estimated by summarizing building footprints provided by North Carolina Emergency Management and property values derived from 2020 insurance assessment data. According to that data, there are 58 buildings associated with UNCA totaling a value of $960,291,331 (building and contents).

C.3.2 Critical Buildings and Infrastructure Exposure

Of significant concern with respect to any disaster event is the location of critical facilities and infrastructure in the planning area. Critical facilities are those essential services and lifelines that, if damaged during and emergency event, would disrupt campus continuity of operations or result in severe consequences to public health, safety, and welfare.

Critical buildings are a subset of the total building exposure and were identified by UNCA's HMPT representatives. The UNCA HMPC updated the list of critical facilities from the previous DRU plan and ranked each facility on a set of standardized criteria designed to evaluate all critical buildings in the UNC System DRU plans. Factors considered for this ranking included:

- the building's use for emergency response,
- the building's use for essential campus operations
- the building's use as an emergency shelter or for essential sheltering services,
- the presence of a generator or generator hook-ups,
- the building's use for provision of energy, chilled water or HVAC for sensitive or essential systems,
- the storage of hazardous materials,

- the building's use for sensitive research functions,
- the building's cultural or historical significance, and
- building-specific hazard vulnerabilities

Figure C.3 below shows the scoring sheet that the UNCA Campus Mitigation Planning Team used to rate critical buildings on campus. All of the campuses in the UNC system used to same scoring methodology for consistency.

FIGURE C.3: CRITICAL BUILDING SCORING WORKSHEET

Critical Building Scoring Worksheet

Campus:
Facility Name:

		Score
1	Does the facility serve as the campus Emergency Operations Center (EOC)? Yes, Primary EOC = 6 pts Yes, Secondary EOC = 3 pts No = 0 pts	0
2	Does the facility house functions essential to campus operations? Main Telecommunication Center = 3 pts; Maintenance = 1 pt Computer Network Hub = 3 pts; Public Safety = 1 pt Adminstrative Operations = 1 pts	0
3	Is the facility equiped with a generator or hook-ups? Generator = 3 pts Hook-ups = 1 pt Neither = 0 pts	0
4	Does the facility serve as a pre or post disaster shelter? Both pre and post disaster shelter = 6 pts Either pre or post disaster shelter = 3 pts Neither = 0 pts	0
5	Does the facility provide services essential to sheltering? Resident Housing = 1 pt; Food Preperation Facility = 1 pt Assesmbly Space = 1 pt; Shower Facilities = 1 pt	0
6	Does the facility provide chilled water distribution or contain HVAC systems necessary to sensitive or essential systems? Yes = 3 pts No = 0 pts	0
7	Are there hazardous materials on-site? (greater than 25 gallons) Yes = 3 pts No = 0 pts	0
8	Does the facility house research functions that have a low level of tolerance for disruption? Yes = 2 pts No = 0 pts	0
9	Does the facility serve as storage for rare or unique collections (art, artifacts, letters, etc) or is it a historically or culturally significant building? Yes = 2 pts No = 0 pts	0
10	Does the facility have hazard specific vulnerabilities (basement susceptible to flood, etc.) Yes = 3 pts No = 0 pts	0
Notes/ Comments		

Total Score:	0
Total Possible Score:	**42**

The identified critical facilities for UNCA, as scored by the UNCS Campus Hazard Mitigation Planning Team are listed below:

- LIST PENDING

C.4 Hazard Identification

This section describes how the regional planning committee identified the hazards to be included this plan

C.4.1 Hazard Identification

Upon a review of the full range of natural hazards suggested under FEMA planning guidance, the Campus Hazard Mitigation Planning Team identified a number of hazards that are to be addressed in its Hazard Mitigation Plan. These hazards were identified through a process that utilized input from the Campus Hazard Mitigation Planning Team, research of past disaster declarations in the surrounding county, and review of the previous UNCA Pre-Disaster Mitigation Plan. To maintain consistency, the Multi-Campus Hazard Mitigation Steering Committee and the Campus Hazard Mitigation Planning Teams voted to assess the same hazards that were identified in the most recent update of the North Carolina State Hazard Mitigation Plan. Therefore, since the development of the previous plan, the hazard identified and included in the plan have changed. A list of all previous hazards covered in the previous UNCA Pre-Disaster Mitigation Plans are viewable in **Table C.4**, 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.

TABLE C.4: 2021 UNIVERSITY OF NORTH CAROLINA AT ASHEVILLE HAZARDS UPDATE

2010 University of North Carolina at Asheville Identified Hazards		2021 University of North Carolina at Asheville Identified Hazards		Description of hazards covered in 2021 Plan and Explanations
Atmospheric Hazards	Drought	**Natural Hazards**	Drought	Agricultural Drought, Hydrological Drought
	Driving Rain			
	Other High Wind events			
			Excessive Heat	
	Hurricane		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
	Tornado		Tornadoes/Thunderstorms	Hailstorm, Torrential Rain associated with Severe Thunderstorms, Thunderstorm Wind, Lightning, Waterspout, High Wind
	Electrical Storm			
	Severe Winter Weather, including ice or snow events		Severe Winter Weather	Freezing Rain, Snowstorms, Blizzards, Wind Chill, Extreme Cold
Hydrologic Hazards			Dam Failures	
	Flood		Flooding	

2010 University of North Carolina at Asheville Identified Hazards		2021 University of North Carolina at Asheville Identified Hazards		Description of hazards covered in 2021 Plan and Explanations
Geologic Hazards	Earthquake		Earthquakes	
	Landslide, Rockslide, and other Geologic		Geological	Landslides, Sinkholes, Erosion
Other Hazards	Wildfire or Building Fire	**Other Hazards**	Wildfires	
	Animal borne and other Infectious Diseases		Infectious Disease	
	Accidental Explosion	**Technological Hazards**		
			Hazardous Substances	Hazardous Materials, Hazardous Chemicals, Oil Spill
			Radiological Emergency – Fixed Nuclear Facilities	
			Terrorism	Chemical, Biological, Radiological, Nuclear, Explosive
			Cyber	
			Electromagnetic Pulse	

C.4.2 Disaster Declarations

Disaster declarations provide insight into the hazards that may impact the University of North Carolina at Asheville. **Table C.5** shows every declared presidential disaster to impact Buncombe County since 1973. There have been nine total disaster declarations in Buncombe County since 1973.

TABLE C.5: BUNCOMBE COUNTY DISASTER DECLARATIONS

Year	Disaster Number	Description
1973	394	SEVERE STORMS & FLOODING
1977	542	SEVERE STORMS & FLOODING
1996	1087	BLIZZARD OF '96
1996	1134	HURRICANE FRAN
2004	1553	HURRICANE IVAN
2004	1546	TROPICAL STORM FRANCES
2010	1871	SEVERE WINTER STORMS & FLOODING
2013	4146	SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES
2020	4487	COVID-19 PANDEMIC

C.4.3 Summary of Hazard Impacts Since Previous Plan

Since the approval of the previous University of North Carolina at Asheville Pre-Hazard Mitigation Plan (March 30th, 2010), there have been 227 hazard events recorded for the planning area in the National Centers for Environmental Storm Event Database. It is important to take note of those hazard events and consider them in the *Hazard Identification* section to help ensure that the appropriate hazards are being considered in the risk assessment sections in the Mitigation Strategy. **Table C.6** documents the hazard events recorded.

TABLE C.6: SUMMARY OF HAZARD EVENTS SINCE PREVIOUS PLAN

Hazard Type*	Number of Reported Events in Buncombe County
Cold/Wind Chill	6
Flash Flood	19
Flood	5
Hail	60
Heavy Snow	6
High Wind	8
Lightning	0
Strong Wind	3
Thunderstorm Wind	57
Tornado	0
Tropical Storm	0
Winter Storm	4
Winter Weather	59
TOTAL NUMBER OF REPORTED EVENTS	227

* The hazard type names that NCEI uses are different than the names of hazards used un this plan; however, one can still get an understanding of the types of hazards that impact the region as the hazard types are similar in name.

C.4.4 Hazard Evaluation

Table C.7 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 furthered 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 further evaluations and updates of the risk assessment if deemed necessary by the Multi-Campus Hazard Mitigation Steering Committee and the Campus Hazard Mitigation Planning Team during the plan update process.

TABLE C.7: 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?
NATURAL HAZARDS			
Avalanche	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of the NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan • Review of US Forest Service National Avalanche Center website	• The United States avalanche hazard is limited to mountainous western states including Alaska as well as some areas of low risk in New England. • Avalanche hazard was removed from the North Carolina State Hazard Mitigation Plan after determining the mountain elevation in Western North Carolina did have enough snow not to produce this hazard. • Avalanche is not included in the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan.
Drought	**YES**	• Review of the NC State Hazard Mitigation Plan • Review of the North Carolina Drought Monitor website	• There are reports of drought conditions in eighteen out of the last nineteen years in Buncombe County, according to the North Carolina Drought Monitor.

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?
		• Review of the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan	• Droughts are discussed in NC State Hazard Mitigation Plan.
Hailstorm	**YES (Assessed under Tornadoes/ Thunderstorms)**	• Review of NC State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NOAA NCEI Storm Events Database • Review of the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan	• Hailstorm events are discussed in the state plan under the Severe Thunderstorm hazard. • NCEI reports 188 hailstorm events (0.75-inch size hail to 2 inches) for Buncombe County between 1962 and 2018. For these events there was $5,000 in property damages. • Although hail is not addressed as an individual hazard in the previous hazard mitigation plan, it is addressed as a sub-hazard under tornadoes/ thunderstorms.
Excessive Heat	**NO**	• Review of NOAA NCEI Storm Events Database • Review of the North Carolina State Hazard Mitigation Plan • Review of the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan	• NCEI did not report any excessive heat events for Buncombe county. • The NC State Hazard Mitigation Plan includes Excessive Heat as a hazard but Buncombe County is at low risk for the hazard. • Excessive Heat was not addressed in the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan.
Hurricane and Coastal Hazards	**YES**	• Review of NC State Hazard Mitigation Plan	• Hurricane and coastal hazard events are discussed in the state

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?
		• Analysis of NOAA historical tropical cyclone tracks and National Hurricane Center Website • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations • Review of the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan	plan and are listed as a top hazard. • NOAA historical records indicate 7 hurricane/coastal hazards have come within 75 miles of Buncombe County since 1850. • Three out of nine disaster declarations in Buncombe County are directly related to hurricane and costal hazard events. • Hurricane hazards were addressed in the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan.
Lightning	**YES (Assessed under Tornadoes/ Thunderstorms)**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of NOAA NCEI Storm Events Database, NOAA lightning statistics • Review of the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan	• Lightning events are discussed in the state plan as part of the severe thunderstorm hazard. • NCEI reports 14 lightning events for Buncombe County since 1996. These events have resulted in a recorded 1 injury and $225,000 in property damage.
Nor'easter	**NO**	• Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan	• Nor'easters are discussed in the state plan; however, Buncombe is at low risk to the hazard. • NCEI does not report any nor'easter activity for Buncombe County. However,

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?
		• Review of NOAA NCEI Storm Events Database	nor'easters may have affected the County as severe winter storms. In this case, the activity would be reported under winter storm events. • Nor'easters were not addressed in the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan.
Tornadoes/ Thunderstorm	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations.	• Tornado events are discussed in the NC State Hazard Mitigation Plan. • NCEI reports 6 tornado events in Buncombe County since 1976. These events have resulted in over $1 million in property damage with the most severe being an F1. • Tornado events were addressed in the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan.
Severe Thunderstorm	**YES (Assessed under Tornadoes/Thunderstorms)**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database	• Severe thunderstorm events are discussed in the NC State Hazard Mitigation Plan. • NCEI reports 167 thunderstorm wind events in Buncombe County since 1959. These events have resulted in $449 thousand in property damage. • Severe thunderstorm events were addressed in the previous University of North Carolina at

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?
		• Review of historical presidential disaster declarations.	Asheville Pre-Disaster Mitigation Plan.
Severe Winter Weather	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations.	• Severe winter weather events, including snow storms and ice storms, are discussed in the state plan. • NCEI reports that Buncombe County has been affected by 178 snow and ice events since 1996. • Two of the County's nine disaster declarations were directly related to winter storm events. • Winter storm events were addressed in the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan.
Earthquakes	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan • Review of the National Geophysical Data Center USGS Earthquake Hazards Program website	• Earthquake events are discussed in the state plan and University of North Carolina at Asheville is considered to be at moderate risk to an earthquake event. • 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. • Earthquakes were addressed in the previous University of North

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?
			Carolina at Asheville Pre-Disaster Mitigation Plan. • 37 events are known to have occurred in the region according to the National Geophysical Data Center. The greatest MMI reported was a 6. • According to USGS seismic hazard maps, the peak ground acceleration (PGA) with a 10% probability of exceedance in 50 years for the area is approximately 6%g. FEMA recommends that earthquakes be further evaluated for mitigation purposes in areas with a PGA of 3%g or more.
Expansive Soils	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan • Review of USDA Soil Conservation Service's Soil Survey	• Expansive soils are not identified in the state plan as a hazard of concern. • According to FEMA and USDA sources, University of North Carolina at Asheville is located in an area that has a "little to no" clay swelling potential. • The previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan did not identify expansive soils as a potential hazard.
Geological (Landslides, Sinkholes, Erosion)	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan	• Landslide/debris flow events are discussed in the state plan. • USGS landslide hazard maps indicate "high landslide incidence" is found in Buncombe County.

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?
		• Review of the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan • Review of USGS Landslide Incidence and Susceptibility Hazard Map • Review of the North Carolina Geological Survey database of historic landslides	• Data provided by NCGS indicates 152 recorded landslide events in Buncombe County • Geological hazards were addressed in the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan.
Land Subsidence	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan	• The state plan delineates certain areas that are susceptible to land subsidence hazards in North Carolina; however, none of these areas are located in Buncombe County. • Land Subsidence was not addressed in the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan.
Tsunami	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan • Review of FEMA "How-to" mitigation planning guidance (Publication 386-2, "Understanding Your Risks –	• Tsunamis are discussed in the state plan. However, Buncombe County has zero risk. • Tsunamis were not addressed in the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan. • No record exists of a catastrophic Atlantic basin tsunami impacting the mid-Atlantic coast of the United States. • Tsunami inundation zone maps are not available for

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?
		Identifying Hazards and Estimating Losses).	communities located along the U.S. East Coast. • 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.
Volcano	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of USGS Volcano Hazards Program website	• There are no active volcanoes in North Carolina. • There has not been a volcanic eruption in North Carolina in over 1 million years. • No volcanoes are located near University of North Carolina at Asheville.
Dam Failure	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan • Review of North Carolina Division of Land Management website	• Dam failure is discussed in the state plan as a hazard of concern. • Of the 97 dams reported on the National Inventory of Dams for Buncombe County, 53 are high hazard. (High hazard is defined as "where failure or mis operation will probably cause loss of human life.") • Dam failure was not addressed in the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan.
Erosion	**YES (Referenced in Geological Hazards)**	• Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina	• Riverine erosion is addressed in the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan.

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?
		at Asheville Pre-Disaster Mitigation Plan	• Coastal erosion is discussed in the state plan but only for coastal areas (there is no discussion of riverine erosion).
Flooding	**YES**	• Review of NC State Hazard Mitigation Plan • Review of historical disaster declarations • Review of NOAA NCEI Storm Events Database • Review of FEMA's NFIP Community Status Book and Community Rating System (CRS) • Review of the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan	• The flood hazard is thoroughly discussed in the state plan. • Seven of the nine Presidential Disaster Declarations were directly associated with flooding events. • NCEI reports that Buncombe County have been affected by 45 flood events since 1996. These events in total caused an over $80.04 million in property damages. • Flooding was addressed in the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan.
Storm Surge	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database	• Storm surge is discussed in the state plan under the hurricane hazard however is not a hazard of concern in Buncombe County. • Storm surge was not addressed in the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan. • No historical events were reported by NCEI • Given the inland location of University of North Carolina at Asheville, storm surge would not affect the area.

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?
OTHER HAZARDS			
Wildfires	**YES**	• Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan • Review of Southern Wildfire Risk Assessment (SWRA) Data • Review of the NC Division of Forest Resources website	• Wildfires occur in virtually all parts of the United States. Wildfire hazard risk will increase as low-density development along the urban/wildland interface increases • Wildfires were not addressed in the previous Appalachian State University Pre-Disaster Mitigation Plan. • According to the North Carolina Division of Forest Resources, Buncombe County experiences an average of 25 fires each year which burn a combined 224 acres.
Hazardous Substances	**YES**	• Review of the Buncombe Madison Regional Hazard Mitigation Plan • Review of the NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan	• Buncombe County identifies hazardous substances as a potential concern. • EPA Toxic Release Inventory indicates 23 Toxic Release Inventory (TRI) facilities in Buncombe County. • This update assesses hazardous materials, hazardous chemicals, and oil spills under this hazard.
Infectious Disease	**YES**	• Review of the NC State Hazard Mitigation Plan.	• Including infectious disease to be consistent with the State Plan. • Although the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan did not include infectious disease as a hazard, it is

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?
			assessed in this update to maintain consistency with the NC State Hazard Mitigation Plan • Infectious Disease has caused one of the nine disaster declarations in Buncombe County
TECHNOLOGICAL HAZARDS			
Terrorism	**YES**	• Review of NC State Hazard Mitigation Plan • Review of previous mitigation plan in University of North Carolina at Asheville • Review of local official knowledge	• Although the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan did not include terrorism threat as a hazard, it is assessed in this update to maintain consistency with the NC State Hazard Mitigation Plan. • This hazard will assess chemical, biological, radiological, nuclear, and explosive terrorism events.
Radiological Emergency – Fixed Nuclear Facilities	**NO**	• Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Asheville Pre-Disaster Mitigation Plan • Review of IAEA list of fixed nuclear power stations in the United States • Discussion with local officials about location of nuclear power stations	• Although radiological emergencies are not identified in any previous plans, local officials expressed a desire to address them in this plan • There are no nuclear plant facilities located within 50 miles of Buncombe County or University of North Carolina at Asheville
Cyber	**YES**	• Review of NC State Hazard Mitigation Plan	• Changing future conditions encourage the assessment of the possibility of a cyber-attack

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?
			with the increase in global technology
Electromagnetic Pulse	**YES**	• Review of NC State Hazard Mitigation Plan	• Changing future conditions encourage the assessment of the possibility of an electromagnetic pulse with the increase in global technology

C.5 Hazard Profiles, Analysis, and Vulnerability

C.5.1 OVERVIEW

This section includes detailed hazard profiles for each of the hazards identified in the Hazard Identification section as significant enough for further evaluation in the University of North Carolina at Asheville Hazard Mitigation Plan. It contains the following subsections:

- C.5.1 Overview
- C.5.2 Drought
- C.5.3 Hurricane and Coastal Hazards
- C.5.4 Tornadoes/Thunderstorms
- C.5.5 Severe Winter Weather
- C.5.6 Earthquakes
- C.5.7 Geological
- C.5.8 Dam Failure
- C.5.9 Flooding
- C.5.10 Wildfires
- C.5.11 Infectious Disease
- C.5.12 Hazardous Substances
- C.5.13 Terrorism
- C.5.14 Cyber
- C.5.15 Electromagnetic Pulse
- C.5.16 Conclusions on Hazard Risk
- C.5.17 Final Determinations

Natural Hazards

C.5.2 DROUGHT

C.5.2.1 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, 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. It is also notable that drought conditions typically do not cause significant damage to the built environment. However, the Campus Hazard Mitigation Planning Team indicated that drought can be devastating for the campus. Especially as it related to athletics and athletics fields and campus grounds in general.

C.5.2.2 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 C.8.**

TABLE C.8: 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 NOAA, Buncombe County has had drought occurrences in eighteen of the last nineteen years (2000-2019) (**Table C.9**). 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 C.9: SUMMARY OF DROUGHT OCCURRENCES IN BUNCOMBE COUNTY (1995-2019)

Year	Buncombe County
2000	Exceptional Drought
2001	Extreme Drought
2002	Extreme Drought
2003	None
2004	Abnormally Dry
2005	Abnormally Dry
2006	Severe Drought
2007	Exceptional Drought
2008	Exceptional Drought
2009	Severe Drought
2010	Moderate Drought
2011	Moderate Drought
2012	Moderate Drought
2013	Abnormally Dry
2014	Abnormally Dry
2015	Severe Drought
2016	Extreme Drought
2017	Severe Drought
2018	Abnormally Dry
2019	Moderate Drought

Source: NOAA, Storm and Weather Events Database

C.5.2.3 Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of Buncombe County, including the University of North Carolina at Asheville campus, 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[1].

[1] *U.S. Seasonal Drought Outlook. National Weather Service Climate Prediction Center. http://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php*

C.5.3 HURRICANE AND COASTAL HAZARDS

C.5.3.1 Location and Spatial Extent

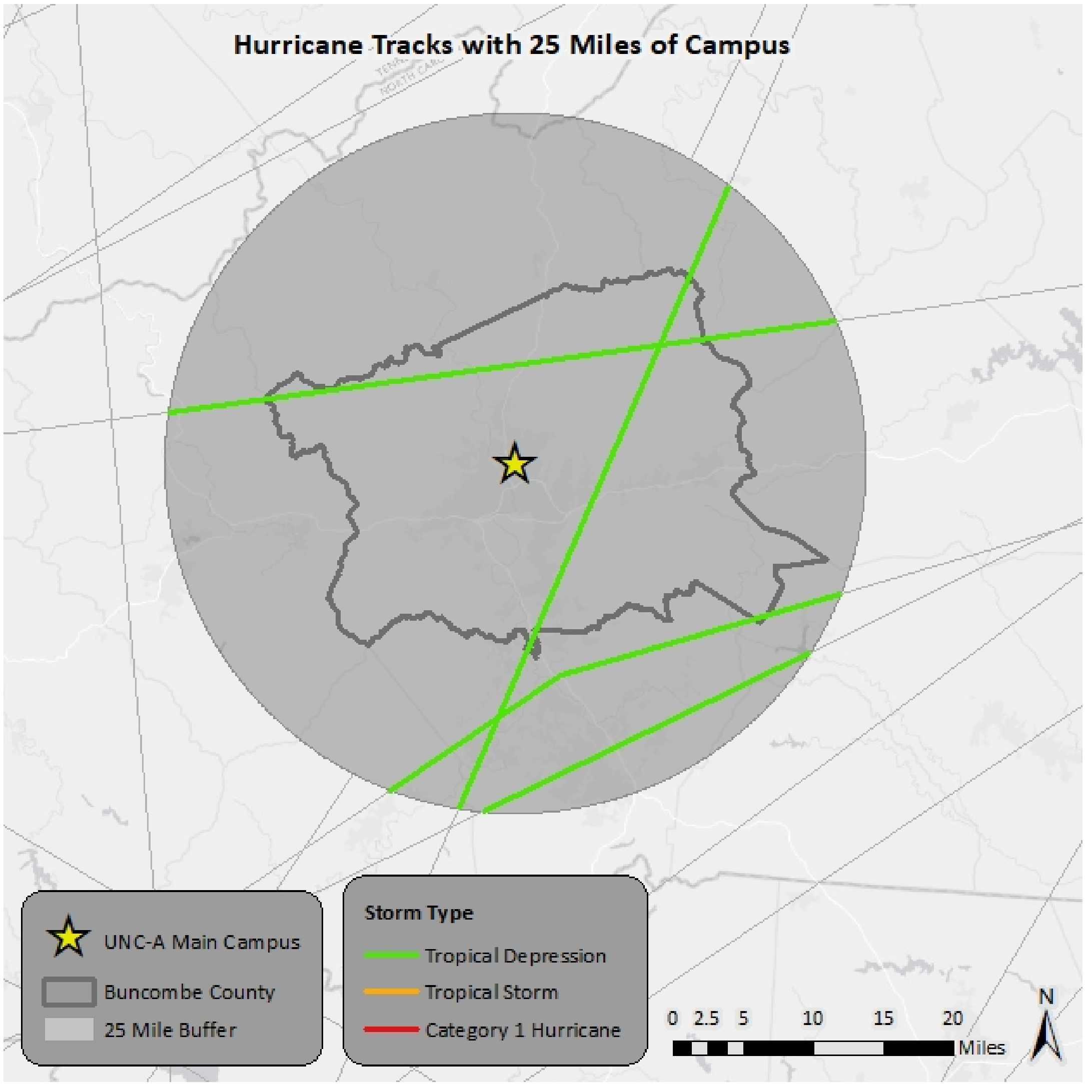
Hurricanes, coastal hazards, and tropical storms threaten the entire Atlantic and Gulf seaboard of the United States. While coastal areas are most directly exposed to the brunt of landfalling storms, their impact is often felt hundreds of miles inland and they can affect the University of North Carolina at Asheville Campus.

C.5.3.2 Historical Occurrences

According to the National Hurricane Center's historical storm track records, 7 hurricane or tropical storm tracks have passed within 25 miles of UNCA's campus since 1901[2]. This includes 7 tropical depressions. These storm events are shown in **Figure C.4.** Furthermore, **Table C.10** provides for each event the date of occurrence, name (if applicable), maximum wind speed (as recorded within 25 miles of Buncombe County) and Category of the storm based on the Saffir-Simpson Scale.

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

FIGURE C.4: HISTORICAL HURRICANE STORM TRACKS WITHIN 25 MILES OF UNIVERSITY OF NORTH CAROLINA AT ASHEVILLE



Source: National Oceanic and Atmospheric Administration; National Hurricane Center

TABLE C.10: HISTORICAL STORM TRACKS WITHIN 25 MILES OF UNIVERSITY OF NORTH CAROLINA AT ASHEVILLE (1901–2018)

Year	Storm Name	Maximum Wind Speed (knots)	Storm Category
1901	Unnamed	35	Tropical Depression
1911	Unnamed	30	Tropical Depression
1911	Unnamed	25	Tropical Depression
1985	Danny	25	Tropical Depression
1994	Beryl	15	Tropical Depression
1994	Beryl	15	Tropical Depression
2005	Cindy	20	Tropical Depression

Source: National Hurricane Center

The National Centers for Environmental Information did not record any hurricane or tropical storm events in Buncombe County between 1950 and 2019. Hurricane and tropical storm events have caused 5 presidential disaster declarations in Buncombe County. While these were not recorded in the database, effects from these types of storms were likely still felt in other hazards, including thunderstorms and flooding. Flooding is generally the greatest hazard of concern with hurricane and tropical storm events in the area near University of North Carolina at Asheville. 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.

Hurricane Fran – September 5-7, 1996
Hurricane Fran originated from a tropical wave that moved off the western coast of Africa, entering the Atlantic Ocean, on August 22, 1996. Rain of up to 16 inches deluged interior North Carolina, Virginia, and West Virginia, bringing dangerous river flooding to much of the mid-Atlantic. Hurricane Fran's thrashing of North Carolina aggravated the state's problems caused by numerous weather disasters in 1996. This was the second hurricane to hit North Carolina that year. The first was Hurricane Bertha, which hit the state a few weeks prior. In North Carolina, 1.3 million people were left without power. In North Topsail Beach and Carteret County, there was over $500 million (1996 USD) in damage and 90% of structures were damaged. The total damage in North Carolina amounted to over $2.4 billion.

Hurricane Florence – September 12-15, 2018
Hurricane Florence was a long-lived Cape Verde hurricane and the wettest tropical cyclone on record in the Carolinas. The sixth named storm, third hurricane, and the first major hurricane of the 2018 Atlantic

hurricane season. Florence became a tropical depression near Cape Verde on August 31 and progressed west-northwest, becoming a Tropical Storm on September 1. Florence strengthened rapidly on September 4–5, becoming a Category 4 storm on the Saffir-Simpson wind scale with maximum sustained winds of 130 mph. Florence weakened to a tropical storm by September 7, but the system regained hurricane strength on September 9 and major hurricane status with winds of 140 mph on September 10. However, increasing wind shear caused the storm's winds to gradually weaken over the next few days. However, the storm's wind field continued to grow. By the evening of September 13, Florence had been downgraded to a Category 1 hurricane. Hurricane Florence made landfall near Wrightsville Beach early on Friday September 14, and weakened further as it slowly moved inland. Florence produced extensive wind damage along the North Carolina coast from Cape Lookout, across Carteret, Onslow, and new Hanover counties. Thousands of downed trees caused widespread power outages to nearly all of eastern North Carolina.

C.5.3.3 Probability of Future Occurrences

Given the inland location of the campus, it is more likely to be affected by remnants of hurricane and tropical storm systems (as opposed to a major hurricane) which may result in flooding or high winds. The probability of being impacted is less than coastal areas, but still remains a real threat to University of North Carolina at Asheville due to induced events like flooding and land sliding. Based on historical evidence, the probability level of future occurrence is possible (between 1 and 10 percent annual probability). However, when the area is impacted, the damage could be severe, threatening lives and property on campus.

C.5.4 TORNADOES/THUNDERSTORMS

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

C.5.4.1 Location and Spatial Extent

Tornadoes

Tornadoes occur throughout the state of North Carolina, and thus in the area surrounding University of North Carolina at Asheville. 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 area surrounding the University of North Carolina at Asheville campus 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 University of North Carolina at Asheville typically experiences several straight-line wind events each year. These wind events can and have caused significant damage. It is assumed that the area surrounding the University of North Carolina at Asheville campus 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 all of the area surrounding the University of North Carolina at Asheville campus is uniformly exposed to severe thunderstorms; therefore, the campus itself is also 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 area surrounding the University of North Carolina at Asheville campus is uniformly exposed to lightning.

C.5.4.2 Historical Occurrences

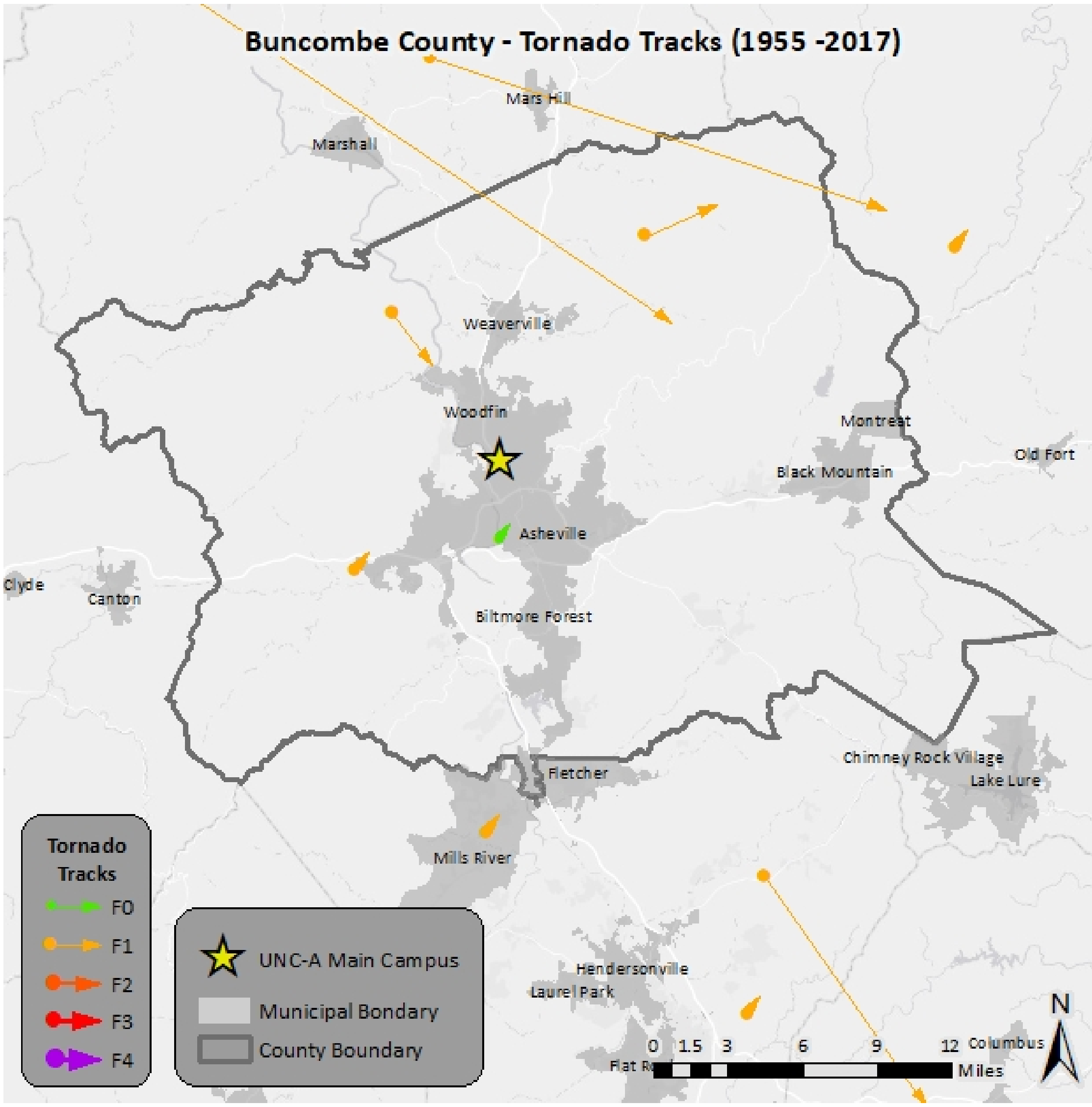
Tornadoes

Tornadoes are a somewhat rare occurrence; however, they have and do occur in the area. According to the National Centers for Environmental Information, there have been 6 recorded tornado events in Buncombe County since 1976 (**Table C.11**), resulting in over $1 million in property damages[3]. No deaths or injuries were reported for these events. The magnitude of these tornados' ranges from F0 to F1 in intensity, although an F5 event is possible but not likely. It is important to note that only tornadoes that

[3] 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 Buncombe County. As additional local data becomes available, this hazard profile will be amended.

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. **Figure C.5** shows a map of tornado impact in Buncombe County.

FIGURE C.5: TORNADO TRACKS IN BUNCOMBE COUNTY (1950 – 2018)



Source: National Centers for Environmental Information

TABLE C.11: HISTORICAL TORNADO IMPACTS IN BUNCOMBE COUNTY

Location	Date	Magnitude	Deaths/Injuries	Property Damage	Details
Buncombe County	2/18/1976	F1	0/0	$25,000	N/A
Buncombe County	2/18/1976	F1	0/0	$250,000	N/A
Buncombe County	6/6/1977	F1	0/0	$250,000	N/A
Buncombe County	6/6/1977	F1	0/0	$250,000	N/A
Asheville	5/19/1993	F0	0/0	$0	Witnesses observed funnel touch down briefly near Biltmore Village.
Asheville	5/6/1999	F1	0/0	$250,000	Two lines of strong and severe thunderstorms moved across the mountains during the early morning hours, causing a considerable amount of wind damage. One severe thunderstorm spawned a weak tornado in the city of Asheville around sunrise. Along the 2-mile damage path, 500 trees were downed, many on homes and vehicles. A garage was destroyed, roofs were blown partially off a couple buildings, a school roof was damaged, and some condos were condemned from tree damage. Elsewhere in the mountains, damaging thunderstorm winds of nearly 70 mph at times blew numerous trees down, many on houses and cars. A few thousand people were left without power. In addition to damaging wind, a few reports of dime to quarter size hail were received. Intense lightning in Robbinsville knocked out the Graham county 911 system for the entire day, and wind gusts near 55 mph blew numerous small limbs onto power lines which resulted in additional power outages across the county.

Source: NCEI

Also, according to the Campus Hazard Mitigation Planning Team, mircrobursts (wind shear) have caused issues on campus in the past.

Thunderstorms

According to NCEI, there have been 167 reported thunderstorm and high wind events since 1959 in Buncombe County[4]. These events caused $448 thousand (2019 dollars) in damages. In addition, NCEI reported one death and nine injuries as a result of thunderstorm wind events. **Table C.12** summarizes this information.

[4] 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 Buncombe County. As additional local data becomes available, this hazard profile will be amended.

TABLE C.12: HISTORICAL THUNDERSTORM IMPACTS IN BUNCOMBE COUNTY

Location	Date	Deaths	Injuries	Property Damage
BUNCOMBE COUNTY	5/22/1959	0	0	$0
BUNCOMBE COUNTY	7/24/1964	0	0	$0
BUNCOMBE COUNTY	6/28/1966	0	0	$0
BUNCOMBE COUNTY	7/4/1970	0	0	$0
BUNCOMBE COUNTY	6/10/1982	0	0	$0
BUNCOMBE COUNTY	3/8/1984	1	1	$0
BUNCOMBE COUNTY	8/21/1985	0	0	$0
BUNCOMBE COUNTY	6/1/1987	0	0	$0
BUNCOMBE COUNTY	6/23/1988	0	0	$0
BUNCOMBE COUNTY	7/10/1988	0	0	$0
BUNCOMBE COUNTY	7/10/1988	0	0	$0
BUNCOMBE COUNTY	6/4/1989	0	0	$0
BUNCOMBE COUNTY	7/25/1989	0	0	$0
BUNCOMBE COUNTY	6/8/1990	0	0	$0
BUNCOMBE COUNTY	4/9/1991	0	1	$0
BUNCOMBE COUNTY	7/24/1991	0	0	$0
BUNCOMBE COUNTY	8/6/1991	0	0	$0
BUNCOMBE COUNTY	8/11/1992	0	0	$0
BUNCOMBE COUNTY	8/11/1992	0	0	$0
Asheville	8/20/1993	0	0	$0
LEICESTER	1/24/1996	0	0	$25,000
ASHEVILLE	6/15/1996	0	0	$0
LEICESTER	6/24/1996	0	0	$0
ASHEVILLE	7/26/1996	0	1	$0
WEAVERVILLE	6/13/1997	0	0	$0
WOODFIN	7/4/1997	0	3	$0
MONTREAT	7/4/1997	0	0	$0
ASHEVILLE	7/28/1997	0	0	$0
ASHEVILLE	3/20/1998	0	0	$0
ENKA	4/16/1998	0	0	$0
SWANNANOA	6/22/1998	0	0	$0
SWANNANOA	7/21/1998	0	0	$0
SKYLAND	1/23/1999	0	0	$0
ASHEVILLE	1/23/1999	0	0	$15,000
SWANNANOA	5/6/1999	0	0	$0
LEICESTER	5/7/1999	0	0	$0
WEAVERVILLE	7/24/1999	0	0	$0
FAIRVIEW	5/13/2000	0	0	$0
CANDLER	5/25/2000	0	0	$50,000

Location	Date	Deaths	Injuries	Property Damage
CANDLER	6/3/2000	0	0	$0
ASHEVILLE	6/25/2000	0	0	$0
WEAVERVILLE	6/25/2000	0	0	$0
BLACK MTN	6/25/2000	0	0	$0
WEAVERVILLE	7/14/2000	0	0	$0
CANDLER	8/10/2000	0	0	$0
JUPITER	4/1/2001	0	0	$20,000
SKYLAND	5/19/2001	0	0	$0
FAIRVIEW	5/19/2001	0	0	$0
CANDLER	5/19/2001	0	0	$0
ASHEVILLE	6/22/2001	0	0	$0
ASHEVILLE	7/3/2001	0	0	$0
WEAVERVILLE	7/8/2001	0	0	$0
ASHEVILLE	7/8/2001	0	0	$0
ASHEVILLE	7/8/2001	0	0	$0
LEICESTER	7/8/2001	0	0	$0
SKYLAND	7/8/2001	0	0	$0
LEICESTER	10/25/2001	0	0	$0
ASHEVILLE	3/17/2002	0	0	$1,000
JUPITER	5/2/2002	0	0	$0
SKYLAND	5/2/2002	0	0	$0
ASHEVILLE	5/2/2002	0	0	$0
COUNTYWIDE	5/13/2002	0	0	$3,000
LEICESTER	6/4/2002	0	0	$0
ASHEVILLE	6/5/2002	0	0	$5,000
BLACK MTN	6/13/2002	0	0	$1,000
ASHEVILLE	7/2/2002	0	0	$0
WEAVERVILLE	7/4/2002	0	1	$0
LEICESTER	5/2/2003	0	0	$3,000
ASHEVILLE	5/2/2003	0	0	$100,000
BLACK MTN	5/2/2003	0	0	$0
ARDEN	6/8/2003	0	0	$0
WEAVERVILLE	6/15/2003	0	0	$1,000
FAIRVIEW	7/12/2003	0	0	$1,000
LEICESTER	7/13/2003	0	0	$0
BARNARDSVILLE	7/22/2003	0	0	$0
ARDEN	8/1/2003	0	0	$5,000
WEAVERVILLE	8/4/2003	0	0	$3,000
ENKA	8/4/2003	0	0	$20,000
CANDLER	5/22/2004	0	0	$20,000
LEICESTER	5/31/2004	0	0	$0
LEICESTER	6/12/2004	0	0	$5,000

Location	Date	Deaths	Injuries	Property Damage
LEICESTER	7/5/2004	0	0	$0
ASHEVILLE	8/11/2004	0	0	$0
COUNTYWIDE	5/20/2005	0	0	$0
ASHEVILLE	7/27/2005	0	0	$0
ENKA	5/20/2006	0	0	$0
CANDLER	5/30/2006	0	0	$0
ASHEVILLE	6/11/2006	0	0	$0
ASHEVILLE	6/11/2006	0	0	$0
CANDLER	7/4/2006	0	0	$0
ASHEVILLE	8/10/2006	0	0	$0
ASHEVILLE	6/15/2007	0	0	$0
BLACK MTN	6/26/2007	0	0	$0
ASHEVILLE	6/28/2007	0	0	$0
SKYLAND	7/19/2007	0	0	$0
ASHEVILLE	7/27/2007	0	0	$0
WOODFIN	8/21/2007	0	0	$0
LEICESTER	1/30/2008	0	0	$0
ASHEVILLE	3/4/2008	0	0	$0
OAKLEY	5/3/2009	0	0	$0
FAIRVIEW	6/8/2009	0	0	$0
LEICESTER	6/11/2009	0	0	$0
FORKS OF IVY	6/16/2009	0	0	$0
LEICESTER	6/17/2009	0	0	$0
ASHEVILLE AIRPARK AR	6/18/2009	0	0	$0
ROYAL PINES	7/28/2009	0	0	$0
ROYAL PINES	7/28/2009	0	0	$0
FAIRVIEW	8/5/2009	0	0	$0
ROCKVIEW	8/5/2009	0	0	$0
BEVERLY HILLS	6/21/2010	0	0	$0
JUGTOWN	7/20/2010	0	0	$0
ROYAL PINES	7/25/2010	0	0	$0
BINGHAM HGTS	8/5/2010	0	0	$0
MIDWAY	8/5/2010	0	0	$0
MURPHY JCT	4/4/2011	0	0	$0
SWANNANOA	5/3/2011	0	2	$0
BOSWELL	6/8/2011	0	0	$0
BEVERLY HILLS	6/9/2011	0	0	$0
FLAT CREEK	6/10/2011	0	0	$0
SKYLAND	6/12/2011	0	0	$0
CANTO	6/18/2011	0	0	$0
WEAVERVILLE	7/4/2011	0	0	$0

Location	Date	Deaths	Injuries	Property Damage
BILTMORE	9/2/2011	0	0	$0
JUPITER	4/1/2012	0	0	$0
ASHEVILLE	4/26/2012	0	0	$30,000
WOODFIN	6/22/2012	0	0	$0
SHUMON	7/3/2012	0	0	$0
LEICESTER	7/5/2012	0	0	$0
WOODFIN	7/6/2012	0	0	$0
WEAVERVILLE	7/6/2012	0	0	$0
VOLGA	7/6/2012	0	0	$0
BARNARDSVILLE	8/10/2012	0	0	$0
AVERY CREEK	5/22/2013	0	0	$0
FAIRVIEW	6/9/2013	0	0	$0
BARNARDSVILLE	7/9/2013	0	0	$0
ASHEVILLE	5/23/2014	0	0	$100,000
WEAVERVILLE	7/2/2014	0	0	$0
BINGHAM HGTS	7/27/2014	0	0	$0
WEAVERVILLE	7/27/2014	0	0	$0
OTEEN	7/27/2014	0	0	$0
NEW BRIDGE	9/1/2014	0	0	$0
MIDWAY	6/21/2015	0	0	$0
OAK FOREST	7/14/2015	0	0	$0
KENNWORTH	7/20/2015	0	0	$0
SAND HILL	8/14/2015	0	0	$5,000
BEVERLY HILLS	8/22/2015	0	0	$0
JUPITER	6/4/2016	0	0	$0
NEW BRIDGE	7/5/2016	0	0	$0
FAIRVIEW	7/6/2016	0	0	$0
LEICESTER	7/6/2016	0	0	$0
LEICESTER	7/7/2016	0	0	$10,000
WEAVERVILLE	7/14/2016	0	0	$5,000
CANDLER HGTS	4/3/2017	0	0	$10,000
JUGTOWN	5/27/2017	0	0	$0
WEST ASHEVILLE	7/5/2017	0	0	$0
SHILOH	7/14/2017	0	0	$0
FAIRVIEW	7/14/2017	0	0	$0
BOSWELL	7/14/2017	0	0	$0
CANDLER	5/31/2018	0	0	$0
OTEEN	6/24/2018	0	0	$0
LEICESTER	6/25/2018	0	0	$0
LEICESTER	6/26/2018	0	0	$5,000
ROCKVIEW	8/8/2018	0	0	$0
SANDYMUSH	6/21/2019	0	0	$0

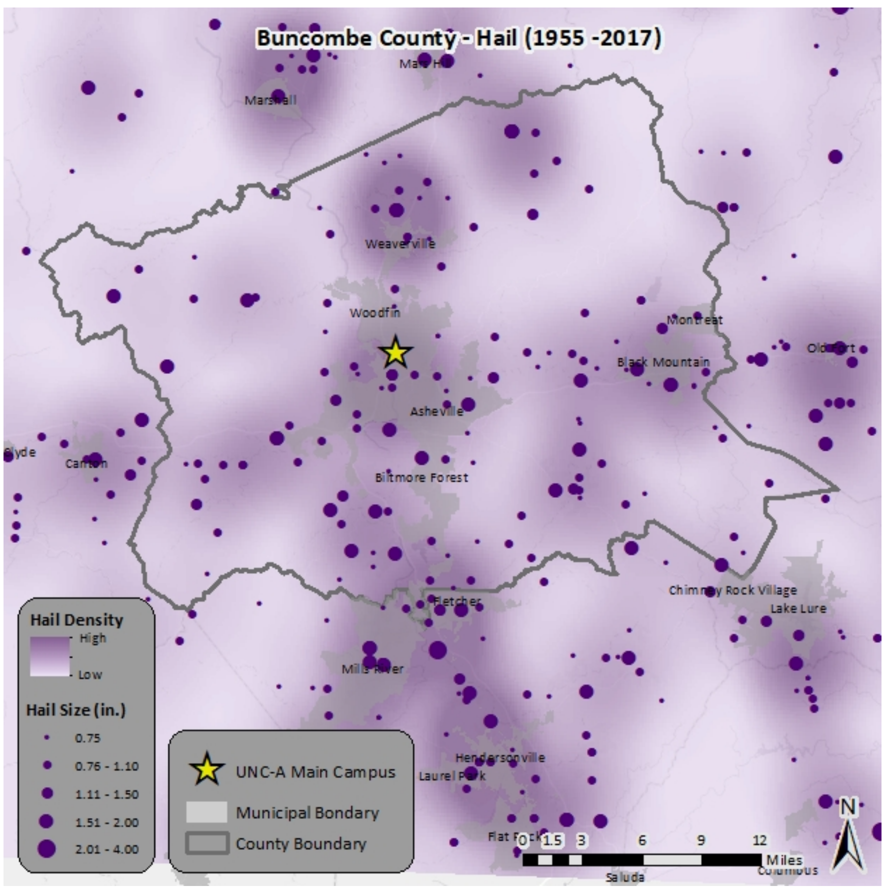
Location	Date	Deaths	Injuries	Property Damage
SKYLAND	8/19/2019	0	0	$5,000
SANDYMUSH	8/22/2019	0	0	$0
BEAVERDAM	1/11/2020	0	0	$0

Source: NCEI

Hailstorms

According to the National Centers for Environmental Information, 188 recorded hailstorm events have affected Buncombe County since 1962 summarized in **Table C.13.** [5] In all, hail occurrences resulted in $5,000 (2020 dollars) in property damages. Hail ranged in diameter from 0.75 inches to 2 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. **Figure C.6** shows a map of hailstorm occurrences in Buncombe County.

FIGURE C.6: HAIL OCCURANCES IN BUNCOMBE COUNTY



Source: NCEI

[5] 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 Buncombe County. 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 C.13: HISTORICAL HAIL OCCURANCES IN BUNCOMBE COUNTY

Location	Date	Magnitude (inches)	Deaths	Injuries	Property Damage
BUNCOMBE COUNTY	5/27/1962	1.75	0	0	$0
BUNCOMBE COUNTY	4/26/1982	1.75	0	0	$0
BUNCOMBE COUNTY	4/26/1982	1.75	0	0	$0
BUNCOMBE COUNTY	5/28/1982	1.5	0	0	$0
BUNCOMBE COUNTY	5/29/1982	1.5	0	0	$0
BUNCOMBE COUNTY	4/14/1984	1.75	0	0	$0
BUNCOMBE COUNTY	6/7/1985	1	0	0	$0
BUNCOMBE COUNTY	7/10/1985	0.75	0	0	$0
BUNCOMBE COUNTY	5/29/1987	1.75	0	0	$0
BUNCOMBE COUNTY	6/24/1988	0.75	0	0	$0
BUNCOMBE COUNTY	7/16/1988	0.75	0	0	$0
BUNCOMBE COUNTY	4/28/1989	0.75	0	0	$0
BUNCOMBE COUNTY	6/2/1989	1	0	0	$0
BUNCOMBE COUNTY	6/26/1989	0.75	0	0	$0
BUNCOMBE COUNTY	6/8/1990	1.5	0	0	$0
BUNCOMBE COUNTY	8/21/1990	0.75	0	0	$0
BUNCOMBE COUNTY	4/29/1991	0.75	0	0	$0
Barnardsville	8/25/1993	1	0	0	$0
Avery's Creek	6/9/1995	1.75	0	0	$0
Weaverville	6/17/1995	1.75	0	0	$0
ASHEVILLE	4/20/1996	0.75	0	0	$0
WEST HAVEN	5/24/1996	0.75	0	0	$0
ASHEVILLE	6/15/1996	0.75	0	0	$0
ASHEVILLE	6/15/1996	1	0	0	$0
LEICESTER	6/24/1996	0.88	0	0	$0
ASHEVILLE	6/24/1996	1.75	0	0	$0
AVERY CREEK	6/24/1996	0.75	0	0	$0
ASHEVILLE	7/26/1996	1.5	0	0	$0
CANDLER	6/2/1997	1	0	0	$0
ASHEVILLE	6/2/1997	0.75	0	0	$0
ASHEVILLE	6/2/1997	0.88	0	0	$0
SKYLAND	4/8/1998	0.75	0	0	$0
ENKA	4/16/1998	2	0	0	$0
BARNARDSVILLE	5/7/1998	1.75	0	0	$0
BARNARDSVILLE	5/7/1998	1.75	0	0	$0
BARNARDSVILLE	5/7/1998	1.75	0	0	$0
SWANNANOA	6/22/1998	0.75	0	0	$0
SWANNANOA	7/21/1998	0.75	0	0	$0
ASHEVILLE	5/6/1999	0.75	0	0	$0

Location	Date	Magnitude (inches)	Deaths	Injuries	Property Damage
ASHEVILLE	5/7/1999	0.88	0	0	$0
ASHEVILLE	5/7/1999	1.25	0	0	$0
ASHEVILLE	5/7/1999	1.25	0	0	$0
FAIRVIEW	6/2/1999	1	0	0	$0
FAIRVIEW	5/13/2000	1	0	0	$0
CANDLER	8/10/2000	0.75	0	0	$0
ASHEVILLE	9/4/2000	0.75	0	0	$0
ASHEVILLE	10/25/2000	0.25	0	0	$0
ASHEVILLE	6/22/2001	1.75	0	0	$0
LEICESTER	6/25/2001	1	0	0	$0
ASHEVILLE	6/4/2002	1.25	0	0	$5,000
SANDYMUSH	6/4/2002	1	0	0	$0
ASHEVILLE	6/4/2002	0.75	0	0	$0
ASHEVILLE	6/4/2002	0.75	0	0	$0
LEICESTER	6/4/2002	1.75	0	0	$0
WEAVERVILLE	6/4/2002	1.75	0	0	$0
MONTREAT	6/4/2002	0.75	0	0	$0
LEICESTER	6/20/2002	0.75	0	0	$0
SWANNANOA	7/1/2002	0.88	0	0	$0
ENKA	7/2/2002	0.75	0	0	$0
WEAVERVILLE	5/15/2003	1.75	0	0	$0
ASHEVILLE	5/15/2003	1	0	0	$0
ASHEVILLE	5/15/2003	1	0	0	$0
ASHEVILLE	5/15/2003	1.75	0	0	$0
FAIRVIEW	5/15/2003	1.75	0	0	$0
WEAVERVILLE	5/15/2003	0.75	0	0	$0
SWANNANOA	7/12/2003	0.75	0	0	$0
ASHEVILLE	7/21/2003	0.75	0	0	$0
WEAVERVILLE	8/4/2003	0.75	0	0	$0
ENKA	8/4/2003	1.75	0	0	$0
BLACK MTN	5/9/2004	0.88	0	0	$0
ASHEVILLE	6/5/2005	0.88	0	0	$0
AVERY CREEK	7/27/2005	0.75	0	0	$0
ASHEVILLE	7/27/2005	0.88	0	0	$0
LEICESTER	8/4/2005	0.75	0	0	$0
ALEXANDER	4/3/2006	1	0	0	$0
WEAVERVILLE	4/3/2006	0.88	0	0	$0
ASHEVILLE	4/3/2006	0.75	0	0	$0
BLACK MTN	4/3/2006	0.75	0	0	$0
ASHEVILLE AIRPARK AR	4/19/2006	0.75	0	0	$0

Location	Date	Magnitude (inches)	Deaths	Injuries	Property Damage
BLACK MTN	5/13/2006	0.75	0	0	$0
ASHEVILLE	6/11/2006	0.75	0	0	$0
ASHEVILLE	6/11/2006	0.88	0	0	$0
BLACK MTN	7/20/2006	0.75	0	0	$0
CANDLER	8/10/2006	1	0	0	$0
WEAVERVILLE	8/10/2006	0.75	0	0	$0
WEAVERVILLE	3/28/2007	0.75	0	0	$0
BLACK MTN	4/19/2007	1	0	0	$0
FAIRVIEW	6/8/2007	1.75	0	0	$0
WEAVERVILLE	6/12/2007	1	0	0	$0
ASHEVILLE	6/12/2007	0.88	0	0	$0
ASHEVILLE	6/12/2007	1.75	0	0	$0
BARNARDSVILLE	6/15/2007	0.75	0	0	$0
WEAVERVILLE	6/15/2007	0.88	0	0	$0
ASHEVILLE	6/15/2007	1	0	0	$0
CANDLER	6/24/2007	1.5	0	0	$0
CANDLER	6/24/2007	0.88	0	0	$0
FAIRVIEW	6/24/2007	0.88	0	0	$0
BARNARDSVILLE	6/27/2007	0.75	0	0	$0
WEAVERVILLE	7/10/2007	0.75	0	0	$0
SKYLAND	7/19/2007	0.75	0	0	$0
ASHEVILLE	8/24/2007	0.88	0	0	$0
BLACK MTN	6/7/2008	0.75	0	0	$0
ASHEVILLE	6/10/2008	0.75	0	0	$0
CANDLER	6/10/2008	1	0	0	$0
CANDLER	6/10/2008	0.75	0	0	$0
WEAVERVILLE	6/26/2008	0.88	0	0	$0
ROYAL PINES	9/30/2008	0.75	0	0	$0
MIDWAY	4/24/2009	0.75	0	0	$0
SHUMON	5/9/2009	0.75	0	0	$0
JUPITER	5/28/2009	0.75	0	0	$0
GROVEMONT	6/2/2009	0.75	0	0	$0
FAIRVIEW	6/2/2009	1.25	0	0	$0
FAIRVIEW	6/8/2009	1	0	0	$0
BLACK MTN	6/9/2009	0.75	0	0	$0
MIDWAY	6/10/2009	1	0	0	$0
ASHEVILLE AIRPARK AR	6/18/2009	0.88	0	0	$0
WEAVERVILLE	7/20/2009	0.75	0	0	$0
PAINT FORK	7/20/2009	0.88	0	0	$0
ARDEN	8/5/2009	0.75	0	0	$0

Location	Date	Magnitude (inches)	Deaths	Injuries	Property Damage
STOCKSVILLE	8/5/2009	0.75	0	0	$0
WEAVERVILLE	9/9/2009	0.75	0	0	$0
MURPHY JCT	9/9/2009	0.75	0	0	$0
DILLINGHAM	5/14/2010	1	0	0	$0
WEST ASHEVILLE	5/14/2010	1	0	0	$0
BEVERLY HILLS	5/14/2010	0.75	0	0	$0
FAIRVIEW	5/14/2010	0.75	0	0	$0
GROVEMONT	5/14/2010	1	0	0	$0
FAIRVIEW	5/14/2010	1	0	0	$0
DUNSMORE	7/26/2010	1	0	0	$0
WEAVERVILLE	4/9/2011	1	0	0	$0
WEAVERVILLE	4/9/2011	0.88	0	0	$0
BARNARDSVILLE	4/9/2011	0.75	0	0	$0
BARNARDSVILLE	4/9/2011	0.88	0	0	$0
RIDGECREST	4/9/2011	0.88	0	0	$0
WALKERTOWN	4/9/2011	0.88	0	0	$0
BLACK MTN	5/3/2011	0.75	0	0	$0
AVERY CREEK	5/12/2011	0.75	0	0	$0
FAIRVIEW	5/13/2011	1	0	0	$0
ASHEVILLE	5/13/2011	1	0	0	$0
STONY FORK	6/2/2011	1	0	0	$0
CANDLER	6/8/2011	0.75	0	0	$0
SAND HILL	6/8/2011	1	0	0	$0
BOSWELL	6/8/2011	1	0	0	$0
BEVERLY HILLS	6/9/2011	1	0	0	$0
FLAT CREEK	6/10/2011	0.75	0	0	$0
BILTMORE	6/15/2011	1.75	0	0	$0
AVERY CREEK	6/21/2011	1.25	0	0	$0
BOSWELL	6/21/2011	1	0	0	$0
WILSON	4/5/2012	1	0	0	$0
ASHEVILLE	4/5/2012	1	0	0	$0
ASHEVILLE	4/17/2012	0.88	0	0	$0
SWANNANOA	4/26/2012	0.88	0	0	$0
BLACK MTN	4/26/2012	0.88	0	0	$0
CANDLER	4/26/2012	1	0	0	$0
CANDLER	4/26/2012	0.88	0	0	$0
SKYLAND	4/26/2012	0.88	0	0	$0
BILTMORE	4/26/2012	1.75	0	0	$0
LEICESTER	4/30/2012	1	0	0	$0
STOCKSVILLE	4/30/2012	0.75	0	0	$0
WEAVERVILLE	4/30/2012	1	0	0	$0

Location	Date	Magnitude (inches)	Deaths	Injuries	Property Damage
WEAVERVILLE	5/17/2012	1	0	0	$0
WEST ASHEVILLE	5/17/2012	0.75	0	0	$0
MIDWAY	5/19/2012	1	0	0	$0
WEAVERVILLE	5/21/2012	0.75	0	0	$0
BLACK MTN	6/22/2012	1	0	0	$0
BILTMORE FOREST	6/22/2012	0.88	0	0	$0
SHUMON	7/3/2012	1	0	0	$0
SHUMON	7/3/2012	1	0	0	$0
MONTREAT	8/10/2012	0.88	0	0	$0
FAIRVIEW	5/21/2013	0.88	0	0	$0
FAIRVIEW	5/21/2013	1	0	0	$0
AVERY CREEK	5/22/2013	0.88	0	0	$0
WALKERTOWN	6/16/2014	1	0	0	$0
LEICESTER	6/18/2014	1	0	0	$0
WEAVERVILLE	6/19/2014	0.75	0	0	$0
WEAVERVILLE	7/2/2014	1	0	0	$0
NEW BRIDGE	7/2/2014	1	0	0	$0
WEST HAVEN	6/18/2015	1.75	0	0	$0
WILSON	6/19/2015	0.75	0	0	$0
DILLINGHAM	5/1/2016	1	0	0	$0
MONTREAT	5/1/2016	1.5	0	0	$0
BLUE RIDGE	5/2/2016	0.75	0	0	$0
JUPITER	5/12/2016	0.75	0	0	$0
GROVESTONE	7/8/2016	0.75	0	0	$0
GROVESTONE	7/8/2016	1.75	0	0	$0
SHILOH	7/14/2017	0.75	0	0	$0
GROVEMONT	5/5/2018	0.75	0	0	$0
SKYLAND	8/19/2019	0.88	0	0	$0

Source: NCEI

Lightning

According to the National Centers for Environmental Information, there have been a total of 14 recorded lightning events in Buncombe County since 1996[6]. These events resulted in $225,000 (2020 dollars) in damages, as listed in summary **Table C.14**. Furthermore, lightning caused one injury in the County.

It is certain that more than 14 events have impacted the County. Many of the reported events are those

[6] 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 Buncombe County. The State Fire Marshall's office was also contacted for additional information but none could be provided. As additional local data becomes available, this hazard profile will be amended.

that caused damage. Therefore, it should be expected that damages are likely much higher for this hazard than what is reported.

TABLE C.14: HISTORICAL LIGHTNING IMPACTS IN BUNCOMBE COUNTY

Location	Date	Deaths/Injuries	Property Damage	Details
WEST ASHEVILLE	1/24/1996	0/0	$0	Lightning struck a home in Buncombe county causing a small fire and some damage.
LEICESTER	5/6/1996	0/0	$20,000	Lightning struck and partially burned a mobile home and also struck several other residences. Similar strikes also occurred in Asheville.
ASHEVILLE	8/29/1996	0/1	$0	Lightning injured one person.
HOMINY	6/21/1997	0/0	$70,000	A couple of severe thunderstorms developed in the mountains in the afternoon causing large hail south of Franklin and blowing down trees between Marshall and Hot Springs. A number of trees and power lines were downed at several locations in the foothills and piedmont. The most damage occurred in Hickory where numerous trees and power lines were downed. Caldwell county was hit hard. A cabinet shop and contents burned after being struck by lightning. Thunderstorm winds caused some damage, then high winds following the storm caused trees to fall in the Cajah's Mountain area. Lightning caused a fire in Buncombe county which destroyed a home.
ALEXANDER	7/21/1997	0/0	$50,000	Lightning sparked a house fire.
ASHEVILLE	8/14/1999	0/1	$0	Lightning struck a person near a dumpster and burned their arm.
ENKA	8/18/2000	0/0	$25,000	Lightning struck a nearby tree, ran into a house, and ignited a fire which burned the house and its contents.
ASHEVILLE	6/20/2001	0/0	$15,000	Lightning struck an unoccupied house, causing a fire that resulted in serious damage.
SKYLAND	7/3/2001	0/0	$15,000	Lightning started a fire at a power transformer, destroying the building which was located at a power plant and a car belonging to one of the power plant employees.
BLACK MTN	6/3/2002	0/0	$50,000	Lightning struck the Public Safety bldg., City Hall, the Fire Station, and 4 residences. One residence suffered a major fire and considerable damage.
WEAVERVILLE	7/12/2003	0/1	$0	A man was seriously injured when he was struck by lightning while standing next to a tree at Reems Creek.
ASHEVILLE	7/14/2006	0/4	$0	Four people, 3 adults and 1 child, received minor injuries from a lightning strike at the Biltmore Estate.
FAIRVIEW	6/8/2009	1/0	$0	A 65-year-old man was struck and killed by lightning on highway 74E just south of Fairview.
AVERY CREEK	2/28/2011	0/0	$10,000	Lightning struck a home on Owenby Lane, igniting a fire.

Source: NCEI

C.5.4.3 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 University of North Carolina at Asheville experience a direct tornado strike. The probability of future tornado occurrences affecting University of North Carolina at Asheville 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 University of North Carolina at Asheville 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 Buncombe County 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), University of North Carolina at Asheville 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 are 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.

C.5.5 SEVERE WINTER WEATHER

C.5.5.1 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. University of North Carolina at Asheville 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.

C.5.5.2 Historical Occurrences

Winter weather has resulted in three disaster declarations Buncombe County. This includes a severe snowfall and winters storm event in 1993 and the Blizzard of 1996[7]. According to the National Centers for Environmental Information, there have been a total of 178 recorded winter storm events Buncombe

[7] A complete listing of historical disaster declarations, including the affected counties, can be found in Section 4: *Hazard Identification*.

County since 1996 (**Table C.15**)[8]. Although there have been a significant number of events in Buncombe County, there were only $250 (2020 dollars) in damages reported.

TABLE C.15: WINTER STORM EVENTS IN BUNCOMBE COUNTY

Date	Deaths/Injuries	Property Damage	Description
1/6/1996	0/0	$0	Snow began early in the morning and by mid-day had reached heavy criteria over part of the mountains with accumulations exceeding 6 inches in some areas. Remaining mountain locations picked up heavy snow accumulations a bit later in the afternoon. At the start of the storm the snow was very wet and accumulations caused power outages in some places. The heavy snow continued through the night and into the next day. Accumulations in the mountains ranged from 4 to 12 inches over the central and southern mountains with 18 to 30 inches in the northern mountains. Brutally cold conditions followed the snow with very windy conditions reported. Blizzard conditions may have been reached in some areas. Extreme cold followed the storm in much of the mountains with wind chills of 20 to 30 below zero.
1/11/1996	0/0	$0	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.
2/1/1996	0/0	$0	Rain began to freeze causing slick roads. Ice also began to accumulate on trees and power lines but did not yet reach damaging accumulations.
2/7/1996	0/0	$0	Light snow fell accumulating to a couple of inches especially at higher elevations.
2/11/1996	0/0	$0	Light snow began across the mountains. The snow persisted on and off for more than 24 hours.
2/16/1996	0/0	$0	Snow fell and accumulated to several inches with heavier amounts in the northern mountains.
12/5/1996	0/0	$0	N/A
2/10/1997	0/0	$0	High elevation snow accumulated 1 to 2 1/2 inches.
2/13/1997	0/0	$0	N/A
12/5/1997	0/0	$0	Light snow in a strong northwest flow lasted for over 24 hours and resulted in a general 1-3 inch snowfall across the counties bordering Tennessee. Heavier snow showers over the last 6 hours, during the early morning of the 6th, resulted in total accumulations in the high elevations from Madison county to Avery county, of 4-6 inches.

[8] These ice and winter storm events are only inclusive of those reported by the National Centers for Environmental Information (NCEI). It is likely that additional winter storm conditions have affected Buncombe County.

Date	Deaths/Injuries	Property Damage	Description
12/8/1997	0/0	$0	A mix of snow, sleet and freezing rain spread from west to east across the mountains, foothills and some piedmont counties of North Carolina. One to three inches of snow fell in the northern mountains. One to two inches of snow and sleet fell in the central and southern mountains and was topped off with some freezing rain. A thin coating of ice from sleet and freezing rain covered areas east of the mountains. Roads were very treacherous, especially in the central and southern mountains. Numerous accidents were reported, including a six-tractor trailer pile up on Interstate 40 near Candler.
12/27/1997	0/0	$0	Snow accumulated in general, up to 3 inches across the mountains, except for some of the higher elevations, where 4-6 inches were common.
1/18/1998	0/0	$0	Snow fell across mainly the high elevations of the mountains and northern foothills. The snow began lightly, accumulating at least 1-3 inches across the entire area by the early morning of the 19th. However, several high elevation locations began to receive heavy snow by midnight. Before the snow ended at 6 am on the 19th, some of these locations had between 4 and 7 inches.
2/3/1998	0/0	$0	A strong slow-moving winter storm moved from the Gulf of Mexico north through the Carolinas on the 3rd and 4th, bringing with it heavy rain, snow and high winds. Snow accumulated between 1 and 3 inches across the higher elevations of the mountains by early afternoon on the 3rd. Newland, Beech Mountain and Jonas Ridge had 4 inches of snow by early evening. Mount Mitchell ended up with 20 inches of snow. Roads were icy across the higher elevations and contributed to some wrecks. Heavy rain in Candler early in the morning caused a mobile home to collapse, destroying its' contents. Flooding developed across portions of the mountains during the afternoon as creeks overflowed, covering roads in many areas. High gradient winds between strong high pressure in the upper Midwest and the passing strong low pressure combined with wet ground conditions to down numerous trees and power lines. Power outages and blocked roads were common into the evening hours. A building collapsed in Statesville due to the wind.
3/3/1998	0/0	$0	Moisture trapped in a broad cyclonic flow across the eastern U.S. combined with temperatures hovering around the freezing mark to produce another light snowfall of 1 to 3 inches. Again, mainly at high elevations.
3/11/1998	0/0	$0	Winter made one last charge into the mountains late on the 11th, as very cold and windy conditions accompanied a general 1 to 2-inch snowfall. A few counties received higher amounts, especially in Avery, Graham and Haywood counties where 4 to 6 inches of snow fell.
2/13/1999	0/0	$0	Low-level moisture in a strong northwest flow was lifted over the mountains of North Carolina, resulting in light snow as far east as the high elevations of some of the foothills. Accumulations ranged between 1 and 3 inches. Cold temperatures and strong winds combined to produce near zero wind chills for much of the day.

Date	Deaths/Injuries	Property Damage	Description
2/23/1999	0/0	$0	An upper level disturbance brought just enough moisture and lift across western North Carolina to produce light snow across portions of the area. Accumulations were generally between 1 and 2 inches, although Little Switzerland reported 3 to 4 inches. Hundreds of traffic accidents occurred, with some injuries resulting, as conditions rapidly deteriorated and became slick in a span of 20 minutes. Interstate 40 was blocked for a while due to several multi-car pile-ups.
2/24/1999	0/0	$0	Weakening surface low pressure moving into the Ohio and Tennessee Valleys spread light snow east across western North Carolina early on the 24th. Most counties received between a dusting and one inch. However, there was one band of 2 to 3 inch accumulations that stretched from the central part of the mountains across the foothills and into the piedmont near Statesville. Numerous traffic accidents occurred even where only 1/2 inch of snow accumulated.
3/3/1999	0/0	$0	Light snow developed in a cold northwest flow behind a cold front and accumulated between 1 and 3 inches.
3/9/1999	0/0	$0	Strong low pressure moved north through the Mississippi River Valley with associated moisture streaming north across the Southeastern States. Cold, dry air was already in place across western North Carolina and caused a mixture of heavy sleet, snow and freezing rain across much of the mountains. Much of the above counties received 1 to 2 inches of sleet before the precipitation changed to snow and added another couples inches. The Highlands area in Macon county received 4 to 5 inches of snow.
4/29/1999	0/0	$0	A deep slow moving closed upper low moved across the southern Appalachians and Mid-Atlantic States on the 29th and 30th. Unseasonably cold air accompanying this closed low produced snow which accumulated at elevations above 3000 feet. By late morning on the 30th, 1 to 3 inches of snow was common. Snow fell a little heavier on the highest peaks where 6 to 12 inches accumulated. Due to warm road surface temperatures, roads did not become hazardous.
12/24/1999	0/0	$0	Low pressure moving east-southeast across Tennessee and North Carolina produced light snow from just after sunrise through much of the afternoon. The only significant accumulations were in the high mountains north and west of Asheville, where 1 to 3 inches of snow fell. A couple of mountain peaks reported 4 or 5 inches. A dusting to and inch or so of snow in the rest of the mountains caused extremely slick roads and numerous traffic accidents (69 in a 12-hour period) were reported. Enough Christmas Eve snow fell in parts of the foothills and piedmont to be noticeable, but any light accumulation melted quickly.
1/16/2000	0/0	$0	A quick burst of freezing rain and sleet caused numerous traffic accidents across the mountains. The precipitation was light - less than a tenth of an inch in most places, but as high as one third inch near Robbinsville.
12/13/2000	0/0	$0	N/A
4/17/2001	0/0	$0	N/A

Date	Deaths/Injuries	Property Damage	Description
2/6/2002	0/0	$0	Light snow and sleet fell for much of the day. Up to 2 inches of accumulation was reported in a few locations, while most areas had only a dusting. By late afternoon, most locations had changed over to rain.
12/22/2002	0/0	$0	Freezing rain developed during the early morning across the North Carolina mountains, and some roads and bridges became ice covered. A few traffic accidents resulted.
12/25/2002	0/0	$0	Light snow fell throughout the day across the North Carolina mountains, resulting in snowfall amounts of between a trace and 3 inches within the valleys. Four to six-inch amounts were common in the higher elevations from Madison County northward.
1/6/2003	0/0	$0	Light snow fell for much of the day across the western mountains of North Carolina. By evening, 1 to 3 inches had accumulated, mainly in areas above 3000 feet. The snow was accompanied by wind gusts of up to 50 mph.
1/19/2003	0/0	$0	Mainly light snow produced accumulations of 1 to 2 inches across much of the North Carolina mountains, although some high elevation areas along the Tennessee border received 3 to 6 inches, while locations near the Blue Ridge received little more than a dusting. In addition, gusty winds resulted in blowing snow across a portion of the area, with some snow drifts to one-and-a-half feet.
1/26/2003	0/0	$0	Light snow fell across the North Carolina mountains during the evening of the 26th, and by early morning on the 27th, up to 3 inches of snow had accumulated. The heaviest amounts occurred in the highest elevations along the Tennessee border, while locations near the Blue Ridge received little more than a dusting.
2/9/2003	0/0	$0	An extended period of intermittent light snow produced spotty accumulations of 1 to 2 inches within the major valleys of the North Carolina mountains. The higher elevations received as much as 4 inches, especially the highest peaks along the Tennessee border.
2/14/2003	0/0	$0	Light snow fell for much of the day across the northern mountains, and accumulated mainly in the higher elevations. Some of the highest peaks received as much as 5 inches.
2/16/2003	0/0	$0	A light freezing rain developed along the Blue Ridge during the morning hours, and began to intensify during the afternoon. By mid-afternoon, a quarter of an inch of glaze had accumulated across much of the area. The precipitation transitioned to mainly sleet during the late afternoon, and by mid-evening, around an inch of sleet had accumulated on top of the glaze of ice. Numerous traffic accidents and road closures resulted from the precipitation.
2/27/2003	0/0	$0	A light freezing rain developed during the overnight hours in areas from the blue ridge eastward to the I-77 corridor. Light ice accumulations were mainly confined trees, bushes, and automobiles. However, some slick spots did develop on bridges and overpasses, especially in the piedmont.

Date	Deaths/Injuries	Property Damage	Description
3/30/2003	0/0	$0	A light, wet snow developed around midnight across the southern and central mountains, and gradually intensified through dawn. By sunrise, 1 to 2 inches had accumulated across much of the area.
3/30/2003	0/0	$0	After a brief lull, snow redeveloped during the afternoon across the mountains. By midnight, an additional 1 to 3 inches of snow had fallen, mainly in areas along the Tennessee border. Some of the highest peaks received as much as an additional 6 inches.
11/28/2003	0/0	$0	The first significant snowfall of the season dumped 1 to 3 inches of snow in some of the major valleys of the North Carolina mountains, and in the higher elevations of the foothills. As much as 6 inches accumulated in the higher elevations of the Balsams and the Smokies.
12/3/2003	0/0	$0	Light snow, mixed at times with sleet, fell across the North Carolina mountains, accumulating up to an inch in some areas.
12/4/2003	0/0	$0	Heavy snow and sleet began during the early morning hours across the North Carolina mountains, and by late afternoon had accumulated to 3 to 4 inches across much of the area. Some slopes with an eastern exposure had up to 5 inches.
12/5/2003	0/0	$0	Light snow fell across portions of the North Carolina mountains during the evening. Accumulations in most locations were an inch or less, although some locations along the Tennessee border received 2 to 3 inches.
12/18/2003	0/0	$0	Light snow developed during the evening of the 18th across the North Carolina mountains. Accumulations were light during this time, but some icy roads developed in the higher elevations. The snow became heavier late in the evening.
1/9/2004	0/0	$0	Light snow developed across much of western North Carolina during the early morning hours of the 9th. By mid-morning, 1 to 2 inches had accumulated across much of the area. There were some isolated 3-inch amounts in the higher terrain along the Tennessee border. Many roads became slick and hazardous.
2/2/2004	0/0	$0	Light freezing rain developed during the morning hours across the North Carolina mountains. This resulted in a thin layer of glaze that was responsible for numerous traffic accidents.
2/5/2004	0/0	$250	Light freezing rain developed during the afternoon of the 5th across portions of the central and northern mountains, and continued periodically through the morning hours of the 6th. A few slick spots developed on roads, and some isolated power outages were reported.
2/7/2004	0/0	$0	Light snow developed across portions of the North Carolina mountains during the afternoon, and continued into the morning of the 8th. Up to 2 inches accumulated by the time the snow ended.
2/15/2004	0/0	$0	Snow and sleet fell periodically during the afternoon and evening across much of the mountains, northern foothills, and northwest piedmont. Up to 2 inches of snow accumulated across the area, causing slick spots to develop on some roads.

Date	Deaths/Injuries	Property Damage	Description
3/30/2004	0/0	$0	Light snow fell across much of the southern and central mountains, as well as the foothills, but accumulations were generally an inch or less.
12/14/2004	0/0	$0	Snow fell, along with winds sustained at 30 mph gusting to 40 mph, and accumulated generally from 1 to 3 inches across much of the mountains. Areas along the TN state line received the most, with areas around Highlands and Cashiers also receiving similar amounts.
1/16/2005	0/0	$0	Light snow fell across the mountains during the evening hours. Significant accumulations were mainly confined to the ridgetops and high valleys near the Tennessee border where 1 to 3-inch totals were common. However, a dusting was observed as far south and east as Waynesville and the higher elevations of eastern Buncombe County. Roads became very slick and hazardous, and there were several traffic accidents, particularly in the Newland and Banner Elk areas.
1/22/2005	0/0	$0	N/A
1/22/2005	0/0	$0	Light snow fell across the southern and central mountains overnight. The heaviest accumulations occurred near the Tennessee border, where 1-2 inch totals were common. Some of the higher elevations received as much as 4 inches. Accumulations tapered off rapidly toward the east, as locations from Franklin to Waynesville to Asheville received only a dusting. Roads became very slick and hazardous, and there were several traffic accidents, especially on I-40 through Haywood County.
2/2/2005	0/0	$0	Light freezing rain began falling during the evening of the 2nd across the mountains, and continued overnight. By the pre-dawn hours of the 3rd, slick spots had developed on roads, and in excess of 1/8 inch of ice had accumulated on elevated surfaces.
2/10/2005	0/0	$0	Light snow began to fall during the pre-dawn hours across the mountains, and continued off and on for much of the day. Accumulations ranged from a trace to an inch in locations from Bryson City to Waynesville to Asheville. However, locations along the Tennessee border, including the lower end of the French Broad Valley, received as much as 3 inches. Slick roads resulted in quite a few traffic accidents across the area.
2/27/2005	0/0	$0	Wet snow, mixed at times with sleet and rain in the valleys, began to fall during the evening hours across the mountains and northern foothills. By 3 AM, accumulations ranged from 1 to 3 inches across the area. Slick roads resulted in a few traffic accidents.
2/28/2005	0/0	$0	Snow showers redeveloped during the evening of the 28th, continuing off and on through the evening of the 1st. Additional snowfall accumulations of 1 to 2 inches were observed. The higher elevations along the Tennessee border were the main areas affected. However, some valley locations as far east as northern Buncombe and northern Jackson counties received light accumulations.
3/1/2005	0/0	$0	Snow showers redeveloped during the evening of the 28th, continuing off and on through the evening of the 1st. Additional snowfall accumulations of 1 to 2 inches were observed. The higher elevations along the Tennessee border were the main areas affected. However, some valley locations as far east as northern Buncombe and northern Jackson counties received light accumulations.

Date	Deaths/Injuries	Property Damage	Description
3/8/2005	0/0	$0	Snow showers developed behind a cold front across the western mountains during the morning hours and continued through much of the day. By the time the snow tapered off to flurries during the evening, isolated accumulations as high as 6 inches were observed in the higher elevations along the Tennessee border. However, the valleys generally received less than 2 inches.
3/11/2005	0/0	$0	Snow showers developed behind a cold front across the western mountains during the afternoon of the 11th, and continued into the early morning hours of the 12th. By the time the snow ended, accumulations generally ranged from a trace to 2 inches across the area, although isolated higher amounts occurred in the higher elevations.
3/17/2005	0/0	$0	Wet snow, mixed at times with rain and sleet developed during the early morning hours across western North Carolina, and persisted through late morning. By the time the snow ended, accumulations ranged from just a dusting in the southwest mountain valleys and southern piedmont areas, to as much as 3 inches in areas north of I-40. Slushy roads led to a few traffic accidents across the area.
4/2/2005	0/0	$0	Wet snow, heavy at times, developed in the higher elevations of the North Carolina mountains during the morning. By early evening, snowfall amounts ranged from trace amounts to 4 inches, mainly in areas above 3500 feet. By early evening, some of the highest elevations reeached heavy snowfall criteria, mainly above 4000 feet. Light accumulations were reported in locations as low as 3000 feet. Meanwhile, the major valleys received mostly rain.
4/23/2005	0/0	$0	A late season storm brought significant snowfall to the mountains of North Carolina. Accumulations were highly variable across the area, with as much as 8 inches falling in the higher elevations. However, even locations in the lower French Broad Valley observed up to 3 inches.
10/25/2005	0/0	$0	N/A
11/21/2005	0/0	$0	Rain quickly transitioned to heavy snow across the higher elevations of the North Carolina mountains during the evening of the 21st. Snow quickly accumulated to depths of 1 to 3 inches, mainly in areas above about 3500 feet. Highway 441 was closed through the Smokies for a brief period of time. Portions of the Blue Ridge Parkway were also reported to be slick and hazardous. Mainly rain fell in the valleys during this time.
12/3/2005	0/0	$0	Light freezing rain developed in the higher elevations of the mountains during the morning, and continued into the afternoon. Ice accretion was mainly confined to elevated surfaces, but a few slick spots did develop. Locations below about 3500 feet observed mainly rain.
12/8/2005	0/0	$0	N/A
12/15/2005	0/0	$0	Light freezing rain developed around midnight across much of western North Carolina, and gradually intensified overnight. By around sunrise, up to one quarter inch of ice accretion had occurred across much of the area. A few trees and sporadic power outages occurred during this time, but became much more widespread after sunrise.

Date	Deaths/Injuries	Property Damage	Description
1/14/2006	0/0	$0	Snow developed across the mountains during the early morning hours, and was periodically heavy before tapering off to flurries and light snow showers later in the morning and during the afternoon. Total accumulations generally ranged from a trace to 3 inches, although there were some locally heavier amounts in the higher elevations. Accumulating snow extended into the higher elevations of the foothills, with around 3 inches reported at Little Switzerland.
1/30/2006	0/0	$0	Rain changed to snow or a rain and snow mixture across the mountains of North Carolina for a brief period during the evening. In some locations, snow quickly accumulated to 1 to 2 inches before ending, mainly in areas above 3000 feet.
2/8/2006	0/0	$0	N/A
2/11/2006	0/0	$0	N/A
2/18/2006	0/0	$0	The southern valleys saw a mixture of sleet, snow, and rain, while the central valleys and higher elevations saw sleet, snow and freezing rain which developed around sunrise and continued off and on through most of the day. Precipitation amounts were light, but numerous slick spots developed on roads, especially in the higher elevations. Numerous accidents resulted.
3/20/2006	0/0	$0	A brief period of heavy sleet developed across portions of the central mountains, foothills, and western piedmont of North Carolina during the morning. Although there was little or no accumulation, trace amounts of sleet accumulated on some roads, causing several traffic accidents. The precipitation transitioned to rain in the afternoon.
3/22/2006	0/0	$0	Snow developed across the higher elevations of the North Carolina mountains during the evening and persisted through the overnight hours. By the morning of the 23rd, snow had accumulated to 1-3 inches, mainly in areas above 4000 feet.
12/7/2006	0/0	$0	Light snow accumulated to depths ranging from a trace in the valleys to up to 2 inches in the higher elevations near the Tennessee border. The combination of the snow and very cold temperatures caused roads to become very slick and hazardous. Numerous traffic accidents resulted.
1/9/2007	0/0	$0	A combination of snow produced by an upper level disturbance in the morning and scattered snow showers in the afternoon produced pockets of accumulating snowfall in areas near the Blue Ridge. Accumulations were generally in the 0 to 3 inch range. Most of the high elevations received measurable snowfall, while snowfall in the valleys was much more spotty.
1/18/2007	0/0	$0	Widespread light precipitation, mainly in the form of freezing rain, produced light ice accretion, mainly across the foothills and piedmont during the morning hours. Accretion was mainly confined to elevated surfaces, although some slick spots developed on bridges and overpasses. Quite a few traffic accidents occurred, especially in the Charlotte metro area and in the northern North Carolina foothills. A few sporadic power outages were reported. In some areas, mainly across the northwest piedmont, precipitation started out as a combination of sleet and snow, resulting in some light accumulations.

Date	Deaths/Injuries	Property Damage	Description
1/21/2007	0/0	$0	Light rain and freezing rain fell across the mountains for much of the day. Ice accretion was most concentrated in areas along and near the Blue Ridge, where around a tenth of an inch of ice accumulation was common, mainly on trees, power lines, and other elevated surfaces. However, some icy spots did develop on roads, and there were sporadic traffic accidents. In locations west of the Blue Ridge, significant accumulations of ice were mainly confined to the higher elevations, as the valleys warmed above freezing early in the day.
1/28/2007	0/0	$0	A brief period of light snow developed near the Blue Ridge during the late evening. Snowfall amounts were generally a half inch or less, but some slick spots developed on roads.
2/1/2007	0/0	$0	Light snow began during mid-morning across portions of the central and northern mountains, as well as the northern foothills, and continued through much of the morning. By late morning, snowfall accumulations of up to 2 inches had occurred across much of the area.
2/17/2007	0/0	$0	Light to occasionally moderate snow developed across the mountainous areas away from the Tennessee border during the early evening and continued through the overnight hours. Snowfall totals ranged from trace amounts across far southern portions of the area to 2-3 inches further north and west.
4/6/2007	0/0	$0	A record-setting cold airmass, northwest flow, and a strong upper air disturbance resulted in a late season snow shower event across the North Carolina mountains. The showery nature of the event resulted in highly variable snowfall totals across the area, with amounts ranging from a trace to 3 inches in the valleys, with heavier totals reported in the higher elevations along the Tennessee border.
1/1/2008	0/0	$0	Scattered snow showers developed over the western mountains of North Carolina, and as far south and east as the foothills before dissipating during the late evening and overnight hours. By sunrise, accumulations ranged from trace amounts over the lower elevations of the foothills, to 4 inches across the higher elevations of the Blue Ridge mountains.
1/19/2008	0/0	$0	Light rain changed to snow during the morning and afternoon hours across the mountains and foothills. Most locations reported accumulations ranging from trace amounts to less than an inch. However, a few spots received as much as 2-3 inches, particularly along the southern escarpment of the Blue Ridge.
1/31/2008	0/0	$0	Freezing rain developed across the mountains during mid-evening and continued past midnight. Roads became slick and hazardous, with a few traffic accidents reported. During the early morning hours of February 1st, more significant icing developed, but that part of the event will be included in next month's Storm Data.
2/26/2008	0/0	$0	Snow showers developed across the western mountains during the late evening and continued overnight. A few of these showers made it as far east as northern Jackson and northern Buncombe counties, with as much as 3 inches were reported in isolated areas, especially in the higher elevations.

Date	Deaths/Injuries	Property Damage	Description
10/27/2008	0/0	$0	The first mountain snowfall of the season produced accumulations as high as 4 inches, mainly across the higher elevations along the Tennessee border. However, even valley locations as far south and east as Cashiers, Black Mountain, and Brevard saw up to a half inch of snowfall.
11/21/2008	0/0	$0	Light snow showers began falling across the mountains of North Carolina around midnight, and continued off and on through the overnight and morning hours. Total accumulations ranged from trace amounts in the lower elevations near the Blue Ridge to as much as 3 or 4 inches in the higher elevations near the Tennessee border.
12/1/2008	0/0	$0	Snow showers developed during the early morning hours and continued through much of the day across the higher elevations of the Blue Ridge mountains. By late afternoon, accumulations ranged from around an inch to as much as 4 inches. Meanwhile, the valleys saw only occasional flurries or light snow, with just a dusting reported here and there.
1/13/2009	0/0	$0	Light to moderate snow showers developed across much of the North Carolina mountains during the late evening. Snowfall amounts ranged from trace amounts to 3 inches or so in areas from the Smokies, to the lower and middle French Broad Valley, to the northern mountains.
1/19/2009	0/0	$0	Snow showers developed during the late evening of the 19th, and continued off and on through the overnight hours, before tapering off by early afternoon on the 20th. Total accumulations ranged from trace amounts in the lower elevations near the Blue Ridge, to 3 inches or more in the higher elevations.
2/2/2009	0/0	$0	Light snow showers developed during the evening of the 2nd, and continued off and on for two days. Total accumulations ranged from amounts up to 2 inches in the lower elevations, to about 4 inches across many high elevation areas. Locally higher amounts occurred in the higher elevations along the Tennessee border.
2/22/2009	0/0	$0	Snow showers developed during the pre-dawn hours across the western mountains and continued through the morning. By noon, accumulations of up to 2 inches were reported in the lower French Broad valley and the higher elevations of the interior mountains, while 3 inches or more fell in the highest elevations along the Tennessee border.
3/1/2009	0/0	$0	Rain changed to snow across portions of the southern and central mountains, generally in locations from the Balsams to areas north and east, and continued through the afternoon. The snow became heavy at times, and quickly accumulated to 1-4 inches by early evening. Locally higher amounts were reported in the higher elevations of the Balsams and Newfound Mountains. Snow, heavy at times continued into the evening hours. By the time the snow tapered off, accumulations of 2-5 inches were common across the area. However, locally higher amounts occurred, especially in the higher elevations, where up to 10 inches were reported. The heavy wet snow, combined with gusty winds, caused some trees to fall and isolated power outages.

Date	Deaths/Injuries	Property Damage	Description
4/7/2009	0/0	$0	Light to occasionally moderate snow showers that developed along the Tennessee border began affecting portions of the interior mountains during the daytime hours. Accumulations ranged from trace amounts in the valleys to as much as 4 inches in the higher elevations of the Balsams.
10/17/2009	0/0	$0	The first high elevation snowfall of the season occurred as moist northwest flow developed behind a strong cold front, resulting in scattered snow showers. Accumulations were mainly confined to areas along the Tennessee border, above 4000 feet, where as much as 2 inches fell. However, locations as far south as the high elevations above Lake Toxaway saw a dusting.
12/12/2009	0/0	$0	Light freezing rain developed during the evening hours across the mountains and portions of the foothills and piedmont of North Carolina. Ice accretion was mainly limited to elevated surfaces.
12/18/2009	0/0	$0	A strengthening area of low pressure moved out of the Gulf of Mexico, across southern Georgia, and then up the southeast coast. As the low passed south of the region, snow became heavy across the southern and central mountains, as well as the Smokies and surrounding valleys late in the morning. Heavy snow developed a little later over the northern mountains. The heavy snow continued throughout the afternoon. Snowfall rates of 1-2 inches per hour became common across the area during the afternoon. Meanwhile, warming temperatures allowed the snow to mix with and eventually change to rain and sleet in the southwest mountain valleys. The heavy, wet snow combined with gusty winds to cause numerous trees and power lines to fall across the area during the afternoon. Widespread power outages resulted, and some customers were without power for as much as a week. Even longer outages affected parts of the northern mountains. ||The snow ended over the Blue Ridge and the central mountains on the evening of the 18th. However, wrap around snow showers developed along the Tennessee line, resulting in additional snow accumulations overnight and into the morning hours of the 19th.||Total accumulations ranged from 12-18 inches across the lower northern mountain valleys, to 2-3 feet in the higher elevations along the Tennessee border, and in areas along the eastern escarpment. Over the southern and central mountains, total accumulations ranged from 6-10 inches in the lower elevations near the southern escarpment, to as much as 2 feet in the higher elevations. While the southwest mountain valleys generally saw only 3-5 inches, 2-3 feet of total snowfall was reported in the higher elevations of the Smokies and along the Cherohala Skyway in Graham County.||Hundreds of traffic accidents were reported during the storm, and continued for several days thereafter, as continuous melting and refreezing of ice and snow resulted in treacherous road conditions during the late night and morning hours. Hospitals reported 100s of cases and slips and falls during this time as well.
12/30/2009	0/0	$0	A light mix of sleet and snow developed over the mountains and foothills of western North Carolina during the evening, and continued for much of the overnight. Accumulations ranged from trace amounts over the lower elevations of the foothills, to localized 2-3 inch amounts over the mountains. A few slick spots developed on mountain roads, resulting in quite a few accidents.

Date	Deaths/Injuries	Property Damage	Description
1/2/2010	0/0	$0	A very cold and moist northwest flow resulted in the development of scattered to numerous snow showers across the Tennessee border counties, and the higher elevations of Buncombe County, during the early morning hours. The higher elevations along the Tennessee line saw 2 to 4 inches of powdery snow, while the lower elevations received anywhere from trace amounts to 2 inches. The snow was a little heavier in Avery County, were total accumulations ranged from 2 to 3 inches in the lower valleys to 4-6 inches in the higher elevations along the state line.
1/4/2010	0/0	$0	Another round of very cold and moist northwest flow resulted in development of scattered to numerous snow showers across the western mountains overnight on the 4th. The showers persisted off and on through the day of the 5th. 24-hour snowfall totals of 1-4 inches were common across the area, with the highest amounts occurring over the higher elevations. Over Avery County, heavy snow accumulations occurred, with amounts ranging from 2-3 inches near the Blue Ridge, to 6-8 inches in the higher elevations along the Tennessee border.
1/7/2010	0/0	$0	A very cold and moist northwest flow resulted in development of scattered to numerous snow showers across the western mountains during the evening of the 7th. The snow showers continued across much of the Tennessee border counties through the day on the 8th, with heavy accumulations reached in some areas by late morning. Total accumulations ranged from 1-3 inches over the lower French Broad Valley, to 3-6 inches across the northern mountains. Over the southwest mountains, total snowfall accumulations ranged from trace amounts in the valleys beneath the Smokies, to 2-4 inches in the higher elevations along the Tennessee border.
1/9/2010	0/0	$0	A very cold and moist northwest flow resulted in development of scattered to numerous snow showers across the western mountains during the evening of the 9th, continuing into the 10th. Total snowfall accumulations were highly variable across the area, ranging from trace amounts in the valleys beneath the Smokies to as much as 4 inches in some areas.
1/12/2010	0/0	$0	Snow showers developed across the western mountains during the early morning hours. In some areas, the snow changed to freezing drizzle, resulting in extremely slick roads, especially in the Asheville and Weaverville areas. Hundreds of vehicle accidents occurred during the morning rush. Accumulations of ice and snow ranged from trace amounts in the lower valleys to a couple of inches above 3000 feet.
1/18/2010	0/0	$0	Black ice resulted in numerous traffic accidents across the mountains and foothills of North Carolina. Several accidents involved injuries.
1/21/2010	0/0	$0	A very narrow corridor of freezing rain developed along the Blue Ridge escarpment during the morning, and continued off and on through the day. A light glaze of ice developed, mainly on elevated surfaces. However, a few vehicle accidents occurred in the northern mountains.

Date	Deaths/Injuries	Property Damage	Description
2/4/2010	0/0	$0	As low pressure moved across the deep south, snow, mixed with sleet, developed over the southern mountains during the late afternoon hours. The precipitation fell heavily at times, and up to 4 inches of snow accumulated across the area by early evening. Snow continued to fall overnight, but became mixed with or changed to sleet around midnight. Total sleet and snow accumulations of 2 to 5 inches occurred across the area by sunrise. By mid-morning of the 5th, precipitation changed to freezing rain, with damaging ice accumulations occurring. Total ice accretion in excess of 1/2 inch occurred along the Blue Ridge, resulting in widespread damage to trees and power lines, and widespread power outages along the southeastern escarpment. Ice accretion diminished rapidly north and west of the Blue Ridge.
2/10/2010	0/0	$0	Moist northwest flow behind a cold front produced numerous snow showers across the western mountains of North Carolina during the early morning hours. Snow began to quickly accumulate, and by late morning, snowfall ranged from trace across the interior valleys from Asheville, to Waynesville, to Franklin, to an inch or two in the valleys near the Tennessee border, to 4 to 5 inches in the higher elevations. Gusty winds of 30 to 40 mph caused periods of blizzard-like conditions, with considerable blowing and drifting snow. A few trees and power lines were blown down across the area as well.
2/12/2010	0/0	$0	Light snow developed during the early evening across the mountains, and then quickly spread into the foothills and the western piedmont through the evening. Total snowfall ranged from an inch or two in areas north of I-40, to as much as three inches in areas further to the south.
2/15/2010	0/0	$0	A band of light to moderate snow moved rapidly across the North Carolina mountains during the morning. Higher elevations saw as much as 4 inches of snow, with most valley locations receiving an inch or less.
2/15/2010	0/0	$0	Scattered to numerous northwest flow snow showers developed on the evening of the 15th, and continued on and off for more than two days. Three-day totals varied widely across the area, depending upon terrain. While the lower elevations from Bryson City, to Waynesville and Sylva, to Asheville saw little more than a dusting, some of the higher elevations along the Tennessee border, including the Smokies and the Cherohala Skyway received 6 or more inches during the period.
3/22/2010	0/0	$0	Snow showers developed over the mountains during the early afternoon, and continued into the evening hours. Total snowfall ranged from trace amounts in the valleys, to as much as 4 inches at the highest peaks.

Date	Deaths/Injuries	Property Damage	Description
12/4/2010	0/0	$0	A storm system brought light snow to the high elevations of the North Carolina mountains early on the 4th. By early afternoon, 1 to 3 inches of snow was reported across the higher elevations, mainly above 3500 feet. After an arctic cold front passed through the area, snow levels dropped quickly during the afternoon and evening, while strong northwest winds resulted in development of scattered to numerous snow showers. The snow showers persisted for almost three days, with snowfall piling up steadily over the ensuing 60 hours. By the morning of the 7th, 3 day accumulations ranged from around 10 inches in the higher elevations of the Smokies, to as much as 18 inches in the higher elevations of the northern mountains. Snowfall totals in the lower elevations were much less, generally 2-6 inches in the valleys of the Tennessee border counties. Gusty winds and very cold temperatures also resulted in wind chill values below 0 in many areas during the overnight and early morning hours.
12/15/2010	0/0	$0	Light precipitation fell across the mountains during the evening, and continued for much of the overnight. Precipitation mainly fell as freezing rain, although some areas saw a period of light accumulating snow at the onset. By late morning, most areas had received at least a trace of ice accretion, resulting in very slippery roads.||Over the piedmont and foothills the majority of the precipitation fell as freezing rain and freezing drizzle. Most areas saw at least trace amounts of ice, with some areas along the I-40 corridor seeing as much as a tenth of an inch. Very hazardous driving conditions existed across the northern foothills and northwest Piedmont. Locations closer to I-85 only saw a light glaze on elevated surfaces and patchy slick spots on roads. Hundreds of traffic accidents were reported across the region. Temperatures warmed above freezing in most areas by late morning.
1/7/2011	0/0	$0	Light to moderate snow developed ahead of a cold front over the mountains during the afternoon and continued into the early evening hours. By the time the snow tapered off to snow showers during the evening, as much as 3 inches had fallen over the area. Snow showers continued to affect the higher elevations and the valleys of northern Buncombe County through the overnight hours, adding to the accumulations. By the time the snow completely tapered off, amounts ranged from 1 to 4 inches, with some higher amounts in the higher elevations and in extreme northern Buncombe County.
1/11/2011	0/0	$0	Moist northwest flow resulted in the development of scattered to numerous snow showers during the evening of the 11th. The snow showers persisted overnight and throughout the 12th. Total accumulations were highly variable across the area, but generally ranged from 1 to 6 inches, with some higher amounts in the higher elevations along the Tennessee border.
1/17/2011	0/0	$0	A mix of light snow and light freezing rain developed along and near the eastern escarpment of the Blue Ridge during the late afternoon and continued off and on into the overnight. Many areas received up to an inch of snow along with a light glaze of ice. Several traffic accidents occurred, with melting and refreezing resulting in a few accidents continuing through the morning of the 20th.

Date	Deaths/Injuries	Property Damage	Description
1/24/2011	0/0	$0	A quick shot of snow produced light accumulations in a brief period of time across the mountains during the pre-dawn hours. Although most areas saw little more than a dusting, roads became very slick, and numerous traffic accidents occurred during the morning rush, especially in areas along and north of I-40.
1/26/2011	0/0	$0	As low pressure developed off the southeast coast, rain changed to snow across the higher elevations of the North Carolina mountains during the morning, and gradually worked its way toward the valleys as colder air filtered into the region. The widespread precipitation moved away from the region during the afternoon, but developing moist northwest flow resulted in development of scattered to numerous snow showers across the area. By midnight, snowfall accumulation ranged from little more than a dusting in the valleys to 4 or 5 inches in the highest elevations along the Tennessee border.
3/6/2011	0/0	$0	Light snow developed across the higher elevations of the mountains of North Carolina in the wake of a cold front. Accumulations generally ranged from 1 to 4 inches at elevations above 3500 feet. However, some areas above 5000 feet received as much as 7 inches.
3/11/2011	0/0	$0	As colder air filtered into the mountains behind a cold front, snow levels dropped to the higher elevations during the evening. Snow showers continued the rest of the night along the Tennessee border, where snow totals ranged from 2 to 5 inches at elevations above 4000 feet. However, even some of the western valleys saw around an inch as snow levels continued to drop overnight.
11/29/2011	0/0	$0	Rain changed to snow across the higher elevations of the North Carolina mountains during the morning and began to accumulate by early afternoon. The snow began to taper off from the southwest during the afternoon, before ending early on the 30th. Accumulations were generally confined to areas above 3000 feet or so, and most locations only saw on inch or two, although some areas of the northern mountains saw as much as 4 inches.
1/2/2012	0/0	$0	Snow showers developed across the mountains during the evening behind a very strong cold front. Snow continued off and on through the night and much of the 3rd before ending during the afternoon. Total accumulations ranged from a dusting near the southern Blue Ridge to four inches across the Tennessee border counties. Localized higher amounts were reported in the high elevations along the state line, mainly north of the Smokies. Even where little snow fell, temperatures that fell rapidly into the teens resulted in snow sticking to roadways on the night of the 2nd and early on the 3rd. Dozens of accidents occurred across the region.
1/4/2012	0/0	$0	A fast-moving low-pressure area brought a quick shot of light snow to the mountains during the evening, with snow showers developing behind a cold front during the overnight. Total accumulations ranged from 1-4 inches across the area, although some high elevation locations received as much as 7 inches, especially along the Tennessee border.

Date	Deaths/Injuries	Property Damage	Description
2/11/2012	0/0	$0	Snow showers developed over much of the North Carolina mountains during the early morning hours, and continued throughout the day. Snow showers continued off and on across the Tennessee border counties during the evening and early part of the overnight. Total accumulations ranged from a couple of inches in the lower valleys, to as much as 8 inches in the higher elevations of the Newfound Mountains and northern mountains.
2/19/2012	0/0	$0	A weak area of low pressure moved south of the region during the day on Sunday. Rain mixed with snow fell across portions of the mountains during the morning before changing to snow during the afternoon. Meanwhile, rain changed to snow in the Piedmont briefly before ending in the evening. Light accumulations were mainly confined to the eastern Blue Ridge and Piedmont areas north of I-40. Total accumulations ranged from around an inch in far northern piedmont and central mountain areas to as much as 5 inches in the higher elevations of the northern mountains. Multiple traffic accidents were reported, especially in the Piedmont.
10/29/2012	0/0	$0	As Superstorm Sandy moved across New England and stalled over the northern Mid-Atlantic region, abundant moisture was transported into the mountains. This caused snow showers to develop mainly across the high elevations of the southern and central mountains of North Carolina during the morning of the 29th which continued off and on through the 30th. Total accumulations ranged from little more than a dusting in most valley locations, to as much as 6 inches in the highest elevations.
11/5/2012	0/0	$0	Light snow developed in the southern and central mountains, mainly above 3000 feet. The snow continued off and on overnight, with total accumulations ranging from trace amounts to as much as 2 inches in the higher elevations of the Balsams and Newfound Mountains.
12/28/2012	0/0	$0	Light sleet developed across the northern mountains and foothills during the evening hours, as a weak area of low pressured moved south of the region. Although mostly rain fell in the lower elevations, a few periodic bursts of sleet resulted in spotty light accumulations. The more significant accumulations occurred in the high elevations along and west of the escarpment, where as much as a half inch fell. Sleet changed to light freezing rain across portions of the northern mountains, mainly above 3000 feet, early on the 29th. The combination of sleet and light ice accretion resulted in some very slick roads.
12/29/2012	0/0	$0	Snow showers developed behind a cold front by the evening of the 29th, and continued off and on through the night before ending early on the 30th. Valley accumulations ranged from little more than a dusting in the lower elevations beneath the Smokies and the middle French Broad Valley, to an inch or two across the lower French Broad and the high valleys of the northern mountains. Meanwhile, some high elevation locations near the Tennessee border saw 6 inches or more.

Date	Deaths/Injuries	Property Damage	Description
1/17/2013	0/0	$0	Rain gradually began to change to snow, first in the higher elevations of the central mountains, followed by the northern foothills and the northwest Piedmont. Although snow was heavy at times in the Piedmont, warm ground temperatures and rain mixing in at times resulted in little accumulation. The brief period of heavy snow was accompanied by occasional lightning and thunder in the Piedmont. Total accumulations ranged from trace amounts in the central mountain valleys to 1-3 inches across the higher elevations, to generally 2 inches or less across the northern foothills and northwest Piedmont.
1/25/2013	0/0	$0	Light sleet developed across much of the western Carolinas and northeast Georgia during the morning. The intermittent sleet eventually changed to light freezing rain in most areas by late afternoon. Most areas north of the I-85 corridor saw measurable sleet, generally less than a quarter inch. A light glaze then fell on top of that, making for treacherous driving conditions during the afternoon. Most areas south of the I-85 corridor saw only trace accumulations, but that was enough to cause plenty of slick spots. Hundreds of accidents were reported across the area, especially along the I-85 corridor.
2/19/2013	0/0	$0	Precipitation developed across the mountains during the early morning hours. Precipitation fell mainly as snow in the high elevations, but snow levels quickly worked their way down to the valleys by sunrise before coming to an end. Most areas above 3000 feet saw 1 to 3 inches of snow, with locally higher amounts, especially across the Balsams and Nantahalas. Valley locations saw accumulations from a light dusting to around an inch.
3/2/2013	0/0	$0	Snow showers moved away from the usual Tennessee border areas during the early morning hours of the 2nd, tapering off by late morning. Most locations near the southern Blue Ridge saw an inch or two of snow, with some high elevation areas reporting 3 or 4 inches.
3/6/2013	0/0	$0	Snow showers developed around midnight over the Blue Ridge counties of the southern and central mountains of North Carolina. Snow showers continued through the early morning hours of the 6th before tapering off by mid-morning or so. Total accumulations ranged from less than an inch in some valley locations to as much as 4 or 5 inches in the higher elevations.
3/25/2013	0/0	$0	Snow showers developed across northern Macon County and northern Buncombe County during the late evening and continued during the overnight hours. By the time the snow tapered off during the morning of the 26th, as much as 5 inches had fallen. Meanwhile, the main population centers of both counties saw little or no snowfall.
4/4/2013	0/0	$0	Weak low pressure moved south of the region during the daytime hours of the forth. A light mix of sleet and freezing rain developed across portions of the North Carolina mountains around daybreak and continued into early afternoon. The most significant accumulation of ice and sleet occurred along and near the eastern Blue Ridge in a persistent area of cold air damming. Some areas along the escarpment received almost a quarter inch accumulation of ice. For areas more than 10 or 15 miles from the escarpment, light accumulations were largely confined to areas above 3000 feet.

Date	Deaths/Injuries	Property Damage	Description
11/26/2013	0/0	$0	As cold air spilled into the North Carolina mountains in the wake of an arctic cold front, rain quickly changed to snow during the pre-dawn hours. Periods of moderate and briefly heavy snow were reported at times. Precipitation ended in most areas by late morning. However, northwest flow snow showers continued across the Tennessee border counties through the 27th before ending around midnight. Most areas saw an inch or less of accumulation. However, 2-4 inches fell across the higher elevations along the Tennessee border, although accumulations were difficult to report owing to wind gusts up to 50 mph causing considerable blowing and drifting snow.
12/14/2013	0/0	$0	Light freezing rain, mixed at times with sleet, developed along the Blue Ridge during the early morning hours. Temperatures gradually warmed above freezing through the morning, with precipitation changing to rain later in the morning. Light ice accretion occurred within a few miles of the Blue Ridge, mainly on elevated surfaces. However, a couple of slick spots were reported on roads across southern Avery County.
1/2/2014	0/0	$0	After a strong cold front introduced much colder air to the mountains, snow showers developed across the mountains during mid-evening and continued into the overnight hours. Light accumulations were primarily confined to areas above 3500 feet, where 1-4 inches accumulated by the pre-dawn hours. Locally higher amounts occurred on the higher peaks near the Tennessee border. Lower elevations saw little more than a dusting. Very strong northwest winds gusting as high as 50-60 mph also resulted in considerable blowing and drifting of snow in the high elevations.
1/21/2014	0/0	$0	Widespread snow showers developed along the Tennessee border along and immediately behind a cold front during the late morning and moved east to the interior mountains, where occasional snow fell off and on through the day. By late evening, 1 to 4 inches had accumulated in many areas of northern Jackson, northern Buncombe, and the high elevations of Swain and northern Macon Counties.
1/28/2014	0/0	$0	Light snow developed across the mountains during the morning and continued into the afternoon before tapering off. The snow initially melted on roads. However, air temperatures rapidly cooling into the lower and mid 20s caused many roads to subsequently freeze. Although snowfall totals were very light (an inch or less in most areas), the slick roads caused hundreds of traffic accidents, including a school bus that overturned in Henderson County.
2/10/2014	0/0	$0	Light to moderate snow developed across the central and northern mountains during late morning and continued off and on through the afternoon. While most locations saw an inch or less, a small band of moderate to heavy snow developed during the afternoon from the high elevations of northern Jackson County, through central Haywood, and central and southern Buncombe Counties, where two to four inch amounts were common. Some high elevation areas saw as much as 5 inches in this area. Several accidents in the Balsam area resulted in major traffic problems on Highway 74 near the Haywood/Jackson line.

Date	Deaths/Injuries	Property Damage	Description
2/12/2014	0/0	$0	A Miller type-A low pressure system moved up along the South Carolina coast bringing widespread heavy snow to the mountains of western North Carolina. Total accumulations generally ranged from 5-9 inches across the area, although locations above 4000 feet or so saw 1-1.5 feet.
3/6/2014	0/0	$0	An intensifying cyclone off the Southeast coast and cold air damming combined to produce a period of rain, sleet, and snow across portions of the southern and central North Carolina mountains as well as portions of the foothills. Precipitation began during the late evening of the 6th. Precipitation changed to rain in most areas after midnight, but not before 1-4 inches of snow had accumulated across the higher elevations of the Balsams, and across the Blue Ridge areas south of I-40. Sleet was favored across the foothills, and some locations saw enough to cover the ground. Meanwhile, rain changed briefly back to heavy snow around daybreak of the 7th, and a narrow corridor along the Blue Ridge areas of Henderson and Buncombe Counties saw 2-5 inch totals, while the lower elevations along the I-40 corridor saw 1-2 inches during this time.
3/17/2014	0/0	$0	A slow-moving low-pressure system combined with weak cold air damming to produce an extended period of light freezing rain along the eastern Blue Ridge escarpment, as well as the northern foothills and Piedmont of North Carolina. Precipitation developed around daybreak of the 17th and continued to fall lightly for most of the day, occasionally mixing with sleet and snow. By evening, most areas reported between 0.10 and 0.20 inch of ice accretion, with a few locations reporting additional light snow/sleet accumulations. Sporadic power outages and multiple vehicle accidents were reported. Ice accretion dropped off considerably farther west toward the French Broad Valley in the southern/central Mountains and toward the Tennessee border in the northern mountains. The freezing rain tapered off to freezing drizzle during the evening of the 17th, but even this continued through the night in some areas.
10/31/2014	0/0	$0	Precipitation associated with a strong upper level disturbance and associated strong cold front changed to snow at the highest peaks and ridge tops by early Halloween evening, with snow levels dropping rapidly to the valley floors by the end of the evening as an arctic air mass infiltrated the region behind the front. Snowfall accumulation by midnight was mainly confined to the high elevations, although the snow continued into the morning of the 1st.

Date	Deaths/Injuries	Property Damage	Description
11/1/2014	0/0	$0	Precipitation associated with a strong upper level disturbance and associated strong cold front changed to snow at the highest peaks and ridge tops by late Halloween evening, with snow levels dropping rapidly to the valley floors by the end of the evening as an arctic air mass infiltrated the region behind the front. By mid-morning on the 1st, snow accumulation ranged from an inch or less in the low valleys of the southern mountains, to as much as 5 inches across portions of the French Broad Valley and in elevations above 4000 feet, where some locally higher amounts also occurred.
11/26/2014	0/0	$0	Rain associated with a cold front changed to snow across the high elevations of the North Carolina mountains during the early morning hours of the 26th. The snow was brief, but heavy at times, with a quick couple of inches accumulating in some areas. the precipitation ended by mid-morning, but snow showers redeveloped near the Tennessee border during the afternoon on a cold and moist northwest flow. Accumulating snowfall continued off and on across the Tennessee border counties through the evening and overnight hours before tapering off during the morning of the 27th. Total accumulations ranged from up to two inches in the valleys north of I-40 near the Tennessee border, to 2-6 inches with locally higher amounts in the high elevations, mainly above 4000 feet.
1/13/2015	0/0	$0	Light freezing rain and drizzle developed first across the northern mountains during the evening of the 13th, then gradually spread south along the Blue Ridge and east along the I-40 corridor through the overnight and early morning of the 14th. While accumulations were very light, generally no more than a few hundredths of an inch, some secondary roads and bridges and overpasses became slick and hazardous, resulting in a few accidents.
1/23/2015	0/0	$0	A mix of light freezing rain and sleet developed across the northern and central mountains around daybreak on the 23rd. Temperatures gradually warmed from the southwest throughout the day, allowing precipitation to change to rain during the afternoon in all areas except along the Blue Ridge escarpment. Accumulations of sleet and ice during this time were quite light, generally less than a tenth of an inch, although a few areas near the escarpment reported up to a quarter inch of ice and sleet. While a few secondary roads became slick, mainly across the northern mountains, travel was not significantly impacted. As a cold front swept across the area during the evening, sleet and freezing rain expanded in coverage before a transition to snow showers occurred, mainly across the northern mountains and Madison County. Additional accumulations of sleet/ice and mostly snow were light in this area, generally less than 2 inches.

Date	Deaths/Injuries	Property Damage	Description
2/2/2015	0/0	$0	Snow showers developed in the wake of a cold front across the central and southern North Carolina mountains during the late morning of the 2nd. The snow showers gradually retreated to areas along the Tennessee border during the afternoon and overnight hours, before tapering off during the morning of the 3rd. Total accumulations ranged from an inch or two across the valleys (primarily the lower French Broad valley), to 4-6 inches in the high elevations near the Tennessee border.
2/16/2015	0/0	$0	Sleet and snow overspread the mountains and foothills of North Carolina during the afternoon and began to accumulate. Precipitation changed quickly to sleet in most areas, before mixing with freezing rain from southwest to northeast during the late afternoon and early evening. Sleet and freezing caused deteriorating road conditions by early evening, when heavy accumulations of sleet and/or freezing rain were reported across much of the area. Most locations saw around a half inch to an inch of sleet, along with around a tenth of an inch of ice accretion. The valleys of southwest North Carolina saw more freezing rain than sleet, with about one quarter inch of ice reported. Scattered power outages were therefore more concentrated there. Meanwhile, the northern foothills saw mostly sleet, with many areas reporting 2 to 3 inches of accumulation. Roads became very treacherous and impassable in many areas until melting began on the afternoon of the 17th.
2/18/2015	0/0	$0	Snow showers developed across the Southern Appalachians along and immediately behind a strong arctic cold front that swept across the region during the afternoon of the 18th. Snow tapered off in most areas through the evening, the only exception being locations across the far western North Carolina mountains, where snow showers didn't taper off until the pre-dawn hours of the 19th. Total accumulations ranged from a dusting up to an inch in locations closer to the South Carolina border and the lower valleys surrounding the Smokies, to 2-4 inches in the valleys north of I-40 near the Tennessee border. Locally, much higher amounts occurred across the high peaks and ridge tops near the Tennessee border. Combined with the snowfall from the storm of the 16th/17th, areas above 5000 feet reported 1-2 feet of snow on the ground by the morning of the 19th. Very strong winds resulted in considerable blowing and drifting of snow and periods of blizzard-like conditions across these high elevations.

Date	Deaths/Injuries	Property Damage	Description
2/25/2015	0/0	$0	After the significant snowfall that fell across portions of the North Carolina mountains on the morning of the 24th, an area of low pressure moving along the Gulf Coast spread yet another round of snow across the southern Appalachians and adjacent foothills during the evening of the 25th. The snow was heavy at times, and quickly accumulated, with occasional mixed rain undercutting the totals a bit across the southern foothills. Many areas reported heavy accumulations by late evening. By the time the snow tapered off during the early morning of the 26th, total accumulations ranged from 4 to 6 inches, with locally higher amounts across the mountains. Across the foothills, where snow occasionally mixed with or changed to rain along the Highway 74 corridor, accumulations ranged from 2 to 5 inches.
3/1/2015	0/0	$0	As a wedge of cold air spread south across the eastern seaboard, rain changed to freezing rain during the early morning hours of the 1st across the Blue Ridge of North Carolina, as well as the I-40 corridor through the Piedmont and foothills. Ice accretion was light, generally only a few hundredths of an inch, although some locations saw as much as a tenth of an inch. Icing was primarily confined to elevated surfaces, so travel was not impacted significantly.
1/20/2016	0/0	$0	Light snow developed over the mountains of North Carolina in association with an upper air disturbance during the morning. The snow continued off and on through much of the day before winding down during the evening. The most significant accumulations were above 4000 feet or so, where amounts ranged from 5 to 8 inches. Meanwhile, valley totals ranged from a half inch across the upper French Broad Valley to around 3 inches across the high valleys of the northern mountains.
2/15/2016	0/0	$0	Very light freezing rain, freezing drizzle, and freezing mist developed across portions of western North Carolina during the morning, in assocation with low pressure developing along a warm front across the Gulf Coast states/Tennessee Valley. Despite the very light nature of the precipitation, due to about a week of unseasonably cold weather, the precipitation froze to surfaces very quickly, and roads became very slick, resulting in numerous traffic accidents. Although precipitation rates increased during the evening, as the warm front gradually pushed north into the area, temperatures warmed above freezing in many locations, allowing much of this heavy precip to fall as rain. Most locations saw less than a tenth of an inch of ice accretion, although some locations across the foothills and far northern Piedmont approached a quarter inch, with a few downed trees, lines, and power outages reported.

Date	Deaths/Injuries	Property Damage	Description
1/29/2017	0/0	$0	A strong upper air disturbance combined with moist northwest winds flowing up the western slopes of the Appalachians resulted in development of numerous snow showers across the North Carolina mountains throughout the 29th and into the early part of the 30th. The most significant impacts were to the high elevations (above 5000 feet) of the northern mountains, where as much as a foot of snow fell. Meanwhile, total accumulations in the high valleys of the northern mountains were generally in the 2-4 inch range. Farther south, accumulations in the high elevations of the Smokies and other ranges along the Tennessee border were from 2 to 5 inches, while the lower valleys from the French Broad south saw little more than an inch.
3/11/2017	0/0	$0	An upper level disturbance interacting with an unseasonably cold air mass resulted in light to moderate snow overspreading the North Carolina mountains late on the 11th, continuing through the overnight hours before tapering off on the morning of the 12th. Total snowfall accumulation generally ranged from 1-3 inches. However, some locations received as much as 5 inches, particularly near the South Carolina border.
3/14/2017	0/0	$0	As low pressure moved up the East Coast, light precipitation developed over western North Carolina during the evening of the 13th, beginning as rain in most locations. As colder air wrapped into the area behind the low, snow levels dropped, allowing all but the lower valleys to transition to snow. Moist northwest flow resulted in the precipitation retreating to the Tennessee border areas with time. Total accumulation were generally in the 3 to 5 inch range for elevations above 3500 feet or so, while the lower valleys saw anywhere from trace amounts to around a couple of inches.
4/6/2017	0/0	$0	Scattered to numerous showers developed under a strong upper-level low pressure throughout the 6th and early on the 7th. Meanwhile, lowering snow levels in the wake of a cold front resulted in periods of snow above about 4000 feet. However, significant accumulations were primarily confined to elevations above 5000 feet. As much as a foot fell on the high peaks of the northern mountains.
12/8/2017	0/0	$0	As moisture associated with developing and strengthening low pressure over the northeast Gulf of Mexico overspread western North Carolina, snow developed across the central and northern mountains around sunrise on the 8th and quickly accumulated. By noon, heavy snowfall accumulations were reported across much of the Blue Ridge area, while moderate to occasionally heavy snow continued to fall throughout the afternoon into the evening. By the time the snow tapered off to flurries and light snow showers during the early morning hours of the 9th, total accumulations ranged from 9-12 inches across the area, with locally higher amounts reported. While occasional flurries and light snow showers produced locally light additional accumulations into the early daylight hours of the 9th, the accumulating snow ended in most areas shortly after midnight.

Date	Deaths/Injuries	Property Damage	Description
12/31/2017	0/0	$0	Very light precipitation developed across the mountains during the afternoon and continued into the evening. While most of the precipitation fell as snow, a brief transition to light freezing rain and drizzle occurred during mid-afternoon. Due to the very cold air that was in place, ice quickly formed on roads across the area. Numerous traffic accidents were reported during this time, especially in the Asheville area. Accumulating snowfall was fairly sporadic, primarily confined to locations along the eastern face of the Blue Ridge. Locations that did see snowfall generally only saw around an inch, with trace amounts of ice.
1/17/2018	0/0	$0	As a strengthening upper level disturbance and associated cold front approached the region from the Tennessee Valley, light precipitation developed across the North Carolina mountains around midnight. While the precipitation may have started as rain or a rain/snow mix in the lower valleys, a transition to snow had occurred in most locations by daybreak. As the snow band moved east, snowfall rates increased with time such that the highest totals were found north and east of the Balsams, where amounts of 2-4 inches were common. Meanwhile, locations west of the Balsams generally saw 1-2 inches.
2/4/2018	0/0	$0	As a wave of low pressure developed and moved along a stationary front over the Deep South, moisture spread into western North Carolina during the early morning hours of the 4th. The precipitation began as a mixture of rain, sleet, and snow in many areas. While some light accumulation of sleet and snow was reported across the mountain valleys, all areas except for the high peaks and ridge tops transitioned to freezing rain by mid-morning. Most of any measurable ice was reported in the Piedmont and foothills, where amounts of .1 to .2 inch were common. Due to temperatures hovering right around freezing, roads generally remained wet, and ice accretion was primarily confined to elevated surfaces and vegetation. Meanwhile, snowfall of 5-7 inches was reported above about 5000 feet.
3/7/2018	0/0	$0	A moist northwest flow developing in the wake of a cold front resulted in snow shower development near the Tennessee border throughout the morning of the 7th. Snow showers were somewhat scattered and accumulations were largely dependent upon terrain exposure and elevation. Most locations saw from a dusting to up to 2 inches. However, localized amounts of 4 to 6 inches were reported, primarily in the high elevations.

Date	Deaths/Injuries	Property Damage	Description
3/13/2018	0/0	$0	Snow showers developed across portions of the central mountains in response to a strong and moist northwest flow developing in the wake of a cold front. While snow showers were initially light, they increased in intensity, becoming moderate to occasionally heavy during the pre-dawn hours. The largest impact was along and near the I-26 corridor north of I-40, where 2 to 4 inches, with locally higher amounts fell across much of Madison County and northern portions of Buncombe County. A large portion of that fell in only a 2 or 3 hour period around daybreak. Meanwhile, amounts across much of Haywood County and southern Buncombe County amounted to little more than a heavy dusting, although some heavier totals were reported in the higher elevations of Haywood County.
11/15/2018	0/0	$0	Precipitation developed in association with weak low pressure moving across the Southeast during the overnight of the 14th and early morning of the 15th. Precipitation began as rain and/or snow across the mountains, but transitioned to liquid as temperatures warmed aloft. However, a wedge of cool air remained in place across the Blue Ridge, resulting in freezing rain, mainly within a few miles either side of the Continental Divide. Most of these areas saw trace amounts to around a tenth of an inch of ice accretion, although locally higher amounts were reported north of I-40.
11/24/2018	0/0	$0	Precipitation developed across the mountains, foothills, and far western Piedmont of North Carolina during the overnight, as a wave of low pressure moved along the Gulf Coast. Precipitation began as rain is most areas, but transitioned to freezing rain as a wedge of cold air locked in across the area. By the time the precip tapered off around sunrise, ice accretion of one tenth to one quarter inch was reported in many areas, with the highest amounts reported near the Blue Ridge. Scattered downed trees and power lines/power outages were reported.
1/23/2019	0/0	$0	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.

Date	Deaths/Injuries	Property Damage	Description
2/19/2019	0/0	$0	A moist southerly flow develop above a cool wedge of high pressure resulted in development of precipitation across western North Carolina during the afternoon and evening of the 19th. Just enough cold air was in place to allow the precipitation to initially fall as a mixture of sleet and snow along the eastern Blue Ridge escarpment as well as the far northern foothills and Piedmont. As warm air developed aloft, precipitation gradually transitioned to sleet and freezing rain in most of these locations during the overnight and early morning hours of the 21st. Most areas transitioned to rain during the morning of the 21st, although some pockets of freezing rain persisted in sheltered areas along the Blue Ridge. Total sleet and snow accumulations generally ranged from one half inch to less than 2 inches, although some high elevation areas along the Blue Ridge saw 2 to 4 inches of snow. Some locations along the Blue Ridge saw between .1 and .2 inch ice accretion before the precip tapered off or changed to rain.
12/1/2019	0/0	$0	Arctic air filtering in behind a cold front, along with a moist northwest flow resulted in the first notable snowfall event of the season for portions of the North Carolina mountains. Scattered to numerous snow showers continued through the day of the 2nd before tapering off during the early morning of the 3rd. Total accumulations were largely elevation dependent, with only a dusting up to an inch reported in the valleys, with 2-4 inches reported above 3500 ft or so. Locally higher amounts were reported in the higher elevations along the Tennessee border.
12/13/2019	0/0	$0	Moisture associated with a developing low pressure system along the Southeast Coast overspreading a cool and dry air mass over western North Carolina resulted in development of freezing rain, mainly along the Blue Ridge escarpment, and along and near the I-40 corridor in the foothills and Piedmont. Light ice accretion of around .10 inch or less was primarily confined to elevated surfaces, although a few slick spots developed over the mountains. Precipitation changed to rain throughout the morning as temperatures warmed above freezing.
1/31/2020	0/0	$0	Precipitation spread northeast across western North Carolina beginning around daybreak. Temperatures were just cold enough for precipitation to begin as snow across the Blue Ridge. Snow continued through the morning across much of this area before ending or changing to rain in some locations. Total accumulations were generally in the 1 to 3 inch range.
2/21/2020	0/0	$0	Moisture overspreading a southward-moving cold front resulted in development of precipitation across the North Carolina mountains throughout the daylight hours of the 21st. Temperatures were cold enough in most locations for this precipitation to fall as snow, although rain mixed in at times below about 2500 feet. By the time the snow tapered off during the evening, snowfall totals ranged from trace amounts up to an inch in the lower interior valleys, to 1 to 4 inches above 2500 feet and in the valleys near the Blue Ridge.

Date	Deaths/Injuries	Property Damage	Description
2/28/2020	0/0	$0	A strong upper level disturbance crossing the southern Appalachians resulted in redevelopment of snow showers across the North Carolina mountains throughout the 28th and early on the 29th. The relatively long duration of the event along with the enhanced lift from the disturbance allowed for higher accumulations than normally seen during northwest flow events, while accumulating snowfall was also reported well south and east of the usual Tennessee border areas, including across portions of the middle and upper French Broad Valley. Total amounts were generally in the 2-4 inch range, although amounts as high as 8 inches were reported on some of the high peaks and ridge tops.

Source: NCEI

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.

C.5.5.3 Probability of Future Occurrences

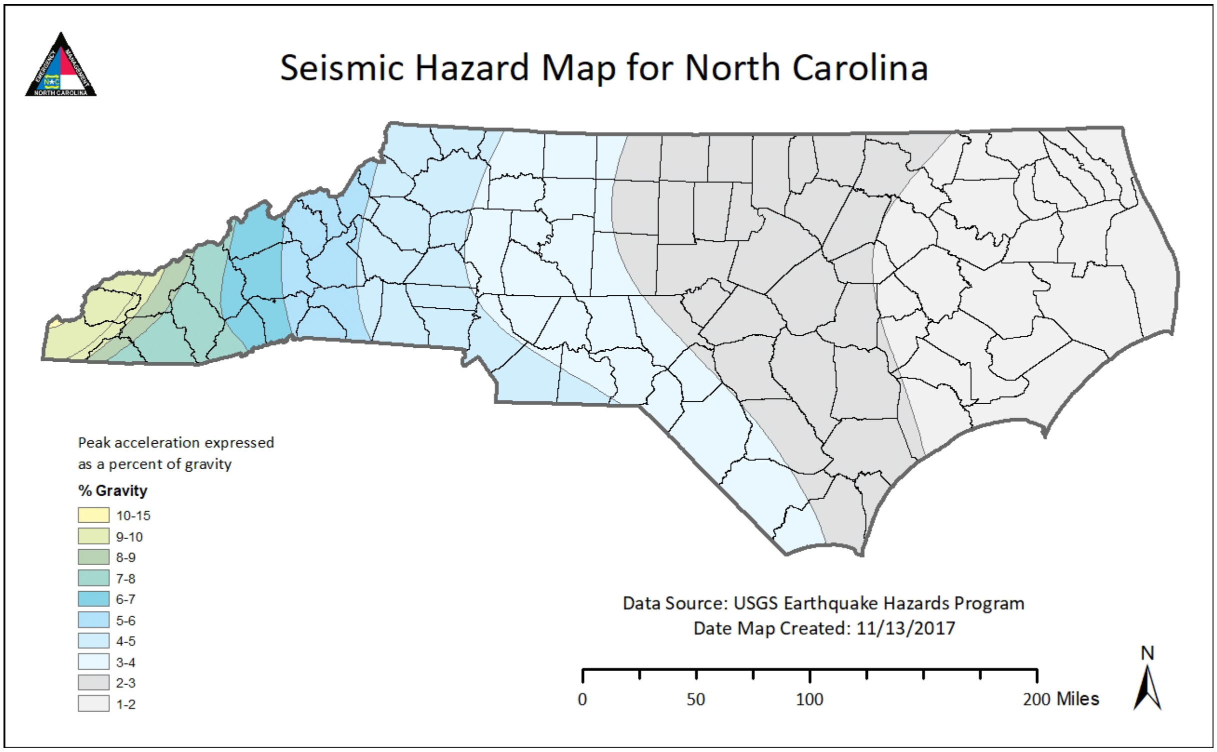
Winter storm events will remain a regular occurrence for University of North Carolina at Asheville due to its location in the western part of the state. According to historical information the University often experiences several winter storms events each year. Therefore, the annual probability is highly likely (100 percent annual probability).

C.5.6 EARTHQUAKES

C.5.6.1 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 C.7** is a map showing geological and seismic information for North Carolina.

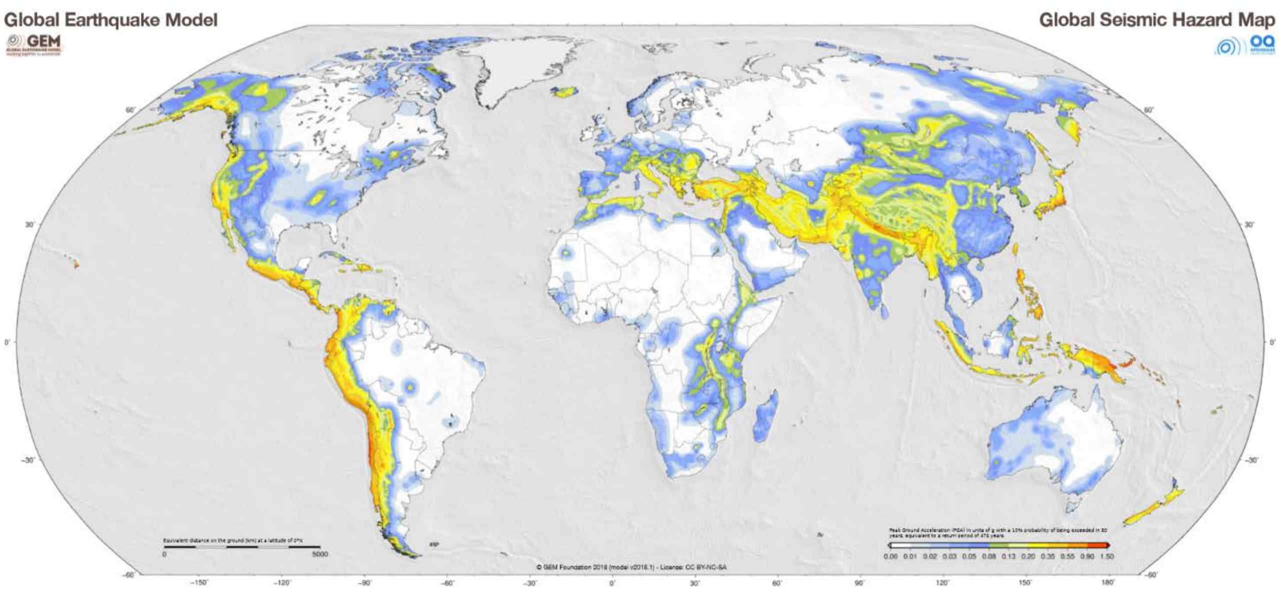
FIGURE C.7: GEOLOGICAL AND SEISMIC INFORMATION FOR NORTH CAROLINA



Source: North Carolina Geological Survey

Figure C.8 shows the intensity level associated with the world 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 campus as a whole exists within an area of moderate seismic risk.

FIGURE C.8: PEAK ACCELERATION WITH 10 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS



Source: Global Earthquake Model, 2018

C.5.6.2 Historical Occurrences

At least 37 earthquakes are known to have affected Buncombe County since 1911. The strongest of these measured a VI on the Modified Mercalli Intensity (MMI) scale. **Table C.16** provides a summary of earthquake events reported by the National Geophysical Data Center between 1885 and 1985.

TABLE C.16: EARTHQUAKES IMPACTING BUNCOMBE COUNTY

Location	Date	Magnitude	MMI
Asheville	4/20/1911	--	5
Asheville	10/29/1915	--	5
Asheville	2/21/1916	--	5
Asheville	10/20/1924	--	4
Asheville	11/3/1928	--	6
West Asheville	11/20/1928	--	4
Asheville	3/31/1938	--	4
Asheville	12/25/1940	--	2
Asheville	12/25/1940	--	3
Asheville	5/10/1941	--	3
Asheville	7/26/1945	5.6	4
Asheville	1/2/1954	--	4
Asheville	9/7/1956	--	5
Asheville	9/7/1956	--	5
Asheville	5/13/1957	--	4
Asheville	7/2/1957	--	6
Asheville	5/16/1958	--	4

Location	Date	Magnitude	MMI
Asheville	11/9/1968	5.3	4
Asheville	7/13/1969	3.5	4
Asheville	11/20/1969	4.3	4
Asheville	12/13/1969	--	3
Asheville	11/30/1973	4.7	3
Asheville	3/24/1978	6.1	3
Asheville	8/13/1979	3.7	2
Asheville	7/27/1980	5.1	4
Asheville	5/5/1981	3.5	4
Asheville	3/25/1983	3.3	4
Black Mountain	2/21/1916	--	5
Black Mountain	7/2/1957	--	4
Black Mountain	3/25/1983	3.3	3
Montreat	1/2/1954	--	4
Montreat	7/2/1957	--	5
Montreat	11/30/1973	4.7	4
Montreat	1/19/1976	4	4
Montreat	3/25/1983	3.3	4
Weaverville	5/13/1957	--	4
Weaverville	7/2/1957	--	6

Source: USGS; National Geophysical Data Center

A list of earthquakes that have caused damage throughout North Carolina is presented below in **Table C.17.**

TABLE C.17: EARTHQUAKES WHICH HAVE CAUSED DAMAGE IN NC

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

Date	Location	Richter Scale (Magnitude)	MMI (Intensity)	MMI in North Carolina
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).

C.5.6.3 Probability of Future Occurrences

The probability of significant, damaging earthquake events affecting the area surrounding University of North Carolina at Asheville 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 campus. The annual probability level for the campus 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, and for Buncombe County the likelihood was 6-7%.

C.5.7 GEOLOGICAL

C.5.7.1 Location and Spatial Extent

Landslides

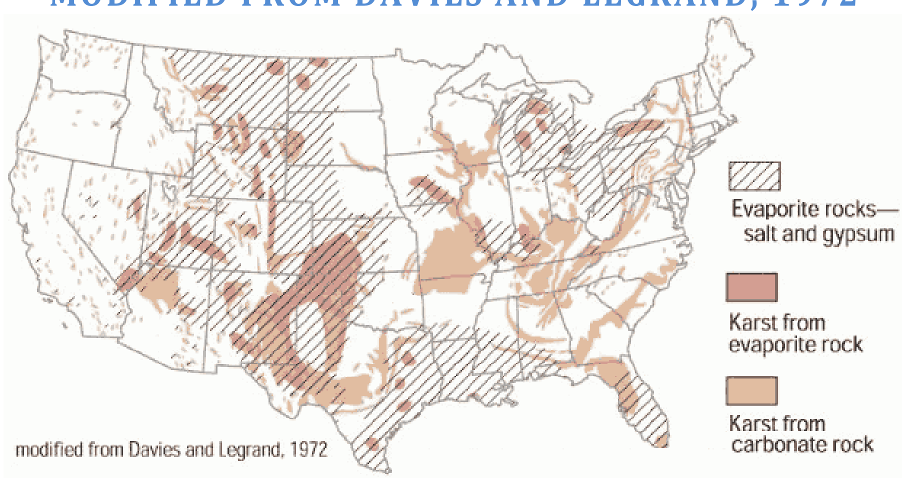
Landslides occur along steep slopes when the pull of gravity can no longer be resisted (often due to heavy rain throughout the region). Human development can also exacerbate risk by building on previously undevelopable steep slopes and constructing roads by cutting through mountains. Landslides are possible throughout the Blue Ridge Mountains, making areas near University of North Carolina at Asheville susceptible to them as well.

The Campus Hazard Mitigation Planning Team indicated that there have been localized areas of flooding in the past on Campus Drive.

Sinkholes

Figure C.9 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 C.9: UNITED STATES GEOLOGICAL SURVEY OF KARST MODIFIED FROM DAVIES AND LEGRAND, 1972



Erosion

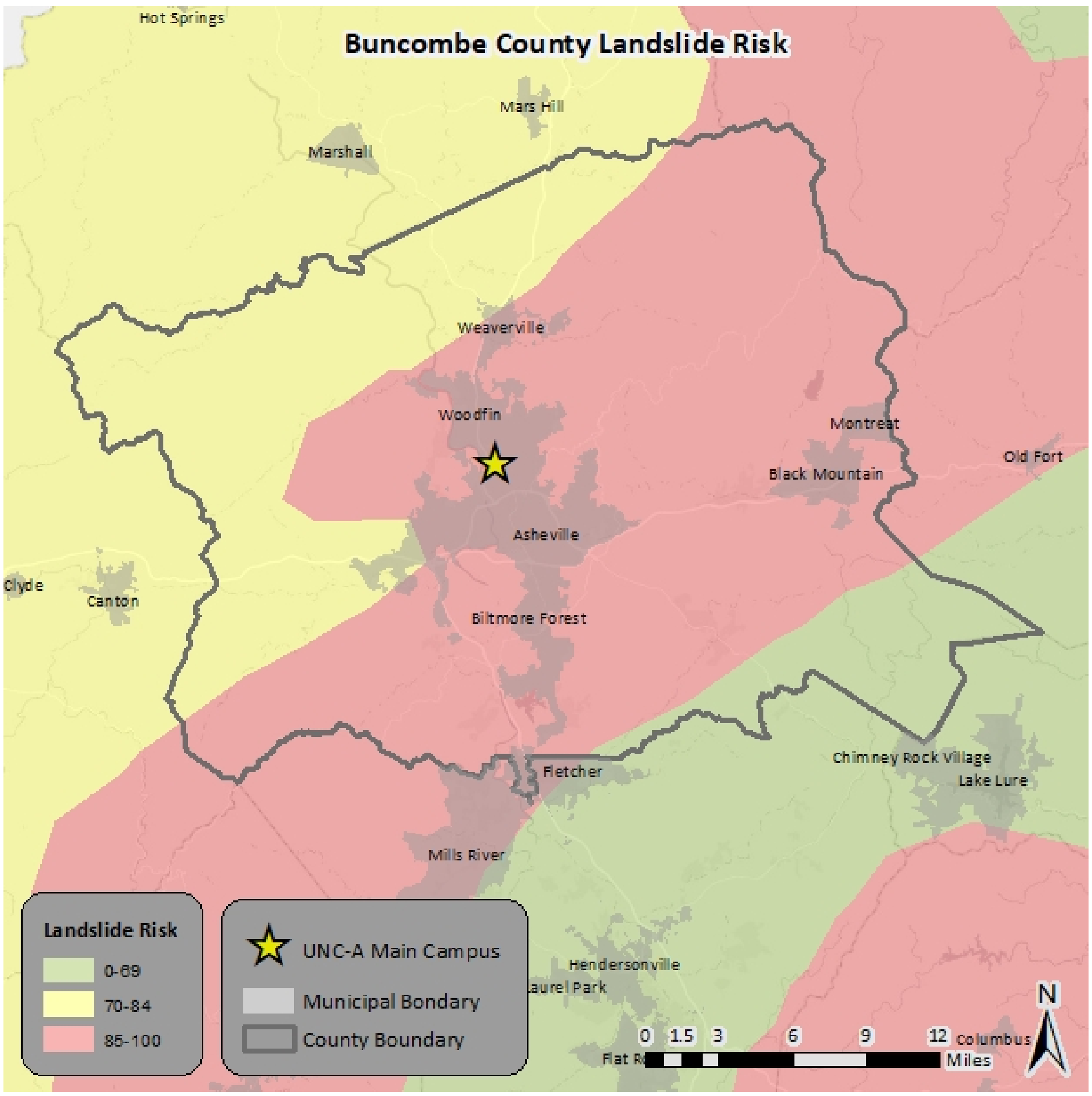
Erosion on the University of North Carolina at Asheville campus is typically caused by flash flooding events. Unlike coastal areas, where the soil is mainly composed of fine-grained particles such as sand, Buncombe County soils have much greater organic matter content. Furthermore, vegetation also helps to prevent erosion in the area. Erosion occurs on the University of North Carolina at Asheville campus, particularly along the banks of rivers and streams, but it is not an extreme threat to any of the buildings on campus. No areas of concern were reported by the Campus Hazard Mitigation Planning Team.

C.5.7.2 Historical Occurrences

Landslides

Steep topography in the area surrounding University of North Carolina at Asheville 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. **Figure C.10** shows the level of landslide risk in Buncombe County according to the USGS.

FIGURE C.10: LANDSLIDE SUSCEPTIBILITY AND INCIDENCE MAP OF BUNCOMBE COUNTY



Source: United States Geological Survey

The Buncombe Madison Regional Hazard Mitigation Plan indicates that there have been 152 recoded landslide events in Buncombe County.

Sinkholes

In North Carolina, most sinkholes occur in the southern coastal plain due to the high concentration of limestone. They are fairly uncommon in the western part of the state and in Buncombe County. However, according to a search of local media outlets across the state, the western area has experienced more than 20 major sinkholes over the past 20 years. Most of these sinkholes were caused by aging underground pipes. Asheville experiences a ground collapse on average at least once a year, and although no injuries or deaths have occurred due to sinkholes, many of the holes caused traffic disruptions, loss of business income and property damage at times exceeding $100,000[9]. **Figure C.11** shows one major sinkhole caused by a water main break, which occurred in Asheville on October 16, 2006.

FIGURE C.11: SINKHOLE IN BUNCOMBE COUNTY

Source: Asheville Citizen Times

Erosion

Most historical occurrences of erosion are seen near the coast of North Carolina, but University of North Carolina at Asheville is still susceptible to the hazard. Several sources were vetted to identify areas of erosion at University of North Carolina at Asheville. This includes searching local newspapers, interviewing local officials, and reviewing previous hazard mitigation plans. Buncombe County have previous mitigation actions that address erosion including bank stabilization and meeting erosion control requirements. Such actions will continue to be implemented as necessary throughout the region. Erosion was referenced in the previous University of North Carolina at Asheville Hazard Mitigation Plan,

[9] https://www.citizen-times.com/story/news/local/2016/12/13/old-pipes-big-problems-more-than-20-sinkholes-asheville/95152436/

but there was no recorded history of significant erosion events and it was found to be hazard with a negligible potential impact.

C.5.7.3 Probability of Future Occurrences

Landslides

Based on historical information and the USGS susceptibility index, the probability of future landslide events are likely (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 of the University of North Carolina at Asheville campus 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 in Buncombe County. While many sinkholes have been relatively small, it is still unlikely (between 1 and 33.3 percent annual probability) that the campus will continue to be affected in the future.

Erosion

Erosion remains a natural, dynamic, and continuous process for University of North Carolina at Asheville, and it will continue to occur. The annual probability level assigned for erosion is possible (between 1 and 10 percent).

C.5.8 DAM FAILURE

C.5.8.1 Location and Spatial Extent

The North Carolina Division of Energy, Mineral and 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 C.18** explains these classifications.

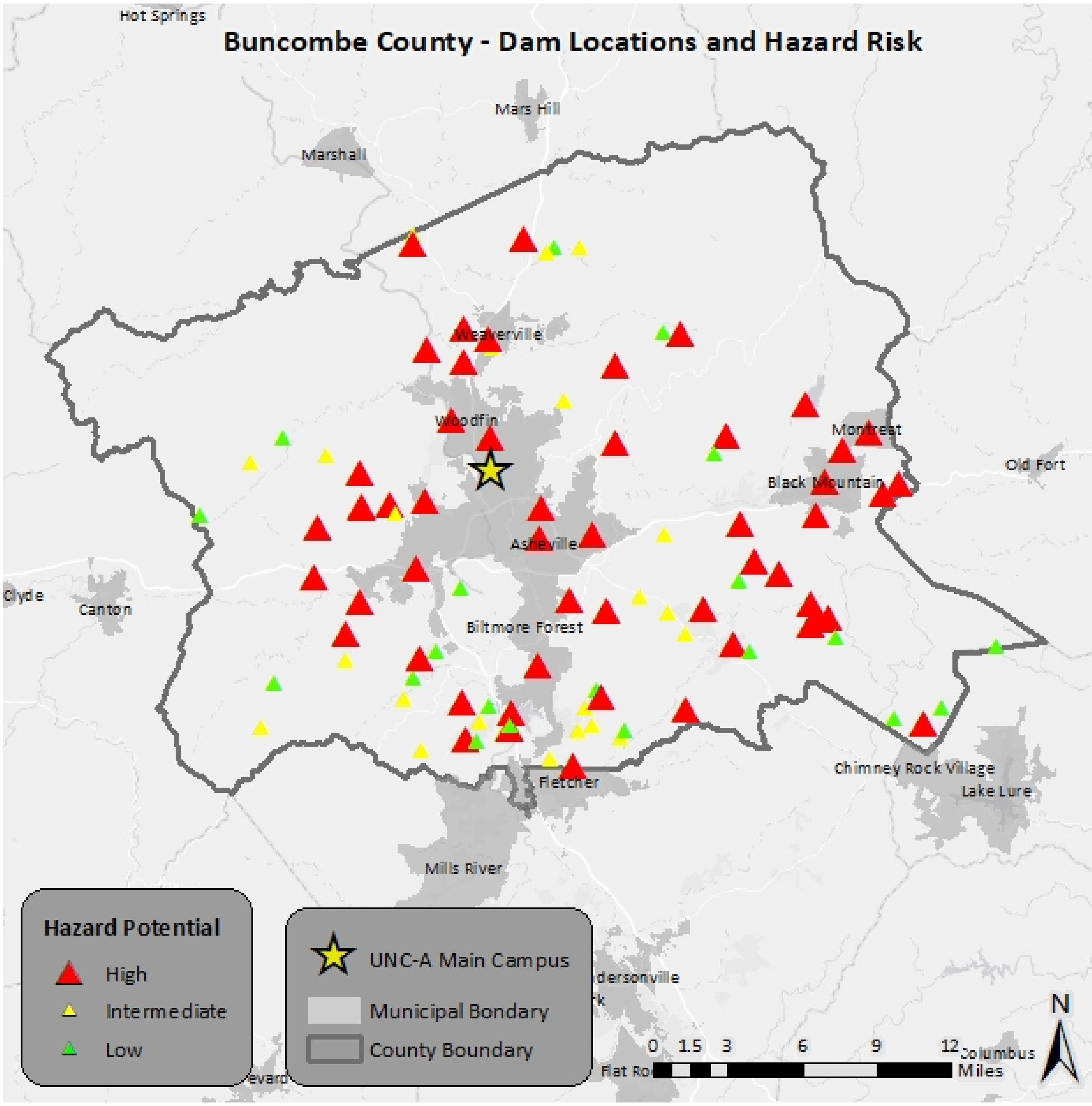
TABLE C.18: NORTH CAROLINA DAM HAZARD CLASSIFICATIONS

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 Management, there are 97 dams in Buncombe County. **Figure C.12** shows the dam location and the corresponding hazard ranking for each. Of these dams, 53 are classified as high hazard potential. These high hazard dams are listed in **Table C.19**. According to a consensus of the Campus Hazard Mitigation Planning Team, there is an extremely low possibility that any of these state-recognized dams would cause any damage whatsoever to University of North Carolina at Asheville should a dam breach or failure occur, despite the hazard classifications assigned to these dams by the state.

FIGURE C.12: BUNCOMBE COUNTY DAM LOCATION AND HAZARD RANKING



Source: North Carolina Division of Land Resources

TABLE C.19: BUNCOMBE COUNTY HIGH HAZARD DAMS

Dam Name	Hazard Potential	Surface Area (Acres)	Max Capacity (Ac-ft)	State Regulated?
Buncombe County				
Lake Ashnoca Dam	High	35.0	0	N
Beacon Reservoir Dam	High	N/A	0	N
Beaver Lake Dam	High	60.0	996	Y
Bee Tree Lake Dam	High	41.0	2800	Y
Black Mountain Reservoir Dam	High	3.1	56	Y
Busbee Reservoir Dam	High	8.0	48	Y
Capps Pond Dam	High	2.4	19	N
Lake Craig Dam	High	0.0	50	N
Crowfields Dam	High	2.0	22	Y
Echo Lake Dam	High	10.5	185	Y
Elida Home Lake Dam	High	N/A	0	N
Biltmore Lake Dam	High	65.0	1523	Y
Flat Top Mountain Lake Dam	High	10.0	200	Y
Holcombe Dam	High	2.0	21	N
Freedom Lake	High	2.0	28	N
Jewell Acres Dam	High	2.0	12	N
Lake Charles Dam	High	3.0	25	Y
Lake Kenilworth Dam	High	12.0	215	Y
Caldwell Pond Dam	High	1.5	18	Y
Camp Merrimac Dam	High	1.0	10	N
Moore's Dam	High	2.0	24	Y
Morgan Pond Dam	High	1.8	25	N
Nolen Pond Dam	High	N/A	0	N
North Fork Reservoir Dam	High	334.0	21700	Y
Walters Lake Dam	High	0.7	0	N
Lake Evens Dam	High	5.0	60	Y
STRAUS POND DAM	High	6.0	80	Y
Camp Ridgecrest Lake Dam	High	3.5	80	Y
Robinson Dam	High	2.0	0	N
Ross Creek Dam	High	3.5	15	N
Russell Dam	High	N/A	0	N
Smith Dam	High	1.5	15	N
MSD Treatment Plant Dam	High	11.0	385	Y
Starnes Cove Lower Dam	High	1.0	12	N
Lake Susan Dam	High	2.7	20	Y
Thrash Dam	High	2.0	37	N
Lake Tomahawk Dam	High	9.6	85	Y
Woodfin Reservoir Dam	High	5.6	157	Y

Dam Name	Hazard Potential	Surface Area (Acres)	Max Capacity (Ac-ft)	State Regulated?
Woodland Hills Dam	High	2.5	35	Y
Schmidt Pond Dam	High	N/A	20	N
Bent Creek Ranch Dam	High	N/A	0	N
Starnes Cove Upper Dam	High	0.6	7	N
Roddy Dam	High	1.0	10	N
Vanderbeek Dam	High	1.0	0	N
Kyle Boone Dam	High	2.0	16	N
Laurel Lake Dam	High	2.0	24	N
Kyfields Condominiums Dam	High	1.3	13	Y
Asheville Lake Julian Dam	High	240.0	0	Y
MacNair Dam	High	1.2	7	N
North Buncombe Quarry SB No. 7	High	N/A	1	Y
Porter Dam	High	2.8	19	N
Ashley Woods Dam	High	N/A	0	Y
Asheville 1964 Ash Pond Dam	High	45.0	1620	Y

Source: North Carolina Division of Land Resources

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

C.5.8.2 Historical Occurrences

According to information from the North Carolina Division of Energy, Mineral and Land Resources, there has been 12 dams breached in Buncombe County. There are no reports of death, injury, or property damage with any of this event. Further, there are no known levees in Buncombe County.

C.5.8.3 Probability of Future Occurrence

Given the current dam inventory and historic data, a dam breech is possible (between 1 and 10 percent annual probability) in the future. However, with regular monitoring, these events can be prevented as has been demonstrated in the past. Inundation by failure of the Phillips Lake Dam would cause catastrophic damage, including loss of life and injuries, especially to those areas located along the Catawba River. In addition to local devastation, the region as a whole would be impacted.

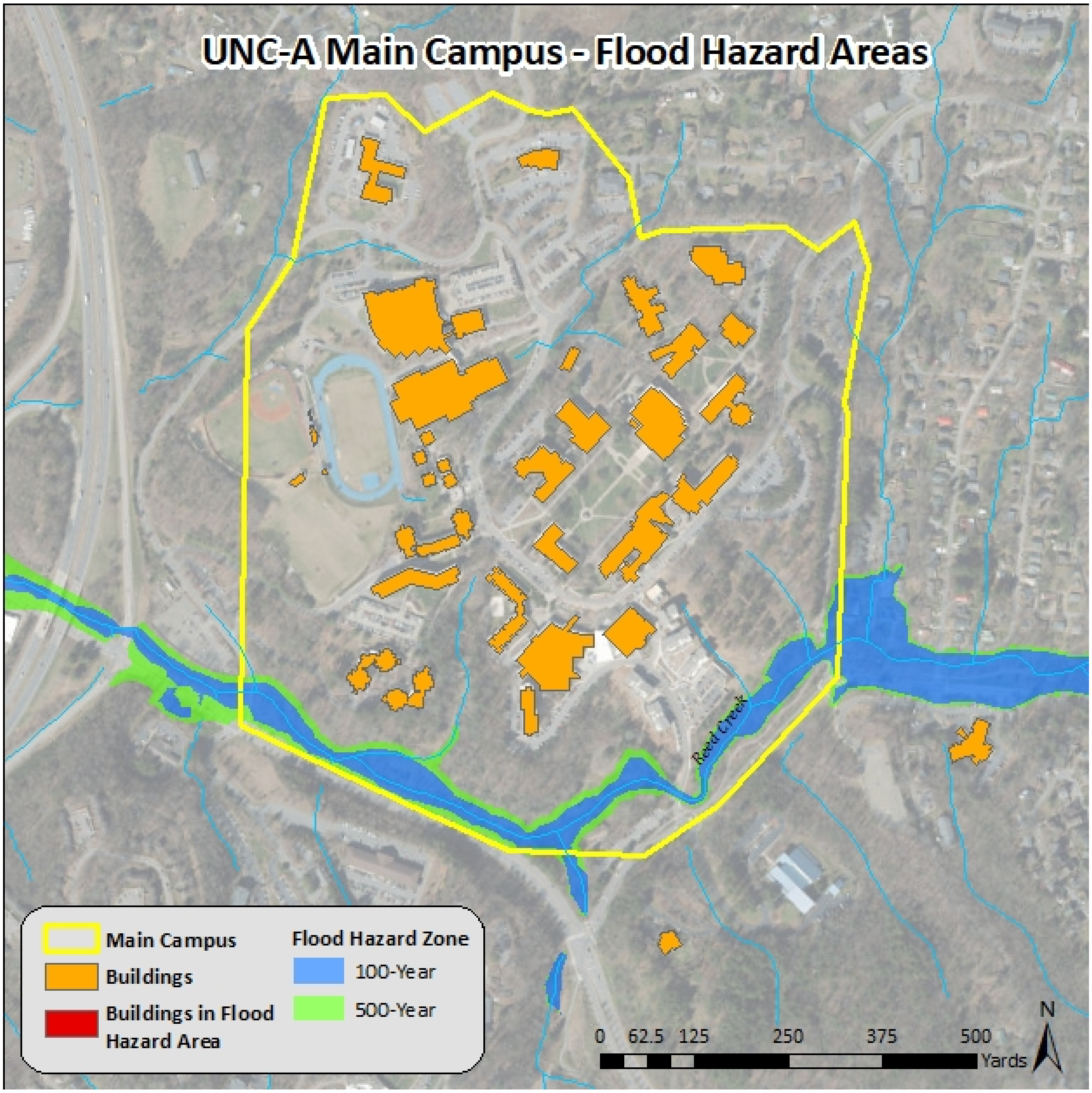
Inventories of statewide dam inundation data is an area that NCEM-RM is currently working hard to improve. At this time, there is geospatial data in final quality control review for 19 dams in North Carolina and that number is expected to increase significantly over the next several years. Additionally, NCEM is currently working with the USACE to acquire inundation data for 9 dams under the Corps' management. As this data becomes available, detailed assessments can be run to better determine vulnerability to dam failures. The 2025 update of this plan may include a much more robust analysis of dam failure vulnerability at the County level.

C.5.9 FLOODING

C.5.9.1 Location and Spatial Extent

There are areas on the University of North Carolina at Asheville campus that are susceptible to flooding from Reed Creek. Special flood hazard areas on the University of North Carolina at Asheville campus were mapped using Geographic Information System (GIS) and FEMA Digital Flood Insurance Rate Maps (DFIRM). This includes the 1-percent annual chance floodplain (100-year), and the 0.2-percent annual chance floodplain (500-year). **Figure C.13** illustrates the location and extent of currently mapped special flood hazard areas for the campus based on best available FEMA DFIRM data from October of 2018. 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 C.13: SPECIAL FLOOD HAZARD AREAS ON THE UNIVERSITY OF NORTH CAROLINA AT ASHEVILLE CAMPUS



Source: Federal Emergency Management Agency

The Campus Hazard Mitigation Planning Team indicated that there are 3 stormwater collection areas that could be breached and could take out a main road on campus. Additionally, there are two university buildings located on the French Broad river (STEAM studio at RAMP Studios and 838 Riverside Dr) that are vulnerable to flooding and the track is also susceptible to floods.

Reed Creek flooding could shut down the entrance to campus and Edgewood Rd would then be the only entrance to campus – if Founders Dr floods, it would cause many problems for the campus.

C.5.9.2 Historical Occurrences

Information from the National Centers for Environmental Information was used to ascertain historical flood events. A summary of major flooding events is presented in **Table C.20**. The National Centers for Environmental Information reported a total of 45 events throughout Buncombe County since 1996[10]. A summary of these events is presented in **Table C.21**. These events accounted for over $85.04 million (2020 dollars) in property damage throughout the county.

TABLE C.20: MAJOR FLOOD OCCURRENCES IN BUNCOMBE COUNTY

Area	Date	Type	Property Damage	Crop Damage	Description
Buncombe County	1/18/1996	Flood	$0	$0	An extremely strong cold front, preceded by heavy rain all day, moved through the mountains, foothills and piedmont during the night. Heavy rain and flooding accompanied the storm system. Several inches of rain fell across the mountains during the day. At Rosman, the French Broad River flooded causing some evacuations in the downtown area.
Buncombe County	1/26/1996	Flood	$30,000	$0	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.
NEW HOMINY	9/3/1996	Flash Flood	$0	$0	Flash flooding from slow moving thunderstorms caused several roads and bridges to be closed.
WEST PART OF COUNTY	9/4/1996	Flash Flood	$0	$0	
EASTERN PART	9/4/1996	Flash Flood	$0	$0	
ASHEVILLE	6/26/1997	Flash Flood	$0	$0	Severe thunderstorms caused several reports of large hail and blew down trees and power lines around Morganton and in northern Mecklenburg county. Heavy rain from storms in the mountains caused relatively minor flooding around parts of Asheville and mostly street and road flooding in Fletcher. Lightning started a fire in Morganton which resulted in some damage to a home.
COUNTYWIDE	1/7/1998	Flash Flood	$1,000,000	$0	Sweeten Creek backed up and flooded, causing significant property damage in the Barnardsville and Biltmore Village areas.
LEICESTER	3/20/2000	Flash Flood	$0	$0	An area of precipitation which fell as rain in the low elevations, and snow in the higher elevations of the northern mountains, crossed western North Carolina early in the morning. Two to 4 inches of rain fell in a short time across portions of Buncombe and Henderson counties and caused small streams to flood briefly. Snowfall in the high elevations ranged between 2 and 3 inches, with 5 inches reported from the highest peaks.

[10] These events are only inclusive of those reported by NCEI. It is likely that additional occurrences have occurred and have gone unreported.

Area	Date	Type	Property Damage	Crop Damage	Description
SKYLAND	6/22/2001	Flash Flood	$1,000,000	$0	A significant, classic flash flood developed when nearly-stationary thunderstorms dumped as much as 4 inches of rain on southern Buncombe County in a short period of time. Several creeks flooded, including Hominy and Avery creeks. The worst of the flooding occurred between 1245 pm and 145 pm EST. A mobile home park was flooded, businesses flooded and cars were caught in rapidly developing flood water. A number of rescues were required.
WEAVERVILLE	8/8/2001	Flash Flood	$0	$0	Lake Louise filled with water from heavy rain of up to 3 inches early in the evening. The lake was near bank full already due to heavy rain the night before. The lake flooded surrounding roads.
ASHEVILLE	6/5/2002	Flood	$10,000	$0	Some street flooding occurred, and water entered a few homes.
WEAVERVILLE	2/22/2003	Flash Flood	$0	$0	Heavy rainfall resulted in flooding along several creeks, as well as mudslides in northern Buncombe County. Some outdoor walls fell due to mudslides. A mobile home park flooded near Weaverville.
CENTRAL PORTION	5/6/2003	Flash Flood	$100,000	$0	Early morning thunderstorms resulted in rapid rises and flash flooding along some small creeks and streams, mainly in the Asheville area. Mud and rock slides also developed. the basements of some businesses and homes were flooded in the Biltmore area of Asheville, resulting in significant property damage.
LEICESTER	7/13/2003	Flash Flood	$0	$0	Numerous creeks overflowed their banks and flooded adjacent roads.
ASHEVILLE	8/4/2003	Flash Flood	$0	$0	Slow-moving thunderstorms producing very heavy rainfall flooded several roads in Biltmore Village. Up to 3 feet of water covered some roads. Several businesses were also flooded. Also, Beaverdam Rd was flooded from Asheville to areas north of the city.
Buncombe County	2/6/2004	Flood	$0	$0	Flooding along the French Broad continued downstream to affect lowland areas in Henderson County to just south of Asheville.
Buncombe County	9/7/2004	Flood	$40,000,000	$1,000,000	Flooding began during the late afternoon across the county and gradually worsened during the evening and overnight hours, with near-record flooding observed along the Swannaoa and French Broad Rivers. Most valley communities across the county were affected by severe flooding along the rivers, or along smaller streams. Flooding along the Swannanoa devastated Asheville's Biltmore area, as well as the Black Mountain and Swannanoa communities. Numerous businesses and residences were damaged or destroyed by flood waters. Widespread damage to roads and bridges also occurred, either due to flooding or landslides.
Buncombe County	9/16/2004	Flood	$40,000,000	$0	After many hours of moderate to heavy rainfall, gradual rises on creeks and streams resulted in the second devastating flood across the county in just 9 days. Flooding first began around Candler, but eventually affected every valley community in the county. Flooding was actually more widespread than during the Frances flood, but was not quite as severe. Virtually every stream in the county flooded, including the French Broad River. Two males, ages 32 and 28, died in Leicester when they attempted to cross a flooded area in a pickup truck. Hundreds of roads were flooded and the bridge over highway 197 in Barnardsville was washed out. The French Broad flooded the studios and other businesses in the River District in downtown Asheville. At Enka, a motel was flooded, which necessitated the rescue of 40 people. Numerous homes were destroyed or severely damaged by flood water or landslides.

Area	Date	Type	Property Damage	Crop Damage	Description
ARDEN	7/11/2005	Flash Flood	$0	$0	Four families evacuated from an apartment complex due to flooding. One resident reported 6-8 inches of water entered his apartment.
SKYLAND	7/13/2005	Flash Flood	$0	$0	Several creeks overflowed their banks in locations from Skyland to Asheville Regional Airport, flooding roads, including Mills Gap and Hendersonville Rds, and some buildings.
LEICESTER	7/19/2005	Flash Flood	$0	$0	Two roads flooded near the Madison County line. A private bridge was also washed out near Leicester
WEAVERVILLE	5/21/2012	Flash Flood	$20,000	$0	The Eden Glenn Mobile Home Park was flooded by Flat Creek after around 3 inches of rain fell in an hour. Approximately 30 people were evacuated from about 2 dozen mobile homes between 7 pm and midnight. One utility building floated away and there was underpinning damage to a few trailers. County officials reported that this same area flooded around 17 years ago.
NEW BRIDGE	7/11/2012	Flash Flood	$50,000	$0	Two to three inches of rain fell across the metro Asheville area, with an inch of that falling in around an hour. This caused widespread urban flooding with numerous roads in city covered by 1 to 2 feet of water. The flooding appears to have been almost entirely the result of poor drainage. Roads affected by urban flooding included Weaverville Rd, Riverside Dr, Charlotte St, Merrimon Ave, Druid Dr and the intersection of Haywood Rd and Patton Ave. Water entered the basements of some buildings and there were several vehicle accidents as well. Three homes were evacuated, not as a direct result of flooding, but out of concern that the embankment they are on would fail.
MURPHY JCT	1/30/2013	Flash Flood	$10,000	$0	Urban flooding affected the Biltmore Village area, including Brook Street which was flooded by 2 to 3 feet of water. One car was stranded in the high water. Sweeten Creek Rd was closed near London Rd and Caribou Road in the same area. Rescuers had to pull people from a car stuck in flood waters on Sweeten Creek Rd. Two stores in the Biltmore Village had a few inches of water enter them. Probable urban flooding was reported at State St and Amboy Rd.
GROVEMONT	1/30/2013	Flash Flood	$0	$0	A stream flooded Highway 70 west of Black Mountain, closing the road in both directions near its intersection with Grovestone Rd. Martin Road was also flooded by a stream about a half mile west of Swannanoa.
FAIRVIEW	1/30/2013	Flash Flood	$0	$0	Gap Creek Road was flooded by Gap Creek.
ELK MTN	5/5/2013	Flood	$10,000	$0	A mix of river and stream flooding affected the county after several inches of rain fell, mainly on the 5th. A few streams went out of their banks during the evening hours of the 5th. Charlotte Street was flooded by Flat Creak during this time. Starting during the early morning hours of the 6th, much of the French Broad and Swannanoa River systems went above flood stage. Several roads were affected around Asheville where the French Broad was above flood stage from 115 AM EDT on the 6th until 630 PM EDT that day. Flooded roads included Amboy Road, Swannanoa River Road, Riverside Drive from Craven Street to the I-26 on-ramp, Lyman Street and Azalea Road among others. Several rock and mud slides affected the county as well, particularly the south and east parts.
ASHEVILLE	7/4/2013	Flash Flood	$0	$0	Tunnel Road was flooded by a creek near Kenilworth Road. A spotter a little north of this location reported a 24-hour rainfall total of 3.94 inches.

Area	Date	Type	Property Damage	Crop Damage	Description
WOODFIN	7/4/2013	Flash Flood	$2,500,000	$0	Several streets were flooded from the Biltmore Forest area northward to Asheville. Numerous roads were closed by flooding, landslides and fallen trees. Around 9 pm EDT a large debris flow took out part of Vance Gap Road, isolating several homes. Around a dozen residences had to be evacuated as a result of the slide.
BEECH	7/10/2013	Flash Flood	$10,000	$0	Reems Creek Road was flooded by Reems Creek near where the road intersects with Many Branch and Sugar Cove Roads. After the creek subsided, a significant amount of debris was left on the road which had to be cleared by earth moving equipment causing the road to be closed for several hours. A couple nearby dirt roads were washed out, cutting off several houses.
NEW BRIDGE	7/10/2013	Flash Flood	$100,000	$0	Flooding along Beaverdam Creek washed out a private access bridge on Pinecroft Road. The road itself was also flooded. The Beaverdam Fire Department was flooded to a depth of 3 feet, causing damage to the station and taking it out of service. Three families in this area were temporarily relocated due to the flooding threat. Flowing water was 1.5 feet deep over the roadway at Weaverville Highway and Breckenridge Parkway. Merrimon Avenue was also flooded at Beaverdam Creek in this same area.
LEICESTER	7/10/2013	Flash Flood	$0	$0	Sandy Mush Creek flooded, affecting Turner Cove Road and blocking two homes. Four other roads in this area, and toward Leicester, were also flooded.
WEAVERVILLE	8/22/2015	Flash Flood	$20,000	$0	County comms and FD reported localized flash flooding developed in the Weaverville area after 2 to 4 inches of rain fell in a short period of time. Several small creeks overflowed their banks and flooded roads as well as the basements of some homes on Woodland Hills Dr, Hamburg Mountain Rd, and Lakeshore Dr. In addition, water from a stream along Merrimon Rd resulted in stalling of a vehicle, with the driver requiring rescue. At least one small mudslide also occurred in the area.
AZALEA	12/29/2015	Flash Flood	$10,000	$0	Emergency manager reported a bridge over Grassy Branch was washed out on Thomas Lee Dr after as much as 3 inches of rain fell across the Asheville area in just a few hours.
KENNWORTH	2/3/2016	Flash Flood	$10,000	$0	After scattered to numerous showers produced up to an inch of rain across Buncombe County in about 24 hours, an area of widespread heavy rain moved over the area during the morning of the 3rd, resulting in an additional 1.5 to 2 inches that fell in only a couple of hours. County comms center and the public reported flash flooding due to poor drainage and overflowing small streams developed during the late morning and early afternoon across the area. In Asheville, part of Tunnel Rd was flooded along with several streets in the Biltmore Village area. Lower Grassy Branch Rd was flooded in East Asheville, probably due to stream flooding. Ivy Creek overflowed its banks at Glen Hill Dr in Barnardsville, blocking a mobile home park entrance. County comms reported about 20 roads closed across the county at the height of the event.

Area	Date	Type	Property Damage	Crop Damage	Description
KENNWORTH	10/23/2017	Flood	$15,000	$0	Media and stream gauges reported flooding developed across southeastern sections of Buncombe County after widespread rainfall of 3 to 4 inches, with roughly half of that occurring over a period of just a couple of hours. Severe urban flooding and stream flooding along Sweeten Creek developed in the Biltmore Village area. Biltmore Ave and Sweeten Creek Rd were both largely impassable in spots due to deep water. Water also entered several businesses along Brook St and Sweeten Creek Rd. Minor stream flooding was also reported along Cane Creek in the Fairview area, where at least one road was flooded and impassable, and near the headwaters of the Swannanoa River, which flooded Veterans Park in Black Mountain.
BLUE RIDGE	5/17/2018	Flash Flood	$500	$0	Public reported (via Social Media) more than a foot of water from an overflowing Garren Creek flooding the intersection of Garren Creek Rd and Morgan Hill Rd after more than three inches of rain fell in only a couple of hours.
BLACK MTN	5/29/2018	Flash Flood	$2,000	$0	A stream gauge indicated and county comms confirmed flash flooding developed along the Swannanoa River in the Black Mountain area after 2 to 3 inches or rain fell across the area in just a few hours. This was after stream levels were already elevated due to heavy rain that fell on the 28th. The main impact was to areas around Veterans Park, including Veterans park Dr. The stream briefly fell below flood stage during late afternoon, but another round of heavy rain during the evening quickly sent it back above flood stage, where it crested at moderate flood stage before beginning to recede during late evening. Total rainfall of 4 to 6 inches was reported in the area on the 29th.
GROVEMONT	5/29/2018	Flood	$100,000	$0	Stream gauge on county comms reported flooding along the Swannanoa River basin. Backwater effects near the town of Swannanoa caused a tributary to flood Azalea Road. The river was also reported to be flooding low-lying areas in the Oteen community. The river crested just below moderate flood stage in Biltmore Village, sending water over portions of Swannanoa River Rd and flooding businesses between the river and the railroad tracks in the village. While only around 2 inches of rain fell in the Asheville area from the 29th through the 30th, the bulk of the flood water originated from the headwaters near Black Mountain, where as much as 10 inches fell during this time.
MONTREAT	9/16/2018	Flash Flood	$500	$0	Law enforcement reported evacuation of a mobile home park after a tributary of Flat Creek flooded the area around Portman Villa Rd and David Dr in Black Mountain. Four to six inches of rain fell across the area throughout the 16th.
BLUE RIDGE	9/30/2018	Flash Flood	$2,000	$0	Cocorahs observer reported flash flooding developed along tributaries of the rocky Broad River in buncombe county after 4 to 8 inches fell in the basin throughout the 29th and the early part of the 30th, with the bulk of that falling during the evening. Affected Streams included grace branch and duck branch, which was responsible for a washed-out bridge.
BLACK MTN	10/11/2018	Flash Flood	$1,000	$0	A stream gauge on the Swannanoa River at Black Mountain exceeded its established flood stage after 4 to 6 inches of rain fell in just a few hours. The main impact was to roads and trails in Veterans Park.

Area	Date	Type	Property Damage	Crop Damage	Description
GROVESTONE	12/28/2018	Flood	$10,000	$0	Stream gauges along the Swannanoa River in Buncombe County exceeded their established flood stages after 3 to 4 inches of rain fell throughout the basin in about 24 hours. Low spots on the campus of Warren Wilson College were inundated. The primary impacts were in Biltmore Village in Asheville. The river, along with backwater effects into smaller tributaries flooded and closed multiple streets, including Garfield St, Decatur St, Caledonia Rd, Glendale Ave, Swannanoa River Rd, and Thompson St. Water entered the lower levels of a couple of businesses on Decatur St and Garfield St.
ROYAL PINES	4/19/2019	Flash Flood	$30,000	$0	Flash flooding developed across central Buncombe County after 3.5 to 5.5 inches of rain fell across the area in just a few hours. Public first reported flooding of Cane Creek was inundating low-lying areas and some roads in the Fletcher and Fairview areas. The more significant issues were along the Swannanoa River from the Swannanoa community downstream to Biltmore Village in Asheville. Stream gauges along the river at Warren Wilson College and in Biltmore Village exceeded their established flood stages by 2-4 feet. Water inundated low lying areas of Warren Wilson College while multiple streets were flooded in Biltmore Village due to the Swannanoa but also due to backwater effects into Sweeten Creek. These included Swannanoa River Rd, Garfield St, Caledonia Rd, Glendale Ave, Thompson St, Decatur St, and Biltmore Ave. Water entered several businesses on Garfield St and Decatur St. Although waters began to recede in most areas by the evening of the 19th, the Swannanoa remained above flood stage at Biltmore Village through midnight. Minor to moderate river flooding also developed along the French Broad River at Fletcher and Asheville on the 19th, and persisted for a couple of days.
BLACK MTN	6/9/2019	Flood	$1,000	$0	Stream gauges on the Swannanoa River at Black Mountain and downstream at Warren Wilson exceeded their established flood stages after 4 to 5 inches of rain fell in the headwaters over a period of several hours. Veterans Park was flooded in Black Mountain, while several campus roads and low-lying areas at Warren Wilson College also flooded.

Source: National Centers for Environmental Information

TABLE C.21: SUMMARY OF FLOOD OCCURRENCES

Location	Number of Occurrences	Deaths	Injuries	Property Damage
Asheville	4	0	0	$10,000
Biltmore Forest	0	0	0	$0
Black Mountain	0	0	0	$0
Montreat	1	0	0	$500
Weaverville	4	0	0	$40,000
Woodfin	1	0	0	$2,500,000
Unincorporated Area	35	2	0	$82,491,500
Buncombe County Total	**45**	**2**	**0**	**$85,042,000**

Source: National Centers for Environmental Information

C.5.9.3 Probability of Future Occurrences

Flood events will remain a threat to University of North Carolina at Asheville, 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).

It can be inferred from the floodplain location maps, previous occurrences, and repetitive loss properties that risk varies throughout the University of North Carolina at Asheville campus.

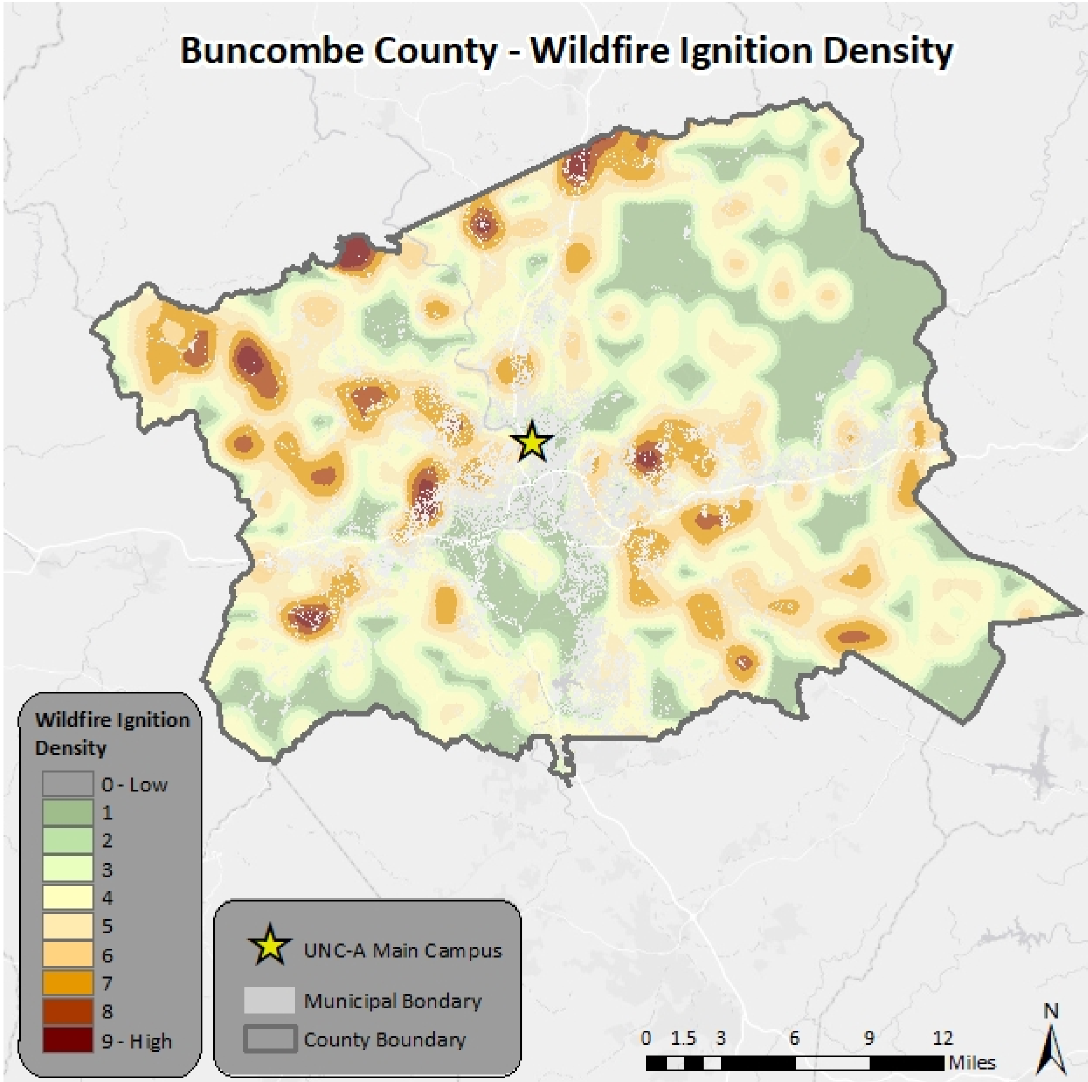
C.5.10 WILDFIRES

C.5.10.1 Location and Spatial Extent

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

Figure C.14 shows the Wildfire Ignition Density in Buncombe County 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.

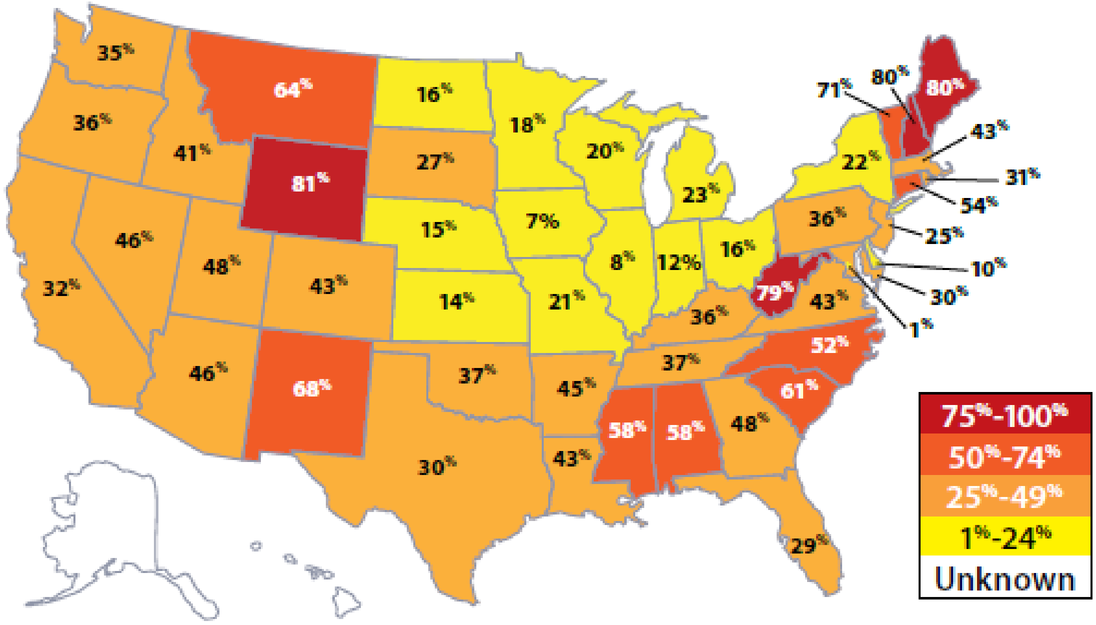
FIGURE C.14: WILDFIRE IGNITION DENSITY IN BUNCOMBE COUNTY



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 C.15** 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.

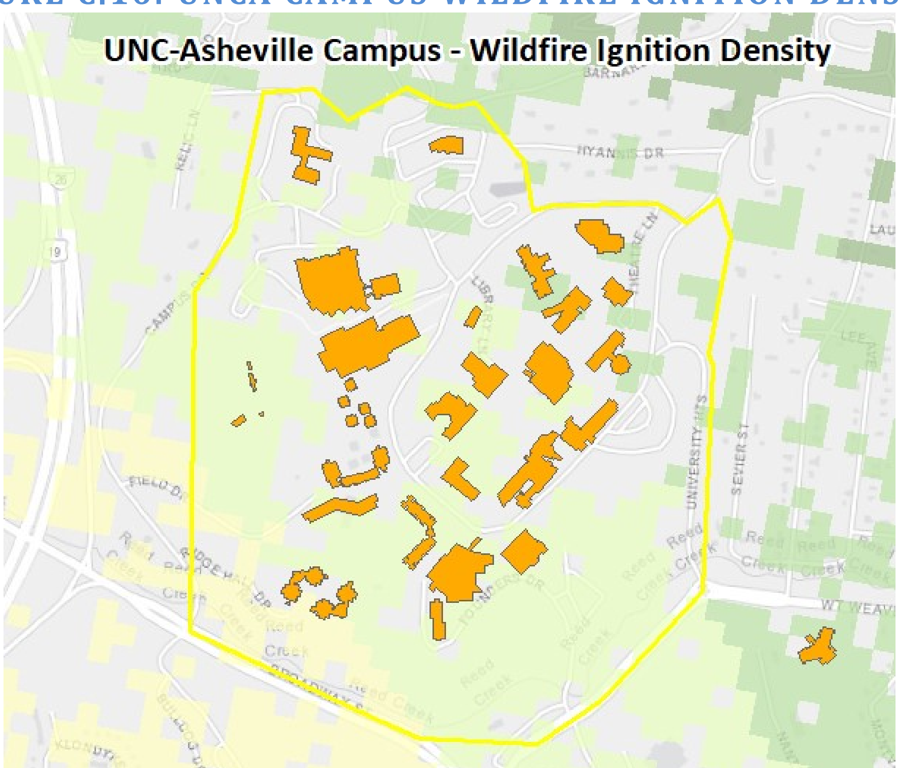
FIGURE C.15: % OF HOMES IN THE WILDLAND URBAN INTERFACE



Source: US Department of Agriculture

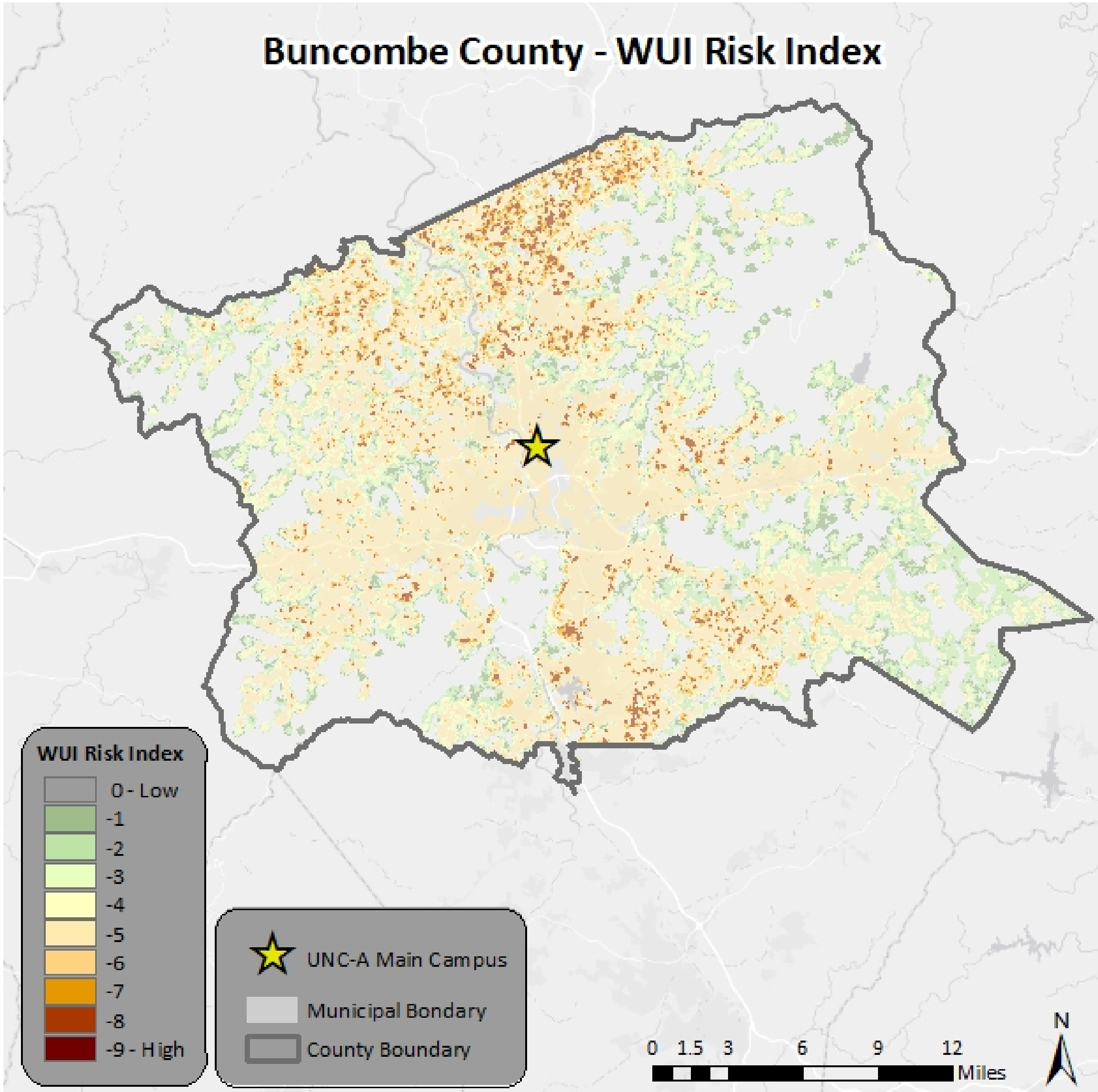
Below, **Figure C.16** displays the Wildfire Ignition Density specifically for the University of North Carolina at Asheville, and **Figure C.17** shows the WUI Risk Index for Buncombe County.

FIGURE C.16: UNCA CAMPUS WILDFIRE IGNITION DENSITY



Source: Southern Wildfire Risk Assessment

FIGURE C.17: BUNCOMBE COUNTY WILDFIRE URBAN INTERFACE RISK INDEX



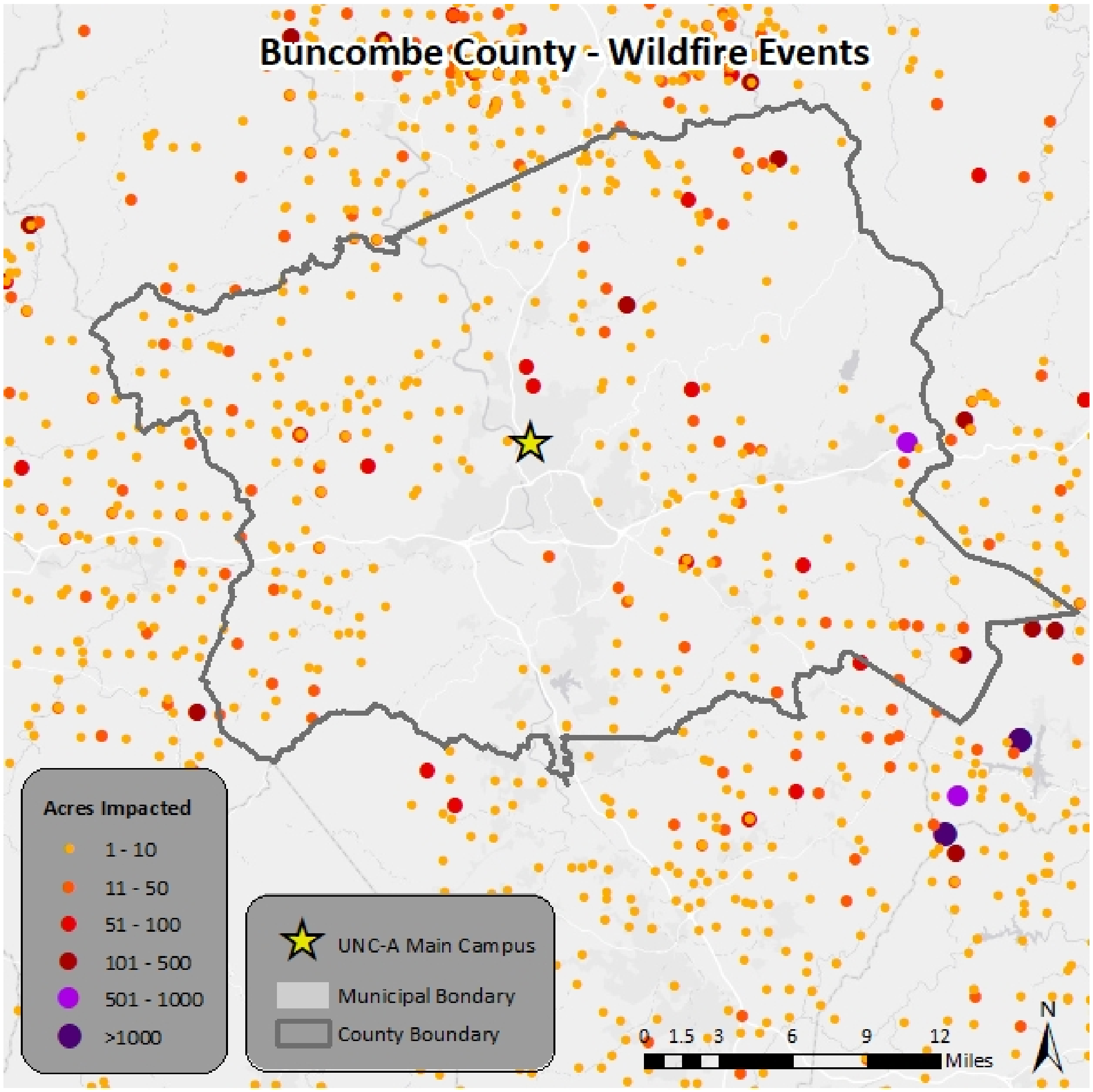
Source: Southern Wildfire Risk Assessment

C.5.10.2 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 464 events that impacted an area greater than 1 acre have occurred throughout the Buncombe county since (January 5, 2001)[11]. **Figure C.18** displays wildfire events in Buncombe County.

[11] These events are only inclusive of those reported by NASFI. It is likely that additional events have occurred and have gone unreported.

FIGURE C.18: WILDFIRE EVENTS IN BUNCOMBE COUNTY



Source: NASFI

Based on data from the North Carolina Division of Forest Resources from 2001 to 2018, Buncombe County experiences an average of 25 wildfires annually which burn a combined 224 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.

C.5.10.3 Probability of Future Occurrences

Wildfire events will be an ongoing occurrence in Buncombe County and for University of North Carolina at Asheville. 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 University of North Carolina at Asheville for future wildfire events are likely (10 to 100 percent annual probability).

C.5.11 Infectious Disease

C.5.11.1 Location and Spatial Extent

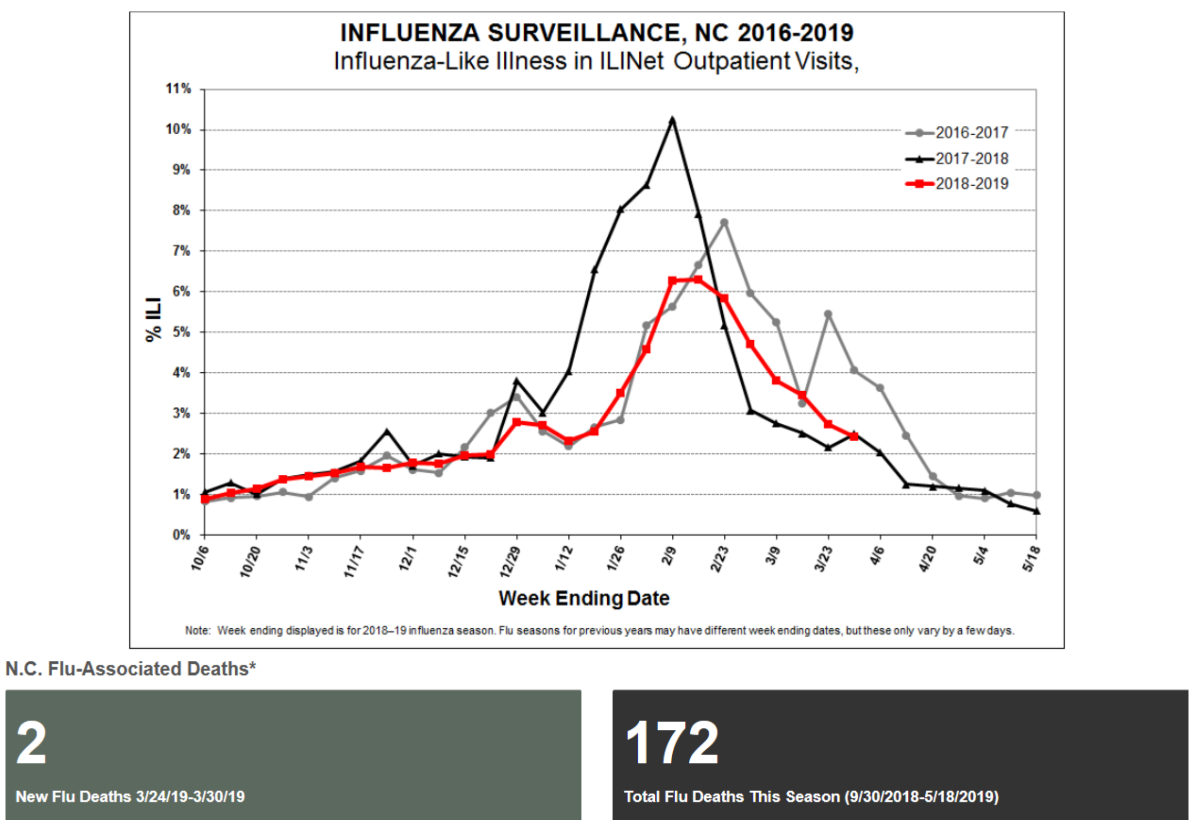
Extent is difficult to measure for an infectious disease event as the extent is largely dependent on the type of disease and on the effect that it has on the population. Extent can be somewhat defined by the number of people impacted, which depending on the type of disease could number in the tens of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

C.5.11.2 Historical Occurrences

Infectious Disease

Influenza is historically the most common infectious disease that has occurred in Buncombe County. Cases of the flu tend to occur in the late fall to early winter months. In recent years, cases of the influenza and influenza-like illnesses have been reported in hospitals. As seen in **Figure C.19** below, 172 people throughout North Carolina died from the flu between 2018 and 2019.

FIGURE C.19: INFLUENZA SURVEILLANCE, NC 2016-2019



Source: NC Department of Health and Human Services

Starting in 2020, the COVID-19 infectious disease pandemic began to impact North Carolina and Buncombe County. The NC Department of Health and Human Services has been actively monitoring and tracking cases since the first case arrived in the State. A Presidential disaster declaration was declared for North Carolina on March 24, 2020 for the COVID-19 pandemic. **Table C.22** provides a summary of confirmed cases of COVID–19 in Buncombe County as of the date of the final version of this plan in 2021. The COVID-19 pandemic is still evolving even though vaccines have been created that are slowing the spread. The pandemic unfolded as this plan was being developed, so the information below presents only a small sample of the pandemic's impacts on Buncombe County. On April 27, 2020, the UNC System made the decision to postpone in-person classes for the remainder of the school year. As a result, UNCA and all other universities in North Carolina, shifted to online courses. Due to Executive Order 135, which extended the existing statewide stay-at-home order through May 8, 2020; college campuses were asked to vacate any on-campus university housing.

TABLE C.22: SUMMARY OF CONFIRMED COVID-19 CASES IN BUNCOMBE COUNTY

Location	Number of Cases	Number of Deaths*
Buncombe County	**17,715**	**316**

Source: North Carolina Department of Health and Human Services as of 5/18/20
** Deaths reflect deaths in persons with laboratory-confirmed COVID-19 reported by local health departments to the 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[12].

C.5.11.3 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 University of North Carolina at Asheville will experience an outbreak of infectious diseases in the future.

[12] https://www.ncdhhs.gov/news/press-releases/nc-prepared-zika-virus-risk-local-virus-carrying-mosquitoes-low

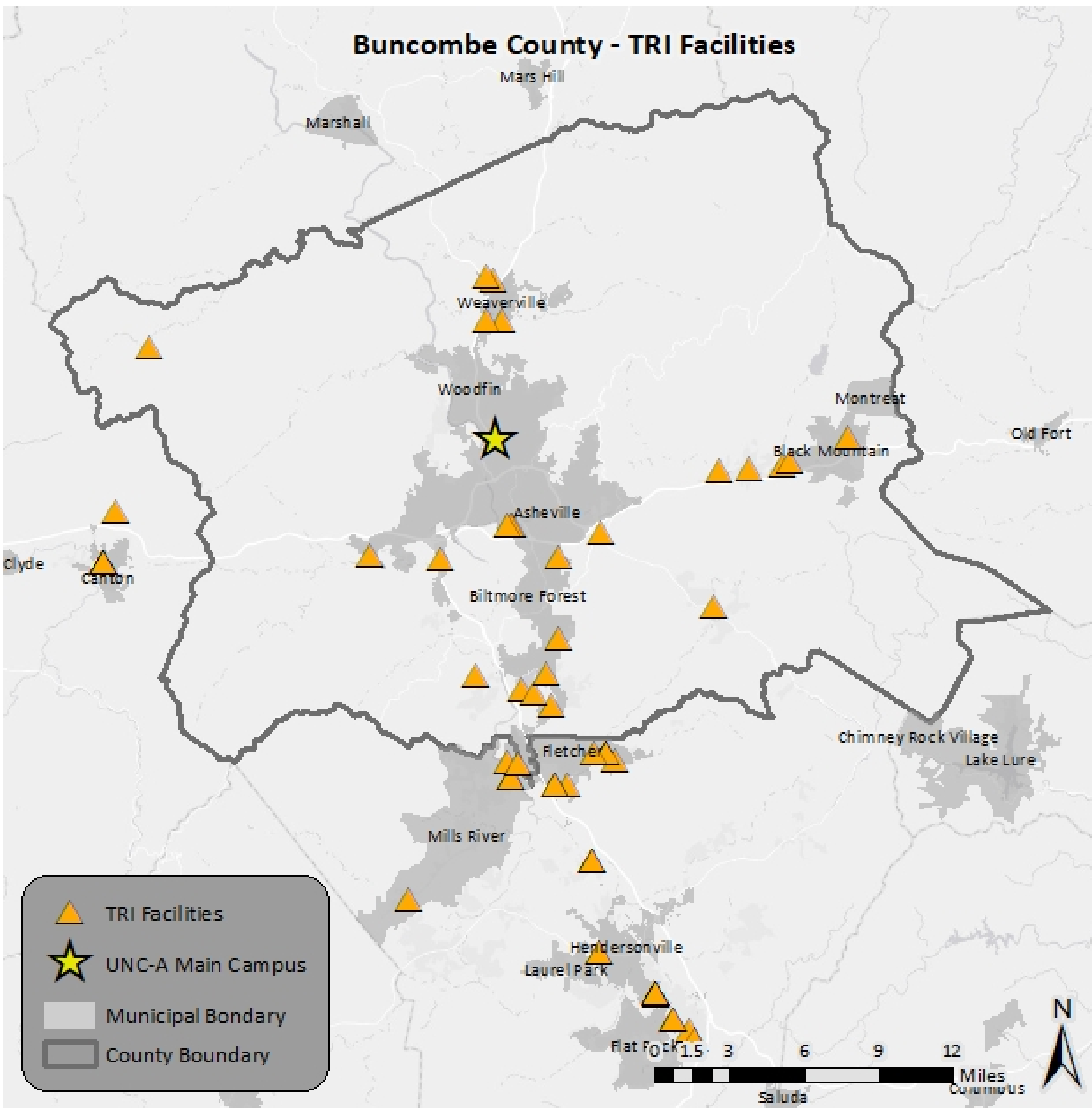
Technological Hazards

C.5.12 HAZARDOUS SUBSTANCES

C.5.12.1 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 collection information from industrial facilities on the releases and transfers of certain toxic agents. This information is then reported in the Toxic Release Inventory (TRI). TRI sites indicate where such activity is occurring. Buncombe County has 23 TRI sites. A map for Buncombe County TRI Facilities is shown in **Figure C.20.**

FIGURE C.20: BUNCOMBE COUNTY TOXIC RELEASE INVENTORY (TRI) SITES



Source: EPA

The Campus Hazard Mitigation Planning Team indicated that there are no major hazmat concerns on campus although there are some stored at Sikes Hall; however, location along major road, rail and air routes have the potential to put the campus at risk to external events. Highway 19/23 is considered to be a huge risk to the campus. Also, Silverline Plastics which is adjacent to campus also poses a potential hazmat risk.

C.5.12.2 Historical Occurrences

The U.S. Department of Transportation Pipeline and Hazard 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.

The Pipeline and Hazardous Materials Safety Administration (PHMSA) is an agency of the United States Department of Transportation that was established in 2004. The PHMSA maintains a database of hazardous materials incidents for communities across the United States. Summary results of their data for events that have occurred in Buncombe County can be found in **Table C.23**.

TABLE C.23: SUMMARY OF HAZMAT INCIDENTS IN BUNCOMBE COUNTY

Location	Incidents Reported	Injuries	Fatalities	Type	Costs
Asheville	296	0	0	Highway, Rail and Air	$1,033,922
Biltmore Forest	0	0	0	--	$0
Black Mountain	3	0	0	Highway	$59,100
Montreat	0	0	0	--	0
Weaverville	0	0	0	--	$0
Woodfin	0	0	0	--	$0
Unincorporated Area	19	0	0	Highway, Rail	$358,680

Buncombe County Total	**318**	**0**	**0**		**$1,451,702**

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

C.5.12.3 Probability of Future Occurrence

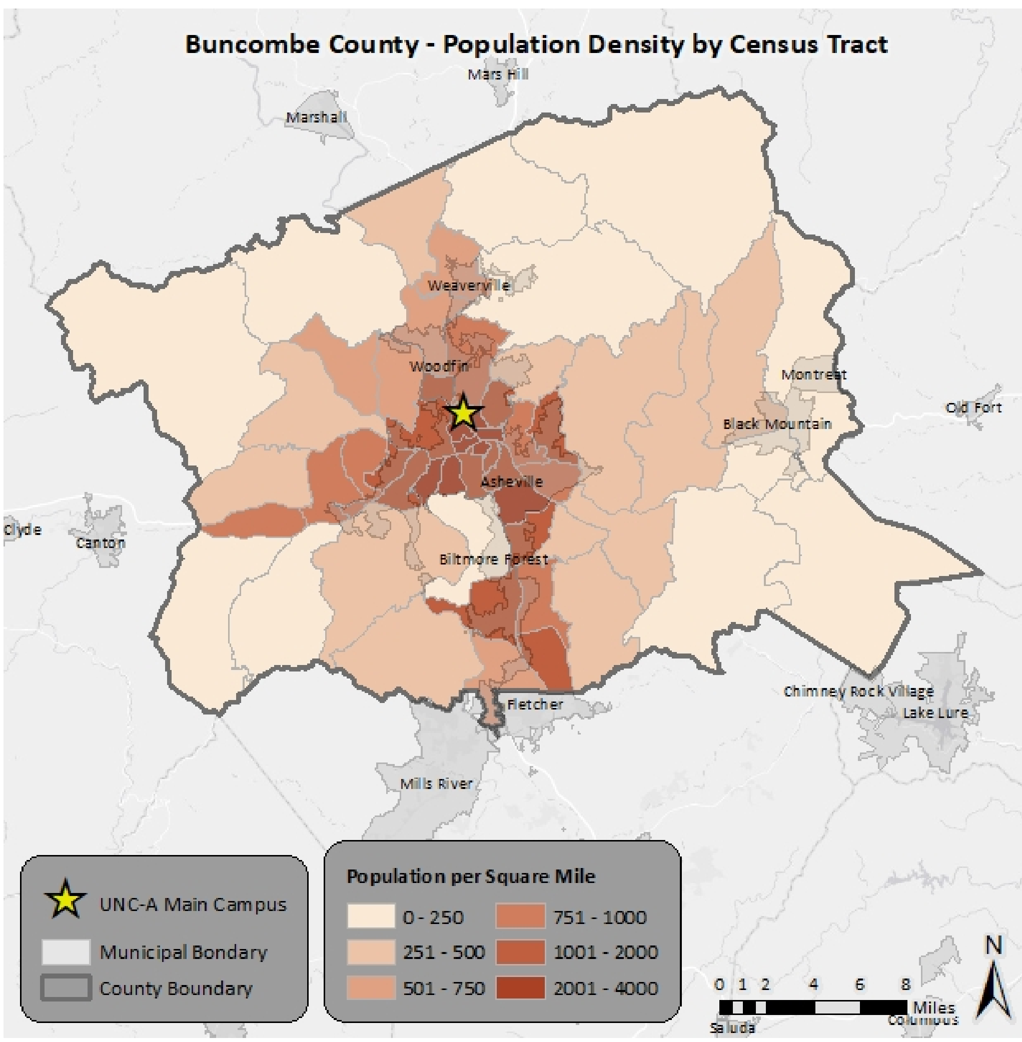
Given the location of toxic release inventory sites in Buncombe County, it is possible (1 to 33.3 percent annual probability) that a hazardous material incident may occur. University officials are mindful of this possibility and take precautions to prevent such an event from occurring.

C.5.13 TERRORISM

C.5.13.1 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 C.21** displays the population density in Buncombe County using census tract levels.

FIGURE C.21: POPULATION DENSITY



Source: US Census Bureau

Furthermore, the most recent population counts of each participating county and jurisdictions can be seen in **Table C.24** below.

TABLE C.24: 2018 POPULATION ESTIMATES FOR BUNCOMBE COUNTY

Location	Population
Asheville	92,870
Biltmore Forest	1,043
Black Mountain	8,148
Montreat	836
Weaverville	3,974
Woodfin	6,582
University of North Carolina at Asheville	3,600
Unincorporated Area	147,738
Buncombe County Total	**261,191**

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

The Campus Hazard Mitigation Planning Team indicated that terrorism is definitely a hazard of concern for the university.

C.5.13.2 Historical Occurrences

No extreme cases of terror attacks have previously affected Buncombe County or University of North Carolina at Asheville. However, as the population in the area continues to increase, so does the chance of an attack. There is an ongoing concern on college campuses about active shooter events. Information from the National Center on Safe and Supportive Learning Environments, a recent study found between the 2001-2002 and 2015-2016 school years, 437 people were shot in 190 college campus shooting incidents.

C.5.13.3 Probability of Future Occurrence

Neither Buncombe County nor University of North Carolina at Asheville have experienced a 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.

C.5.14 CYBER

C.5.14.1 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. University of North Carolina at Asheville is susceptible to cyber-attacks. The ITS Office of Information Security (ITS-OIS) and the Student Cyber Security Operations Center (SCSOC) are UNCA's information security unit.

C.5.14.2 Historical Occurrences

In North Carolina, 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. **Table C.25** displays the North Carolina Cybercrimes and Victim Counts in 2018.

TABLE C.25: NORTH CAROLINA CYBERCRIMES AND VICTIM COUNTS IN 2018

Crime Type by Victim Count

Crime Type	*Victim Count*	*Crime Type*	*Victim Count*
Advanced Fee	436	Identity Theft	330
BEC/EAC	430	Investment	47
Charity	11	Lottery/Sweepstakes/Inheritance	213
Civil Matter	15	Malware/Scareware/Virus	49
Confidence Fraud/Romance	432	Misrepresentation	148
Corporate Data Breach	39	No Lead Value	246
Credit Card Fraud	306	Non-payment/Non-Delivery	1,647
Crimes Against Children	28	Other	172
Denial of Service/TDos	28	Overpayment	406
Employment	391	Personal Data Breach	1,125
Extortion	1,219	Phishing/Vishing/Smishing/Pharming	947
Gambling	4	Ransomware	29
Government Impersonation	255	Re-shipping	31
Hacktivist	2	Real Estate/Rental	286
Harassment/Threats of Violence	330	Spoofing	430
Health Care Related	9	Tech Support	361
IPR/Copyright and Counterfeit	30	Terrorism	2
Descriptors*			
Social Media	902	Virtual Currency	790

Source: FBI Internet Crime Compliant Center, 2018

C.5.14.3 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 at University of North Carolina at Asheville, and it is considered likely (between 10 and 100 percent annual probability) to experience one in the near future.

C.5.15 ELECTROMAGNETIC PULSE

C.5.15.1 Location and Spatial Extent

An EMP can happen in any location, and they are relatively unpredictable. Due to advancing technologies, densely populated areas may be more prone to damages from an EMP. Therefore, Asheville and the University of North Carolina at Asheville campus may be more susceptible.

C.5.15.2 Historical Occurrences

There have been no reports of EMP occurrences at University of North Carolina at Asheville.

C.5.15.3 Probability of Future Occurrences

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

C.5.16 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.

C.5.16.1 Hazard Extent

Table C.26 describes the extent of each natural hazard identified for University of North Carolina at Asheville. The extent of a hazard is defined as its severity or magnitude, as it relates to the planning area.

TABLE C.26 EXTENT OF UNIVERSITY OF NORTH CAROLINA AT ASHEVILLE 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. According to the North Carolina Drought Monitor Classifications, the most severe drought condition is Exceptional. Buncombe County has received this ranking (three times) over the nineteen-year reporting period. According to the NOAA, Buncombe County has had drought occurrences in eighteen of the last nineteen years (2000-2019).
Excessive Heat	The extent of excessive heat can be defined by the maximum temperature reached. The highest temperature recorded in Buncombe County is 100 degrees Fahrenheit (reported on June 30, 2012).

Hurricane and Coastal Hazards	Hurricane extent is defined by the Saffir-Simpson Scale which classifies hurricanes into Category 1 through Category 5. The greatest classification of hurricane to traverse directly through Buncombe County was an unnamed tropical depression in 1901 which carried tropical force winds of 35 knots upon arrival.
Tornadoes /Thunderstorms	<u>Tornadoes</u>: Tornado hazard extent is measured by tornado occurrences in the US provided by FEMA as well as the Fujita/Enhanced Fujita Scale. The greatest magnitude reported in Buncombe County was an F1 (reported in 1977). <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 Centers for Environmental Information, the strongest recorded wind event in Buncombe County was reported on May 3, 2009 at 75 knots (approximately 86 mph). It should be noted that future events may exceed these historical occurrences. <u>Lightning</u>: According to the Vaisala flash density map, University of North Carolina at Asheville 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. <u>Hailstorms</u>: Hail extent can be defined by the size of the hail stone. The largest hail stone reported in Buncombe County was 2.0 inches (reported on April 16, 1998). It should be noted that future events may exceed this.
Severe Winter Weather	The extent of winter storms can be measured by the amount of snowfall received (in inches). The greatest 24-hour snowfall was reported in Buncombe County was 20 inches reported on March 3, 1942.
Earthquakes	Earthquake extent can be measured by the Richter Scale and the Modified Mercalli Intensity (MMI) scale and the distance of the epicenter to Buncombe County. According to data provided by the National Geophysical Data Center, the greatest MMI to impact Buncombe County was VI (strong) reported on November 3, 1928. The epicenter of this earthquake was located between 236 and 284 km away.
Geological	<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 Buncombe County. There is also a high susceptibility throughout a majority of the region. <u>Sinkhole</u>: The western part of North Carolina and University of North Carolina at Asheville are susceptible to sinkholes; however, there are no historical records of sinkholes in Buncombe County. Local media outlets have reported more than 20 major sinkholes in the last 20 years. <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 Buncombe County or University of North Carolina at Asheville.

<table>
<tr><td>Dam Failure</td><td>Dam failure extent is defined using the North Carolina Division of Land Resources criteria. Of the 97 dams in Buncombe County, 53 are classified as high-hazard.</td></tr>
<tr><td>Flooding</td><td>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 7 percent of the total land area for University of North Carolina at Asheville. Flood depth and velocity are recorded via United States Geological Survey stream gages throughout the region. While a gauge does not exist on University of North Carolina at Asheville's campus, there is one at or near many areas. The greatest peak discharge recorded for the area was reported in July 1916. Water reached a discharge of 110,000 cubic feet per second and the stream gage height was recorded at 23.1 feet. Peak discharge for the gage on the French Broad River at Asheville, NC is in the table below.

<table>
<tr><th>Location/Jurisdiction</th><th>Date</th><th>Peak Discharge (cfs)</th><th>Gage Height (ft)</th></tr>
<tr><td>Buncombe County</td><td></td><td></td><td></td></tr>
<tr><td>French Broad River at Asheville, NC</td><td>7/16/1916</td><td>110,000</td><td>23.1</td></tr>
</table></td></tr>
<tr><td colspan="2">Other Hazards</td></tr>
<tr><td>Wildfires</td><td>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 Buncombe County.

• The greatest number of fires to occur in any year was 63 in 2001.
• The greatest number of acres to burn in a single year occurred in 2015 when 887 acres were burned.
• The largest acres burned in a single incidence occurred in 2015 when 738 acres were burned.
Although this data lists the extent that has occurred, larger and more frequent wildfires are possible throughout Buncombe County.</td></tr>
<tr><td>Infectious Disease</td><td>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 University of North Carolina at Asheville is susceptible to infectious diseases such as the flu, which kills hundreds of people annually.</td></tr>
<tr><td colspan="2">Technological Hazards</td></tr>
<tr><td>Hazardous Materials Incident</td><td>According to USDOT PHMSA, the largest hazardous materials incident reported in Buncombe County is 8500 LGA released on the highway on October 3, 1997. It should be noted that larger events are possible.</td></tr>
</table>

Terrorism	Although no severe terrorism attacks have been reported at University of North Carolina at Asheville, the entire campus 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 for University of North Carolina at Asheville. Technology usage, however, is increasing. A cyber-attack could potentially devastate the campus and could have lasting negative impacts.
Electromagnetic Pulse	Electromagnetic Pulse (EMP) occurrences have not taken place at University of North Carolina at Asheville, 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.

C.5.16.2 Priority Risk Index

In order to draw some meaningful planning conclusions on hazard risk for University of North Carolina at Asheville, the results of the hazard profiling process were used to generate hazard classifications according to a "Priority Risk Index" (PRI). The purpose of the PRI is to categorize and prioritize all potential hazards for University of North Carolina at Asheville 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 University of North Carolina at Asheville to consider as part of their proposed mitigation strategy.

The prioritization and categorization of identified hazards for University of North Carolina at Asheville 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 University of North Carolina at Asheville Campus Hazard Mitigation Planning Team in gaining consensus on the determination of those hazards that pose the most significant threat to the campus 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 at University of North Carolina at Asheville 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[13], as summarized in **Table C.27**. 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:

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

[13] The Campus 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.

(DURATION x .10)]

According to the weighting scheme and point system applied, the highest possible value for any hazard is 4.0. When the scheme is applied for University of North Carolina at Asheville, 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 University of North Carolina at Asheville Campus Hazard Mitigation Planning Team.

TABLE C.27: PRIORITY RISK INDEX FOR THE UNIVERSITY OF NORTH CAROLINA AT ASHEVILLE

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%

PRI Category	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
	Small	Between 1 and 10% of area affected	2	
	Moderate	Between 10 and 50% of area affected	3	
	Large	Between 50 and 100% of area affected	4	
Warning Time	More than 24 hours	Self-explanatory	1	10%
	12 to 24 hours	Self-explanatory	2	
	6 to 12 hours	Self-explanatory	3	
	Less than 6 hours	Self-explanatory	4	
Duration	Less than 6 hours	Self-explanatory	1	10%
	Less than 24 hours	Self-explanatory	2	
	Less than one week	Self-explanatory	3	
	More than one week	Self-explanatory	4	

C.5.17 FINAL DETERMINATIONS

The conclusions drawn from the hazard profiling process for University of North Carolina at Asheville, including the PRI results and input from the Campus 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 at University of North Carolina at Asheville. 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 C.28** 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 University of North Carolina at Asheville Campus Hazard Mitigation Planning Team.

TABLE C.28: 2020 CONCLUSIONS ON HAZARD RISK FOR UNIVERSITY OF NORTH CAROLINA AT ASHEVILLE

HIGH RISK	Severe Winter Storm Tornadoes/Thunderstorms Flooding Hurricane and Coastal Hazards
MODERATE RISK	Drought Earthquakes Terrorism Geological Wildfires Infectious Disease Hazardous Substances Excessive Heat
LOW RISK	Dam Failure Electromagnetic Pulse Cyber

C.6 Capability Assessment

The purpose of conducting a capability assessment for an institution of higher learning is to determine the ability of the institution to implement a comprehensive mitigation strategy and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs, or projects[14]. 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 the university's regulatory framework, level of administrative and technical support, access to fiscal resources, and current political climate.

A capability assessment is generally based upon two primary components: 1) an inventory of the university's relevant plans, programs and policies already in place and 2) an analysis of the university's capacity to carry them out. Careful examination of campus capabilities will detect any existing gaps, shortfalls, or weaknesses with ongoing 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 university, which should continue to be supported and enhanced through future mitigation efforts.

The capability assessment completed for UNCA 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.

Capability Assessment Findings and Conclusion

Collectively, UNCA's administrative, technical and fiscal capabilities are high. Some of the highlights of UNCA's capabilities include the following:

- The University has committed to going carbon neutral by 2050 in efforts to fight against climate change.

UNCA's high capability will help ensure that the Mitigation Strategy is effectively carried out and that hazard risk reduction for the campus is an attainable goal. 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 Campus Hazard Mitigation Planning Committee considered not only their level of hazard risk, but also their existing capability to minimize or eliminate that risk.

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[14] While the Final Rule for implementing the Disaster Mitigation Act of 2000 does not require a local capability assessment to be completed for hazard mitigation plans, it is a critical step in developing a mitigation strategy that meets the needs of the campus while taking into account their own unique abilities. The Rule does state that a 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)).

C.7 Mitigation Action Plan

The Mitigation Action Plan, or MAP, provides a functional plan of action for each building at the Appalachian State University. It is designed to achieve the mitigation goals established in Section 4, Mitigation Strategy, of the main plan and will be maintained on a regular basis according to the plan maintenance procedures established in Section 5, Plan Maintenance, of the main plan.

Each proposed mitigation action has been identified as an effective measure (policy or project) to reduce hazard risk to the buildings on UNCA's campus. 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's 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. 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.

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 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.
- Relative Cost
- Identification of University Department Responsible for each action
- Implementation Schedule—Date by which the action should be completed. More information is provided when possible.
- Implementation Status (2021)—Indication of completion, progress, deferment, or no change since the previous plan. If the action is new, that will be noted here.

All of the mitigation actions in this section have been assigned to Emergency Management and Facilities staff to ensure their implementation. Other University Departments will be consulted for input on an as-needed basis.

For the update of this plan, the UNCA Campus Hazard Mitigation Planning Team participated in three activities related to the mitigation strategy for the university. Those activities included the following:

1. Review and reapproval of previous mitigation goals for the UNC Western Campuses. All eight of the campuses in the Western region decided to leave the previous mitigation goals in place and unchanged.
2. Review and update of existing mitigation actions. The Campus Hazard Mitigation Planning Team reviewed each existing action to determine if it was still relevant, if the prioritization of the action remained the same and to provide an update on the status of implementation for the actions.
3. Identification of any new mitigation actions as determined necessary. The Campus Hazard Mitigation Team identified several new actions for inclusion in the plan. New mitigation actions for this update are marked as such in the Mitigation Action Plan.

The Mitigation Action Plan for ASU is found on the following pages.

Campus-Wide Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Property Protection							
CW-PP-1	As feasible and as funding is available, install generators/back-up power, for critical facilities campus wide	All Hazards	Moderate	$25,000-$100,000 per generator	Emergency Management, Facilities	2026	New action for the 2021 update.

Founders Hall Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Property Protection							
FH-PP-1	The emergency generator should have anchorage to its foundation that complies with the provisions of the building code.	All Hazards	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
FH-PP-2	Trees adjacent to the overhead power lines should be pruned to prevent damage as a result of falling limbs.	Earthquake, Geological, Severe Winter Weather, Flood	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
FH-PP-3	Corrosion of the shelf angle should be repaired before serious façade damage occurs.	Earthquake, Geological, Severe Winter Weather, Flood	Moderate	$25,000-$100,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
FH-PP-4	Caulking at masonry expansion joints should be repaired or replaced to prevent water intrusion.	Wind/Rain Events	Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Structural Projects							
FH-SP-1	Existing emergency vehicle access should be maintained. Future site work should incorporate vehicular access to additional areas of the building.	Earthquake, Geological, Severe Winter Weather, Flood	Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.

Health and Fitness Center Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Property Protection							
HFC-PP-1	The chiller/condenser unit should be anchored to its foundation.	All Hazards	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
HFC-PP-2	The natural gas generator should be properly anchored to its foundation.	All Hazards	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
HFC-PP-3	Trees that are located adjacent to the facility should be regularly pruned to prevent damage as a result of falling limbs or clogged roof drains. Dead or dying trees should be completely removed.	Earthquake, Geological, Severe Winter Weather, Flood	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Structural Projects							
HFC-SP-1	The transformer and structural column should have bollards installed to protect them against accidental vehicle impacts.	Earthquake, Geological, Severe Winter Weather, Flood	Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Emergency Services							

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
HFC-ES-1	The facility should have a larger or supplemental emergency generator installed to permit the building to serve as an emergency shelter during power outages.	Earthquake, Geological, Severe Winter Weather, Flood	Moderate	>$100,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
HFC-ES-2	Fire alarm systems should have a telemetry unit to alert campus police if the alarm is triggered.	Earthquake	Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.

Justice Gym Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Property Protection							
JG-PP-1	The drainage at the front of the structure should be routinely serviced to prevent clogs. Supplemental drainage should be installed or maintenance personnel should have access to emergency pumping equipment in the event of drainage failure.	Flood	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
JG-PP-2	The timber portion of the structure exposed to weather should be periodically inspected for deterioration by a licensed engineer.	Severe Winter Weather, Flood	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
JG-PP-3	Trees overhanging the pool structure should be pruned away from the building. Roof drains should be regularly cleaned to prevent ponding.	Flood	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Structural Projects							
JG-SP-1	The deteriorating steel and concrete in the pool area should be repaired to prevent further damage and electrical hazards.	Earthquake, Geological, Severe Winter Weather, Flood	Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Emergency Services							

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
JG-ES-1	A source of redundant power should be provided for the fire alarm system. The system should have a telemetry unit that alerts campus police when the alarm is triggered.	Earthquake	Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.

Karpen Hall Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Property Protection							
KH-PP-1	The belly tank should be replaced, repaired, or eliminated from the system to prevent a diesel leak which would render the system inoperable. The generator should be anchored to its foundation.	All Hazards	Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
KH-PP-2	The data center should have permanent climate control equipment installed. The entire data center should have sufficient backup power to operate during outages.	Earthquake, Geological, Severe Winter Weather, Flood	Moderate	$25,000-$100,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
KH-PP-3	Trees adjacent to the structure should be routinely pruned and should not overhang the structure.	Earthquake, Geological, Severe Winter Weather, Flood	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
KH-PP-4	The antennae cable on the roof should be securely anchored and corroding antennae hardware should be replaced with galvanized or stainless hardware.	All Hazards	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Structural Projects							

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
KH-SP-1	The cause of stairwell movement should be identified and corrected. Cracks in the masonry should be filled to prevent water infiltration. The exterior brick masonry should be closely inspected to locate and seal any cracks before water infiltration becomes problematic.	Earthquakes, Landslides	Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.

Lipinsky Hall Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2020 Action Implementation Status
Property Protection							
LH-PP-1	Trees overhanging the generator and HVAC condensers should be routinely pruned to prevent damage from falling limbs.	Earthquake, Geological, Severe Winter Weather, Flood	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
LH-PP-2	The generator should be attached to its foundation to comply with the building code.	All Hazards	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
LH-PP-3	Trees overhanging the roof should be pruned away from the building.	Earthquake, Geological, Severe Winter Weather, Flood	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Structural Projects							
LH-SP-1	Corrosion damage to all precast elements is becoming serious and repairs should be made as soon as possible. Loose concrete should be removed, reinforcing steel cleaned and coated, and a protective epoxy mortar installed to prevent further deterioration. The cause of sidewalk settlement should be identified and corrected.	Earthquake, Geological, Severe Winter Weather, Flood	Moderate	$25,000-$100,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Emergency Services							

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2020 Action Implementation Status
LH-ES-1	An alarm telemetry unit should be installed to alert campus police in the event that the fire alarm is triggered.	Earthquake	Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.

Mills Hall Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Property Protection							
MH-PP-1	Mechanical equipment should be attached to its foundation.	All Hazards	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
MH-PP-2	Trees that are located adjacent to the facility should be regularly pruned to prevent damage from falling limbs. Dead or dying trees should be completely removed.	Earthquake, Geological, Severe Winter Weather, Flood	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Structural Projects							
MH-SP-1	The emergency generator and gas connection should be protected from accidental vehicle impacts using bollards or other barriers. A	Earthquake, Geological, Severe Winter Weather, Flood	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
MH-SP-2	The low-lying area on the northwestern façade should have improved drainage installed to prevent flooding during intense rain events.	Flood	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
MH-SP-3	The roof deck should be replaced as soon as possible to provide a stronger, more durable decking.	Earthquake, Geological, Severe Winter Weather, Flood	Moderate	>$100,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.

Phillips Hall Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2020 Action Implementation Status
Property Protection							
PH-PP-1	Trees that are located adjacent to the facility should be regularly pruned to prevent damage as a result of falling limbs. Dead or dying trees should be completely removed.	Earthquake, Geological, Severe Winter Weather, Flood	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Structural Projects							
PH-SP-1	The condensate lines should be re-routed through new plumbing to prevent water damage during heavy rains.	Flood	Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Emergency Services							
PH-ES-1	The fire alarm system should be updated so that alarms are audible throughout the facility. The alarm system should have a telemetry unit which will alert campus police in the event that the alarm is triggered. The alarm system should receive additional backup power to provide fire detection during power outages.	Earthquake	Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
PH-ES-2	Provide an emergency generator capable of enabling business continuity.	Earthquake, Geological, Severe Winter Weather, Flood	Moderate	>$100,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.

Rhoades, Rhoades Tower and Robinson Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2020 Action Implementation Status
Property Protection							
RRRT-PP-1	Mechanical equipment located on the roofs should rest on an appropriate equipment support that is attached to the structure. Loose debris should be removed from the roof deck. Exhaust stacks should have well tensioned guy-wires.	All Hazards	Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
RRRT-PP-2	The under-floor water detection system in the Data Center should be repaired.	Flood	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
RRRT-PP-3	Gas storage cylinders should be anchored to prevent sliding or overturning.	Earthquake, Geological, Severe Winter Weather, Flood	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
RRRT-PP-4	The emergency generator should be anchored to its foundation and the large tree overhanging generator should be removed. This tree (and other dead trees/limbs) should be removed promptly.	All Hazards	Moderate	<$5,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Structural Projects							

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2020 Action Implementation Status
RRRT-SP-1	The cause of the cracking in the Robinson stairwell should be identified and remedied. Cracks in the masonry should be repaired to prevent water infiltration.	Earthquake, Geological, Severe Winter Weather, Flood	Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.
Emergency Services							
RRRT-ES-1	Fire alarms should have a telemetry unit that alerts campus police in the event the alarm is triggered.	Earthquake	Moderate	$5,000-$25,000	Emergency Management, Facilities	2026	Implementation pending staff time and/or funding.

Annex D University of North Carolina at Charlotte

This section provides planning process, campus profile, hazard risk, vulnerability, capability, and mitigation action information specific to University of North Carolina at Charlotte (UNCC). This section contains the following subsections:

- D.1 Planning Process Details
- D.2 Campus Profile
- D.3 Asset Inventory
- D.4 Hazard Identification
- D.5 Hazard Profiles, Analysis, and Vulnerability
- D.6 Capability Assessment
- D.7 Mitigation Strategy

D.1 Planning Process Details

The update of the campus hazard mitigation plan was conducted by a Campus Hazard Mitigation Planning Committee comprised of university staff and faculty. The committee followed a planning process prescribed by FEMA and participated in a series of meetings to update the plan. Details about the meetings help by the committee are provided below.

TABLE D.1: UNC CHARLOTTE CAMPUS HAZARD MITIGATION PLANNING COMMITTEE

LAST NAME	FIRST NAME	TITLE	ATTENDED FIRST MEETING	FACILITATED INFORMATION COLLECTION
Brown	Anne	AVC Finance	X	
Dunham	Steve	Chief Risk Officer	X	
Fiorelli	Joe	RMI	X	
Gonyar*	Chris	Director of Emergency Management	X	
Klein	Stephanie	Lieutenant/EM Liaison	X	
Martin	Kevin	Emergency Preparedness Coordinator		X
Snodgrass	Lee	Facilities Operations Director	X	
Steele	Rich	AVC Business Services	X	
Stone	Stephanie	Director of SACUM	X	
Trahan	Brad	Office of Legal Affairs	X	

* Primary Point of Contact

December 6, 2019 – Kickoff Meeting

ESP Associates' Project Manager, Nathan Slaughter, 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 Campus Hazard Mitigation Planning Team and began by having attendees introduce themselves. The 9 attendees included faculty and staff from various departments at the University. 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 was managing the planning effort and had assigned ESP Associates, Inc. to manage the update.

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 on campus (buildings, infrastructure 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 a discussion about various mitigation techniques. He briefly explained the six different categories of mitigation techniques: emergency services, prevention, natural resource protection, structural projects, public education and awareness, and property protection. The attendees were then asked what types of mitigation projects would be needed the most at UNCC if FEMA funding was available. This helped demonstrate how priorities in mitigation actions should be considered for the plan.

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

- Coordinate between the eight participating campuses to update the existing plan,
- Update the plan to demonstrate progress and reflect current conditions,
- Complete the update in a timely manner because the existing plan expired in October of 2017,
- Increase public awareness and education,
- Maintain grant eligibility for participating campuses, and
- Maintain compliance with State and Federal requirements.

Mr. Slaughter reviewed the list of participating campuses with the group. He also explained the project tasks to be accomplished. These included the planning process, risk assessment, capability assessment, mitigation strategy, mitigation action plan, and plain maintenance procedures.

He explained that the project as being managed by a Campus Hazard Mitigation Steering Committee that had one representative from each of the eight campuses. For UNC Charlotte, that representative was Chris Gonyar, Director of Emergency Management. He explained that the group currently in the room would be known as the Campus Hazard Mitigation Planning Team.

Mr. Slaughter explained that this update would expand the scope of the plan to not only address natural hazards, as was previously done for the existing plan, but that it would also address manmade/technological hazards as well. This was done to ensure alignment with the State of North Carolina's Hazard Mitigation Plan.

Mr. Slaughter explained that the plan would address campus vulnerability, where feasible, to identify specific types and numbers of campus assets that are at risk to the identified hazards. He said that an attempt would be made to address other types of vulnerability as well to include social, economic and environmental vulnerabilities.

He then discussed the capability assessment and how the plan would include a discussion on the University's capability to address their hazard vulnerability through mitigation. Next, he discussed the mitigation strategy and explained how that section of the plan would be reviewed and updated as required by FEMA.

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

Mr. Slaughter then reviewed the roles and responsibilities of ESP Associates, Inc, the campus leads and stakeholders. The presentation concluded with a discussion of the next steps to be taken in the project development. He explained that a Hazard Mitigation Public Survey was being developed and that it would be distributed soon. The next campus HMPT meeting was discussed and would be held sometime in the Spring or Summer of 2020. The purpose of the second meeting would be to discuss the findings of the risk and capability assessments and to begin updating existing mitigation actions and identify new goals.

April 30, 2021 - Outstanding Information Discussion – Google Meeting

Because of the ongoing COVID-19 pandemic, the UNCC Campus Hazard Mitigation Team was unable to formally meet a second time for the Mitigation Strategy meeting and presentation. However, the Project Manager from ESP Associates and the Emergency Preparedness Coordinator from UNCC were able to have an online video call to discuss the information needed from UNCC to complete the project. Mr. Slaughter and Mr. Martin met and determined that the following information was needed from UNCC, and would be returned in short order to the project consultant:

- Status updates for the existing hazard mitigation actions from the previous plan,
- Any new actions that UNCC wishes to include in the plan for this update, and
- Scoring and reranking of the most critical buildings on campus to include in the plan.

Involving the Public

Because this plan update was developed during the COVID-19 pandemic, the planning teams had to get creative in order to solicit feedback from the public about the plan and their thoughts on hazard mitigation. A public survey instrument was developed to provide an opportunity for the public to provide comment on their concerns about hazard impacts on the campuses and their thoughts on how mitigation could help reduce vulnerability. The public survey was distributed by each campus through different means to outreach to faculty, staff and students.

For UNCC, 16 public survey responses were received and the results from those surveys were shared with the Campus Hazard Mitigation Planning Team. Feedback from the surveys was reviewed and considered for inclusion in this plan, as applicable, where determined to be relevant. A summary of the responses can be found in **Appendix B** and detailed survey responses can be obtained through North Carolina Emergency Management, Hazard Mitigation Planning staff.

D.2 Campus Profile

This section of the plan provides a general overview of the University of North Carolina at Charlotte Campus and surrounding area.

D.2.1 Geography and the Environment

UNC Charlotte is located in the outskirts of Charlotte, North Carolina and is only about 8 miles from Uptown Charlotte. The University operates several campuses in Charlotte, the Main Campus is built upon almost 1,000 acres of rolling land. UNCC has several man-made lakes and is heavily wooded. The botanical gardens are well-known and attract over 300,000 visitors per year. Close to the Carolina Panthers stadium, Charlotte Douglas International airport, Concord Mills mall, and a rapidly growing art-district NoDa, UNC Charlotte offers so much to do after class is out. The main campus consists of residence halls, academic buildings, athletic and recreational facilities, libraries, a conference center, student apartments, auditoriums, and research centers. Located off campus are recreational areas. An orientation map of the University of North Carolina at Charlotte can be seen in **Figure D.1** and a map of the main-campus can be seen in **Figure D.2.**

FIGURE D.1: UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE LOCATOR MAP

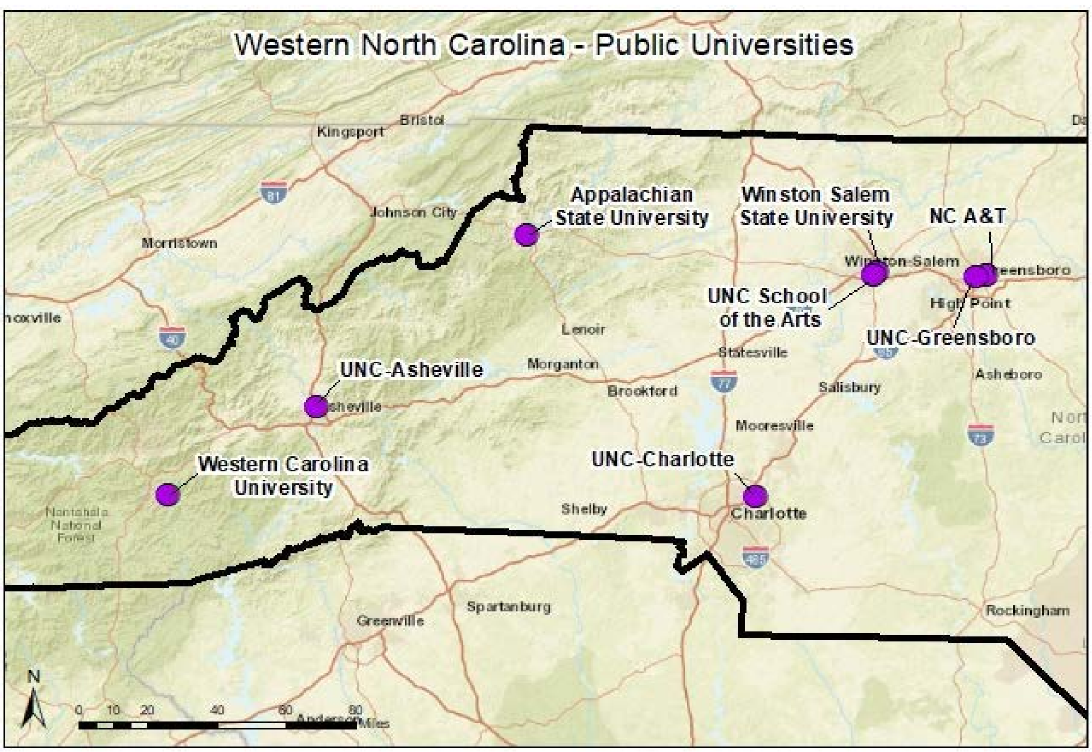
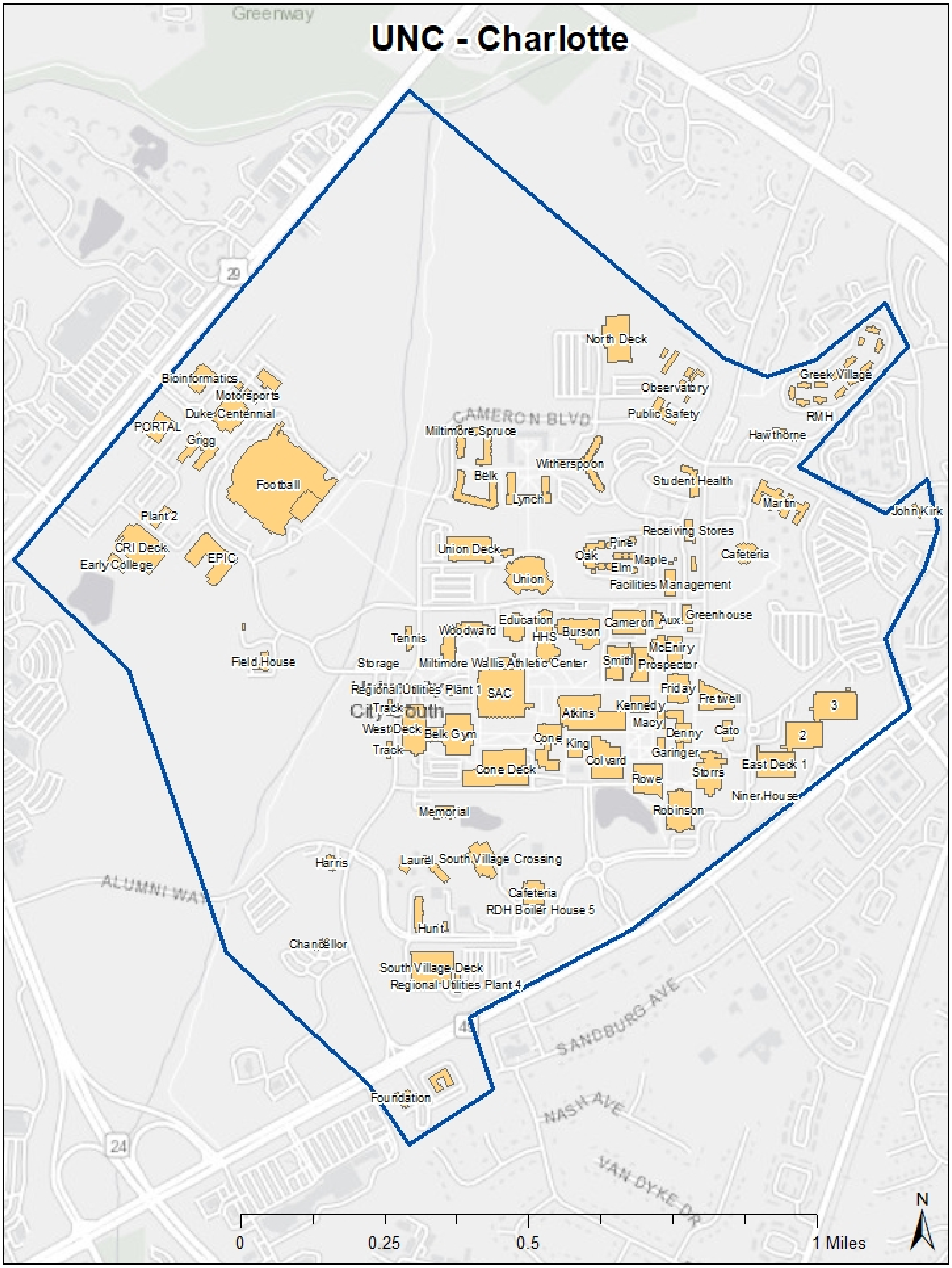


FIGURE D.2 MAIN CAMPUS MAP



Charlotte is the most populated city in North Carolina. In 2018 the U.S Census Bureau estimated the population was nearly 2.8 million making it the second-largest city in the Southeast U.S. The Catawba River lies several miles West of Charlotte, while Lake Norman is located northwards. Charlotte has a climate similar to much of the Piedmont region of the Southeastern U.S. which is characterized as humid but with 4 distinct seasons. During the summer months, it is hot and humid. Summer temperatures reach 90 degrees or above roughly 44 days out of the year. Winters are cool to mild with an average temperature in January around the lower 40's. Charlotte on average receives 41 inches of precipitation annually, with an average of 4.3 inches of snow. The monthly averages for Charlotte are presented in **Table D.2**.

TABLE D.2: MONTHLY AVERAGES FOR CHARLOTTE, NORTH CAROLINA

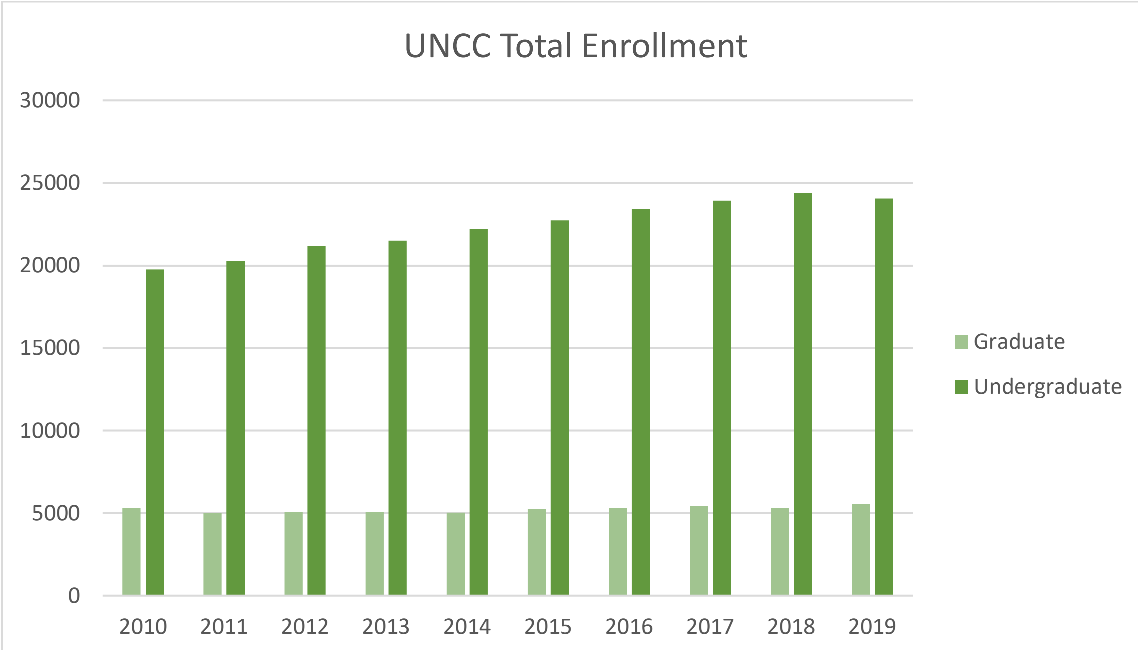
Month	Average High	Average Low	Average Precipitation
January	51°F	30°F	3.41 in
February	55°F	33°F	3.32 in
March	63°F	39°F	4.01 in
April	72°F	47°F	3.04 in
May	79°F	56°F	3.18 in
June	86°F	65°F	3.74 in
July	89°F	68°F	3.68 in
August	87°F	67°F	4.22 in
September	81°F	60°F	3.24 in
October	72°F	49°F	3.40 in
November	62°F	39°F	3.14 in
December	53°F	32°F	3.25 in

Source: National Weather Service

D.2.2 Population and Demographics

UNC Charlotte has grown rapidly over the years, and has been an established university since 1946. With a record-breaking total enrollment of 29,710 for the 2018-2019 school year, UNC Charlotte trails only North Carolina State University and UNC Chapel Hill in terms of student body size among the UNC System's 17 campuses. Enrollment at UNC Charlotte has increased 10 percent in the past five years which has brought on a non-stop flow of construction on campus in order to have enough space for the influx of students each year. The majority of students attending this university are White representing about 60% of the student population, and the second most prevalent ethnicity being African-American represents 17% of the total student body. Hispanics are the next most represented group for this University consisting of 9% of the total student population. UNC Charlotte is considered to have an overall high racial diversity.

FIGURE D.3 ENROLLMENT TOTALS



Source: UNC System – Interactive Data Dashboards

For a breakdown of enrollment demographics please see **Table D.3** below.

TABLE D.3: ENROLLMENT DEMOGRAPHICS (2018)

Race/Ethnicity	Enrollment (Fall 2018)	Percentage
White	16,013	54.07%
Hispanic or Latino	2,940	9.92%
Black or African American	4,618	15.59%
Two or More Races	1,260	4.25%
Asian	2,165	7.31%
Nonresident Alien	1,964	6.63%
American Indian or Alaska Native	87	0.29%
Native Hawaiian or Other Pacific Islander	25	0.08%
Unknown	543	1.83%

Source: UNC System – Interactive Data Dashboards

D.3 Asset Inventory

An inventory of assets was compiled to identify the total count and value of property exposure on the UNCC campus. This asset inventory serves as the basis for evaluating exposure and vulnerability by hazard. Assets for analysis include buildings, critical facilities, and critical infrastructure.

D.3.1 Building Inventory

This section provides total building exposure for the campus, which was estimated by summarizing building footprints provided by North Carolina Emergency Management and property values derived from 2020 insurance assessment data. According to that data, there are 179 buildings associated with UNCC totaling a value of $2,575,847,051 (building and contents).

D.3.2 Critical Buildings and Infrastructure Exposure

Of significant concern with respect to any disaster event is the location of critical facilities and infrastructure in the planning area. Critical facilities are those essential services and lifelines that, if damaged during and emergency event, would disrupt campus continuity of operations or result in severe consequences to public health, safety, and welfare.

Critical buildings are a subset of the total building exposure and were identified by UNCC's HMPC representatives. The UNCC HMPC updated the list of critical facilities from the previous DRU plan and ranked each facility on a set of standardized criteria designed to evaluate all critical buildings in the UNC System DRU plans. Factors considered for this ranking included:

- the building's use for emergency response,
- the building's use for essential campus operations
- the building's use as an emergency shelter or for essential sheltering services,
- the presence of a generator or generator hook-ups,
- the building's use for provision of energy, chilled water or HVAC for sensitive or essential systems,
- the storage of hazardous materials,
- the building's use for sensitive research functions,
- the building's cultural or historical significance, and
- building-specific hazard vulnerabilities

Figure D.4 below shows the scoring sheet that the UNCC Campus Mitigation Planning Team used to rate critical buildings on campus. All of the campuses in the UNC system used to same scoring methodology for consistency.

FIGURE D.4: CRITICAL BUILDING SCORING WORKSHEET

Critical Building Scoring Worksheet

Campus:
Facility Name:

		Score
1	Does the facility serve as the campus Emergency Operations Center (EOC)? Yes, Primary EOC = 6 pts Yes, Secondary EOC = 3 pts No = 0 pts	0
2	Does the facility house functions essential to campus operations? Main Telecommunication Center = 3 pts Computer Network Hub = 3 pts Adminstrative Operations = 1 pts Maintenance = 1 pt Public Safety = 1 pt	0
3	Is the facility equiped with a generator or hook-ups? Generator = 3 pts Hook-ups = 1 pt Neither = 0 pts	0
4	Does the facility serve as a pre or post disaster shelter? Both pre and post disaster shelter = 6 pts Either pre or post disaster shelter = 3 pts Neither = 0 pts	0
5	Does the facility provide services essential to sheltering? Resident Housing = 1 pt Assesmbly Space = 1 pt Food Preperation Facility = 1 pt Shower Facilities = 1 pt	0
6	Does the facility provide chilled water distribution or contain HVAC systems necessary to sensitive or essential systems? Yes = 3 pts No = 0 pts	0
7	Are there hazardous materials on-site? (greater than 25 gallons) Yes = 3 pts No = 0 pts	0
8	Does the facility house research functions that have a low level of tolerance for disruption? Yes = 2 pts No = 0 pts	0
9	Does the facility serve as storage for rare or unique collections (art, artifacts, letters, etc) or is it a historically or culturally significant building? Yes = 2 pts No = 0 pts	0
10	Does the facility have hazard specific vulnerabilities (basement susceptible to flood, etc.) Yes = 3 pts No = 0 pts	0
Notes/ Comments		

Total Score:	0
Total Possible Score:	**42**

The identified critical facilities for UNCC, as scored by the UNCC Campus Hazard Mitigation Planning Team are listed below:

- Facilities/Police (14)
- Student Activity Center (11)
- Belk Gym (7)
- Library (7)
- Facilities Operations (7)
- South Village (3)
- Student Union (2)

D.4 Hazard Identification

This section describes how the regional planning committee identified the hazards to be included this plan

D.4.1 Hazard Identification

Upon a review of the full range of natural hazards suggested under FEMA planning guidance, the Campus Hazard Mitigation Planning Team identified a number of hazards that are to be addressed in its Hazard Mitigation Plan. These hazards were identified through a process that utilized input from the Campus Hazard Mitigation Planning Team, research of past disaster declarations in the surrounding county, and review of the previous UNCC Pre-Disaster Mitigation Plan. To maintain consistency, the Multi-Campus Hazard Mitigation Steering Committee and the Campus Hazard Mitigation Planning Teams voted to assess the same hazards that were identified in the most recent update of the North Carolina State Hazard Mitigation Plan. Therefore, since the development of the previous plan, the hazard identified and included in the plan have changed. A list of all previous hazards covered in the previous UNCC Pre-Disaster Mitigation Plans are viewable in **Table D.4**, 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.

TABLE D.4: 2021 UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE HAZARDS UPDATE

2010 University of North Carolina at Charlotte Identified Hazards		2021 University of North Carolina at Charlotte Identified Hazards		Description of hazards covered in 2021 Plan and Explanations
Atmospheric Hazards	Drought	Natural Hazards	Drought	Agricultural Drought, Hydrological Drought
	Driving Rain			
	Other High Wind events			
			Excessive Heat	
	Hurricane		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

2010 University of North Carolina at Charlotte Identified Hazards		2021 University of North Carolina at Charlotte Identified Hazards		Description of hazards covered in 2021 Plan and Explanations
	Tornado		Tornadoes/Thunderstorms	Hailstorm, Torrential Rain associated with Severe Thunderstorms, Thunderstorm Wind, Lightning, Waterspout, High Wind
	Electrical Storm			
	Severe Winter Weather, including ice or snow events		Severe Winter Weather	Freezing Rain, Snowstorms, Blizzards, Wind Chill, Extreme Cold
Hydrologic Hazards			Dam Failures	
	Flood		Flooding	
Geologic Hazards	Earthquake		Earthquakes	
	Landslide, Rockslide, and other Geologic		Geological	Landslides, Sinkholes, Erosion
Other Hazards	Wildfire or Building Fire	**Other Hazards**	Wildfires	
	Animal borne and other Infectious Diseases		Infectious Disease	
	Accidental Explosion	**Technological Hazards**		
			Hazardous Substances	Hazardous Materials, Hazardous Chemicals, Oil Spill
			Radiological Emergency – Fixed Nuclear Facilities	
			Terrorism	Chemical, Biological, Radiological, Nuclear, Explosive
			Cyber	
			Electromagnetic Pulse	

D.4.2 Disaster Declarations

Disaster declarations provide insight into the hazards that may impact the University of North Carolina at Charlotte. **Table D.5** shows every declared presidential disaster to impact Mecklenburg County since 1977. There have been six total disaster declarations in Mecklenburg County since 1977.

TABLE D.5: MECKLENBURG COUNTY DISASTER DECLARATIONS

Year	Disaster Number	Description
1989	844	HURRICANE HUGO
1996	1087	BLIZZARD OF '96
2000	1312	SEVERE WINTER STORM
2002	1448	SEVERE ICE STORM
2004	1546	TROPICAL STORM FRANCES
2020	4487	COVID-19 PANDEMIC

D.4.3 Summary of Hazard Impacts Since Previous Plan

Since the approval of the previous University of North Carolina at Charlotte Pre-Hazard Mitigation Plan (June 30th, 2010), there have been 287 hazard events recorded for the planning area in the National Centers for Environmental Storm Event Database. It is important to take note of those hazard events and consider them in the *Hazard Identification* section to help ensure that the appropriate hazards are being considered in the risk assessment sections in the Mitigation Strategy. **Table D.6** documents the hazard events recorded.

TABLE D.6: SUMMARY OF HAZARD EVENTS SINCE PREVIOUS PLAN

Hazard Type*	Number of Reported Events in Mecklenburg County
Cold/Wind Chill	3
Flash Flood	36
Flood	7
Hail	64
Heavy Snow	3
High Wind	1
Lightning	13
Strong Wind	3
Thunderstorm Wind	134
Tornado	3
Tropical Storm	1
Winter Storm	5
Winter Weather	14
TOTAL NUMBER OF REPORTED EVENTS	**287**

* The hazard type names that NCEI uses are different than the names of hazards used in this plan; however, one can still get an understanding of the types of hazards that impact the region as the hazard types are similar in name.

D.4.4 Hazard Evaluation

Table D.7 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 furthered 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 further evaluations and updates of the risk assessment if deemed necessary by the University Core Planning Team and the University Campus Core Committee during the plan update process.

TABLE D.7: 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?
NATURAL HAZARDS			
Avalanche	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of the NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan • Review of US Forest Service National Avalanche Center website	• The United States avalanche hazard is limited to mountainous western states including Alaska as well as some areas of low risk in New England. • Avalanche hazard was removed from the North Carolina State Hazard Mitigation Plan after determining the mountain elevation in Western North Carolina did have enough snow not to produce this hazard. • Avalanche is not included in the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan.
Drought	**YES**	• Review of the NC State Hazard Mitigation Plan • Review of the North Carolina Drought Monitor website • Review of the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan	• There are reports of drought conditions eight of the last ten years (2010-2019) in Mecklenburg County, according to the North Carolina Drought Monitor. • Droughts are discussed in NC State Hazard Mitigation Plan.

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?
Hailstorm	**YES (Assessed under Tornadoes/Thunderstorms)**	• Review of NC State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NOAA NCEI Storm Events Database • Review of the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan	• Hailstorm events are discussed in the state plan under the Severe Thunderstorm hazard. • NCEI reports 228 hailstorm events (0.75-inch size hail to 3 inches) for Mecklenburg County between 1985 and 2019. For these events there was $1,000,000 (2020 dollars) in property damages. • 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.
Excessive Heat	**YES**	• Review of NOAA NCEI Storm Events Database • Review of the North Carolina State Hazard Mitigation Plan • Review of the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan	• NCEI did not report any excessive heat events for Mecklenburg County. • The NC State Hazard Mitigation Plan does include Excessive Heat as a hazard.
Hurricane and Coastal Hazards	**YES**	• Review of NC State Hazard Mitigation Plan • Analysis of NOAA historical tropical cyclone tracks and National Hurricane Center Website	• Hurricane and coastal hazard events are discussed in the state plan and are listed as a top hazard of concern. • NOAA historical records indicate 7 hurricane/coastal hazards

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?
		• Review of NOAA • NCEI Storm Events Database • Review of historical presidential disaster declarations • Review of the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan	have come within 25 miles of Mecklenburg County since 1850. • Two out of six disaster declarations in Mecklenburg County are directly related to hurricane and costal hazard events. • Hurricane hazards were addressed in the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan.
Lightning	**YES (Assessed under Tornadoes/ Thunderstorms)**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of NOAA NCEI Storm Events Database, NOAA lightning statistics • Review of the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan	• Lightning events are discussed in the state plan as part of the severe thunderstorm hazard. • NCEI reports 46 lightning events for Mecklenburg County since 1973. These events have resulted in over \$3.69 million (2020 dollars) in property damage. •
Nor'easter	**NO**	• Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database	• Nor'easters are discussed in the state plan although Mecklenburg County has low vulnerability to the hazard. • NCEI does not report any nor'easter activity for Mecklenburg County. However, nor'easters may have affected the County as severe winter

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?
			storms. In this case, the activity would be reported under winter storm events. • Nor'easters were not addressed in the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan.
Tornadoes/ Thunderstorm	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations.	• Tornado events are discussed in the NC State Hazard Mitigation Plan. • NCEI reports 23 tornado events in Mecklenburg County since 1975. These events have resulted in over $5.5 million (2020 dollars) in property damage with the most severe being an F2. • Tornado events were addressed in the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan.
Severe Thunderstorm	**YES (Assessed under Tornadoes/ Thunderstorms)**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database	• Severe thunderstorm events are discussed in the NC State Hazard Mitigation Plan. • NCEI reports 366 thunderstorm wind events in Mecklenburg County since 1969. These events have resulted in 14 injuries and over $1.6 million (2020 dollars) in property damage. • Severe thunderstorm events were addressed in the previous University of North Carolina at

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?
		• Review of historical presidential disaster declarations.	Charlotte Pre-Disaster Mitigation Plan.
Severe Winter Weather	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations.	• Severe winter weather events, including snow storms and ice storms, are discussed in the state plan. • NCEI reports that Mecklenburg County has been affected by 44 snow and ice events since 1996. These events did not result in any deaths, injuries or damages reported. • Three of the region's six disaster declarations were directly related to winter storm events. • Winter storm events were addressed in the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan.
Earthquakes	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan • Review of the National Geophysical Data Center USGS Earthquake Hazards Program website	• Earthquake events are discussed in the state plan and the University of North Carolina at Charlotte is considered to be at moderate risk to an earthquake event. • Earthquakes were addressed in the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan. Earthquakes have occurred in and around the State of North Carolina in the past. The state is affected by the Charleston and

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 New Madrid (near Tennessee) Fault lines which have generated a magnitude 8.0 earthquake in the last 200 years. • 16 events are known to have occurred in the region according to the National Geophysical Data Center. The greatest MMI reported was an 8. • According to USGS seismic hazard maps, the peak ground acceleration (PGA) with a 10% probability of exceedance in 50 years for the area is approximately 6%g. FEMA recommends that earthquakes be further evaluated for mitigation purposes in areas with a PGA of 3%g or more.
Expansive Soils	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan • Review of USDA Soil Conservation Service's Soil Survey	• Expansive soils are identified in the state plan but no local reports of expansive soils exist according to local investigation. • According to FEMA and USDA sources, University of North Carolina at Charlotte is located in an area that has a "little to no" clay swelling potential. • The previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan did not identify expansive soils as a potential hazard.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Geological (Landslides, Sinkholes, Erosion)	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan • Review of USGS Landslide Incidence and Susceptibility Hazard Map • Review of the North Carolina Geological Survey database of historic landslides	• Landslide/debris flow events are discussed in the state plan; however, it is a lower hazard of concern for Mecklenburg County. • USGS landslide hazard maps indicate "high landslide incidence" (more than 15% of the area is involved in land sliding) is found in Mecklenburg County. • Data provided by NCGS indicate no recorded landslide events for UNCC. • Geological hazards were addressed in the previous UNCC Pre-Disaster Mitigation Plan.
Land Subsidence	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan	• The state plan delineates certain areas that are susceptible to land subsidence hazards in North Carolina; however, none of these areas are located in Mecklenburg County. • The plan identifies Mecklenburg County as having scored very low for the land subsidence hazard. • Land Subsidence was not addressed in the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan.

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?
Tsunami	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan • Review of FEMA "How-to" mitigation planning guidance (Publication 386-2, "Understanding Your Risks – Identifying Hazards and Estimating Losses).	• Tsunamis are discussed in the state plan however, Mecklenburg County is not at risk to the hazard. • Tsunamis were not addressed in the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan. • No record exists of a catastrophic Atlantic basin tsunami impacting the mid-Atlantic coast of the United States. • Tsunami inundation zone maps are not available for communities located along the U.S. East Coast. • 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.
Volcano	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of USGS Volcano Hazards Program website	• There are no active volcanoes in North Carolina. • There has not been a volcanic eruption in North Carolina in over 1 million years. • No volcanoes are located near University of North Carolina at Charlotte.

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?
Dam Failure	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan • Review of North Carolina Division of Land Management website	• Dam failure is discussed in the state plan as a top hazard of concern. • Of the 69 dams reported on the National Inventory of Dams, 28 are high hazard (40%), (High hazard is defined as "where failure or mis operation will probably cause loss of human life.") • Dam failure was not addressed in the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan.
Erosion	**YES (Referenced in Geological Hazards)**	• Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan	• Riverine erosion is addressed in the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan. • Coastal erosion is discussed in the state plan but only for coastal areas (there is no discussion of riverine erosion).
Flooding	**YES**	• Review of NC State Hazard Mitigation Plan • Review of historical disaster declarations • Review of NOAA NCEI Storm Events Database • Review of the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan	• The flood hazard is thoroughly discussed in the state plan. • Two of the six Presidential Disaster Declarations were directly associated with flooding events. • NCEI reports that Mecklenburg County has been affected by 105 flood events since 1996. These events in total caused over $23

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?
			million (2020 dollars) in property damages. • Flooding was addressed in the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan.
Storm Surge	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database	• Storm surge is discussed in the state plan under the hurricane hazard; however, it is not a hazard of concern for UNCC. • Storm surge was not addressed in the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan. • No historical events were reported by NCEI • Given the inland location of University of North Carolina at Charlotte, storm surge would not affect the campus.
OTHER HAZARDS			
Wildfires	**YES**	• Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan • Review of Southern Wildfire Risk Assessment (SWRA) Data • Review of the NC Division of Forest Resources website	• Wildfires occur in virtually all parts of the United States. Wildfire hazard risk will increase as low-density development along the urban/wildland interface increases. • NCEI reported one wildfire event for Mecklenburg County • Wildfires were not addressed in the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan.

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?
			• According to the North Carolina Division of Forest Resources, Mecklenburg County experiences an average of 11 fires each year which burn a combined 22 acres
Hazardous Substances	**YES**	• Review of the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan	• Review of Pipeline and Hazardous Materials Safety Administration data indicates 7,702 HAZMAT incidents occurred in Mecklenburg County. • EPA Toxic Release Inventory indicates multiple Toxic Release Inventory (TRI) facilities in Mecklenburg County. • This update assesses hazardous materials, hazardous chemicals, and oil spills under this hazard.
Infectious Disease	**YES**	• Review of the NC State Hazard Mitigation Plan.	• Infectious Disease is identified as a hazard in the state plan. • Although the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan did not include infectious disease as a hazard, it is assessed in this update to maintain consistency with the NC State Hazard Mitigation Plan • Infectious Disease has caused one of the six disaster declarations in Mecklenburg County

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?
TECHNOLOGICAL HAZARDS			
Terrorism	**YES**	• Review of previous mitigation plans in University of North Carolina at Charlotte • Review of local official knowledge	• 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. • There is a fixed nuclear facility in the state. • This hazard will assess chemical, biological, radiological, nuclear, and explosive terrorism events.
Radiological Emergency – Fixed Nuclear Facilities	**YES**	• Review of the previous University of North Carolina at Charlotte Pre-Disaster Mitigation Plan • Review of IAEA list of fixed nuclear power stations in the United States • Discussion with local officials about location of nuclear power stations	• The McGuire Nuclear Power Station is located on Lake Norman near the region. • The Catawba Nuclear Power Stations is located across the state border in York, South Carolina, and could impact the region • Although radiological emergencies are not identified in the previous plans, local officials expressed a desire to address them in this plan • 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

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?
Cyber	**YES**	• Review of NC State Hazard Mitigation Plan	• Changing future conditions encourage the assessment of the possibility of a cyber-attack with the increase in global technology
Electromagnetic Pulse	**YES**	• Review of NC State Hazard Mitigation Plan	• Changing future conditions encourage the assessment of the possibility of an electromagnetic pulse with the increase in global technology

D.5 Hazard Profiles, Analysis, and Vulnerability

This section includes detailed hazard profiles for each of the hazards identified in the Hazard Identification section as significant enough for further evaluation in the University of North Carolina at Charlotte Hazard Mitigation Plan. It contains the following subsections:

- D.5.1 Overview
- D.5.2 Drought
- D.5.3 Excessive Heat
- D.5.4 Hurricane and Coastal Hazards
- D.5.5 Tornadoes/Thunderstorms
- D.5.6 Severe Winter Weather
- D.5.7 Earthquakes
- D.5.8 Geological
- D.5.10 Flooding
- D.5.11 Wildfire
- D.5.12 Infectious Disease
- D.5.13 Hazardous Substances
- D.5.14 Radiological Emergencies Fixed Nuclear Facilities
- D.5.15 Terrorism
- D.5.16 Cyber
- D.5.17 Electromagnetic Pulse

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.

D.5.1 Overview

This section includes detailed hazard profiles for each of the hazards identified in the Hazard Identification section as significant enough for further evaluation in the University of North Carolina at Charlotte 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 Campus Hazard Mitigation Planning Team as it relates to unique historical or anecdotal hazard information as it applies specifically for UNCC.

After reviewing the list of assessed hazards from the previous plan, the University of North Carolina at Charlotte Campus Hazard Mitigation 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**
  - 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

Much of the information in this section begins with a review of how the hazards impact Mecklenburg County because that is the level at which the most readily-available and best-available information is provided. Where feasible, County-level information is supplemented with campus-specific details.

D.5.2 DROUGHT

D.5.2.1 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, 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. It is also notable that drought conditions typically do not cause significant damage to the built environment.

D.5.2.2 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 D.8.**

TABLE D.8: 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 NOAA, Mecklenburg County has had drought occurrences in eight of the last ten years (2010-2019) (**Table D.9**). 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 D.9: SUMMARY OF DROUGHT OCCURRENCES IN MECKLENBURG COUNTY (1995-2019)

Year	Months of Recorded Drought	Event Details
1998	4	Dry conditions started in July, subsided in August, started again in September, and continued through most of November. In most areas, crops were damaged or destroyed. Water levels in creeks, streams, rivers, and lakes were fairly low. Water levels in some shallow wells were low.
1999	3	Dry conditions that began in July of 1998, subsided for several months during the latter part of 1998 and the first part of 1999, returned in June of 1999 and continued in many areas through early September. In many areas, crops were damaged or destroyed. Water levels in creeks, streams, and rivers were very low. The drought ended in most areas with the arrival of heavy rain from the remnants of hurricane Dennis on the 4th and 5th of September.
2007	6	Significant rainfall deficits led to drought conditions across the northwest mountains of NC, peaking at an extreme D4 drought level in October. Crop and livestock losses were significant, and the governor urged citizens to conserve water.
2008	12	The drought conditions seen in 2007 continued into 2008. Rainfall in April along with rain from Tropical Storm Fay in August helped to mitigate drought conditions, though the drought conditions continued in Mecklenburg County through the year.
2016	2	It was extremely dry for most of November and only a late month rainfall event prevented a record or near-record dry month. Drought conditions into December until rainfall early in the month ended the drought.
2019	1	Parts of northwest North Carolina began to experience dry conditions during the mid-summer month. These dry conditions were aggravated by an early October heat wave with numerous records or near-record highs occurred from October 1st through 4th which propelled the county into drought conditions.

Source: NCEI Storm Event Database

D.5.2.3 Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of Mecklenburg County, including the University of North Carolina Charlotte campus, 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[1].

D.5.3 EXCESSIVE HEAT

D.5.3.1 Location and Spatial Extent

Excessive heat typically impacts a large area and cannot be confined to any geographic or political boundaries. The entire University of North Carolina Charlotte campus is susceptible to extreme heat conditions.

[1] *U.S. Seasonal Drought Outlook. National Weather Service Climate Prediction Center. http://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php*

D.5.3.2 Historical Occurrences

Data from the National Centers for Environmental Information showed that there have not been any historical excessive heat/heat wave events in Mecklenburg County. Typical weather conditions in Charlotte, North Carolina, where the campus is located, tend not to rise above 80 degrees Fahrenheit. **Table D.10** shows the average maximum temperatures from 2001 to 2019 for Franklin, NC which is the closest weather reporting station to UNCC.

TABLE D.10: AVERAGE MAXIMUM TEMPERATURE IN CHARLOTTE, NORTH CAROLINA

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
51	55	63	72	79	86	89	87	81	72	62	53

Source: State Climate Office of North Carolina

The highest temperature ever recorded at the Charlotte Douglas Airport, at 104 degrees Fahrenheit on June 29, 2012.[2]

D.5.3.3 Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of Mecklenburg County, including the University of North Carolina Charlotte campus, has a probability level of possible (1 to 10 percent annual probability) for future extreme heat events to impact the region.

D.5.4 HURRICANE AND COASTAL HAZARDS

D.5.4.1 Location and Spatial Extent

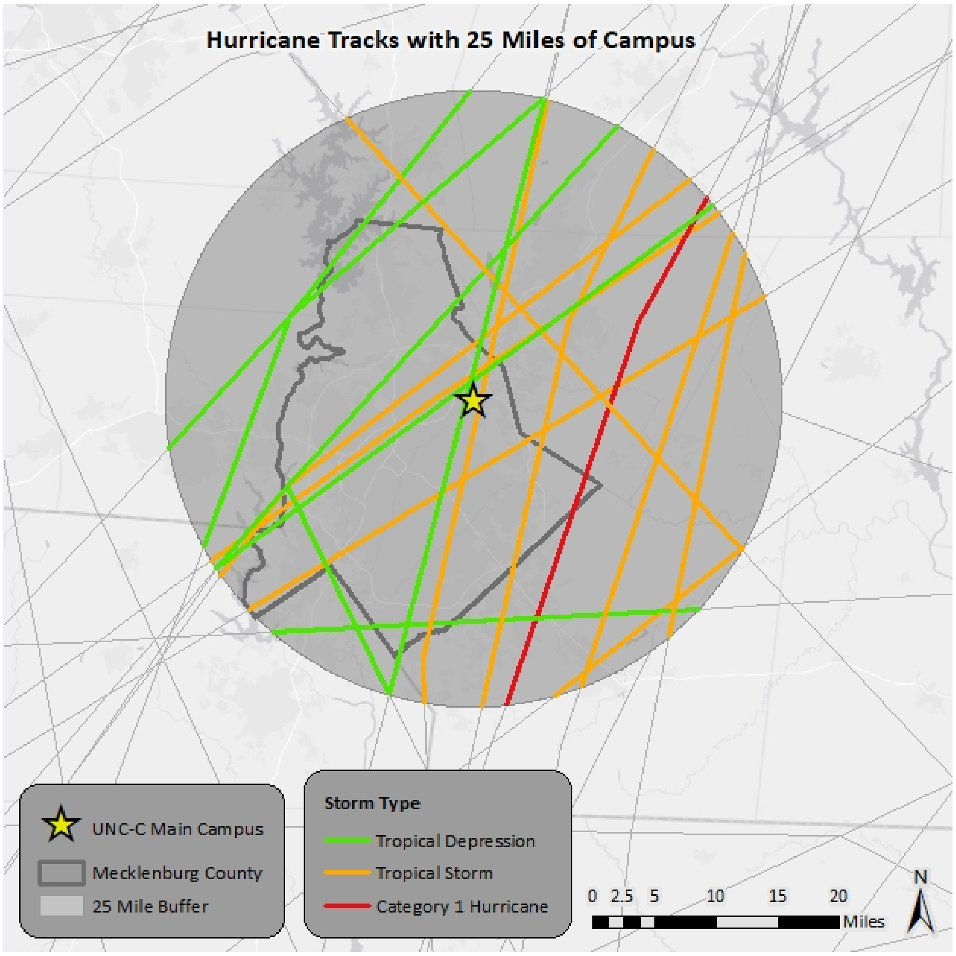
Hurricanes, coastal hazards, and tropical storms threaten the entire Atlantic and Gulf seaboard of the United States. While coastal areas are most directly exposed to the brunt of landfalling storms, their impact is often felt hundreds of miles inland and they can affect the University of North Carolina Charlotte Campus.

D.5.4.2 Historical Occurrences

According to the National Hurricane Center's historical storm track records, 7 hurricane or tropical storm tracks have passed within 25 miles of UNCC's campus since 1850[3]. This includes 5 tropical depressions, 1 tropical storm, and 1 category 1 hurricane. These storm events are shown in **Figure D.5.** Furthermore, **Table D.11** provides for each event the date of occurrence, name (if applicable), maximum wind speed (as recorded within 25 miles of Mecklenburg County) and Category of the storm based on the Saffir-Simpson Scale.

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

FIGURE D.5: HISTORICAL HURRICANE STORM TRACKS WITHIN 25 MILES OF UNIVERSITY OF NORTH CAROLINA CHARLOTTE



Source: National Oceanic and Atmospheric Administration; National Hurricane Center

TABLE D.11: HISTORICAL STORM TRACKS WITHIN 25 MILES OF UNIVERSITY OF NORTH CAROLINA CHARLOTTE (1901–2018)

Year	Storm Name	Maximum Wind Speed (knots)	Storm Category
1901	UNNAMED	35	Tropical Depression
1952	UNNAMED	30	Tropical Depression
1959	GRACIE	45	Tropical Storm
1989	HUGO	85	Cat 1 Hurricane
2003	BILL	20	Tropical Depression
2004	IVAN	20	Tropical Depression
2005	CINDY	20	Tropical Depression

Source: National Hurricane Center

The National Centers for Environmental Information did not record any hurricane or tropical storm events in Mecklenburg County between 1950 and 2019. Hurricane and tropical storm events have caused 2 presidential disaster declarations in Mecklenburg County. While these were not recorded in the database, effects from these types of storms were likely still felt in other hazards, including thunderstorms and flooding. Flooding is generally the greatest hazard of concern with hurricane and tropical storm events in the area near University of North Carolina Charlotte. However, hurricane remnant 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 or the Gulf of Mexico. 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.

D.5.3.3 Probability of Future Occurrences

Given the inland location of the campus, it is more likely to be affected by remnants of hurricane and tropical storm systems (as opposed to a major hurricane) which may result in flooding or high winds. The probability of being impacted is less than coastal areas, but still remains a real threat to University of North Carolina Charlotte due to induced events like flooding and land sliding. Based on historical evidence, the probability level of future occurrence is possible (between 1 and 10 percent annual probability). However, when the area is impacted, the damage could be severe, threatening lives and property on campus.

D.5.5 TORNADOES/THUNDERSTORMS

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

D.5.5.1 Location and Spatial Extent

Tornadoes

Tornadoes occur throughout the state of North Carolina, and thus in the area surrounding University of North Carolina Charlotte. 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 area surrounding the University of North Carolina Charlotte campus 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 University of North Carolina Charlotte typically experiences several straight-line wind events each year. These wind events can and have caused significant damage. It is assumed that the area surrounding the University of North Carolina Charlotte campus 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 all of the area surrounding the University of North Carolina Charlotte campus is uniformly exposed to severe thunderstorms; therefore, the campus itself is also 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 area surrounding the University of North Carolina Charlotte campus is uniformly exposed to lightning.

D.5.5.2 Historical Occurrences

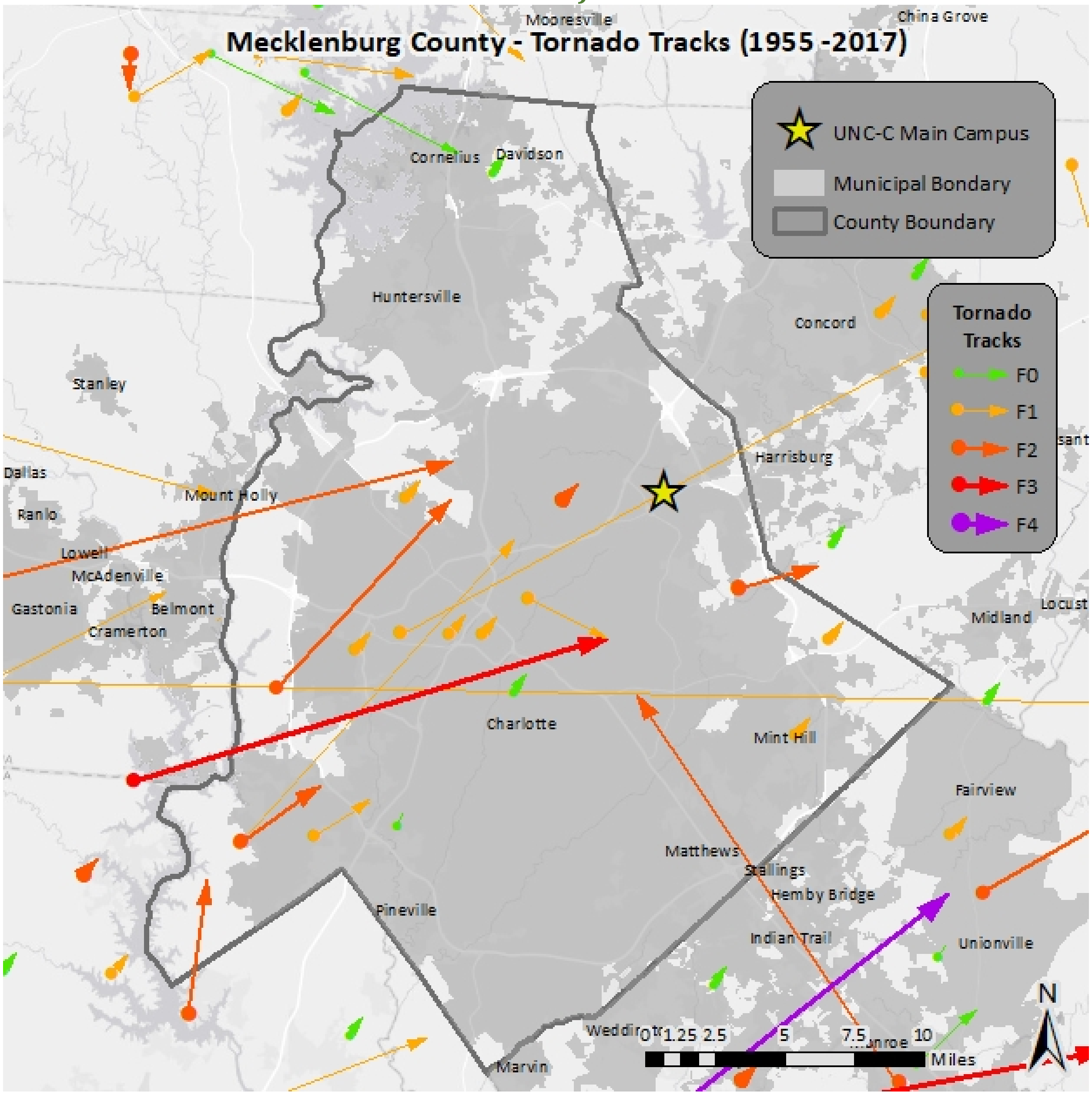
Tornadoes

Tornadoes are a somewhat rare occurrence; however, they have and do occur in the area. According to the National Centers for Environmental Information, there have been 23 recorded tornado events in Mecklenburg County since 1975 (**Table D.12**), resulting in over $5.5 million in property damages[4]. There have been no deaths or injuries reported with these events. The magnitude of these tornadoes ranged from F0 to F2 in intensity. The greatest extent for tornadoes is an EF5, however, that strong of a

[4] 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 Mecklenburg County. As additional local data becomes available, this hazard profile will be amended.

tornado is not likely in Mecklenburg County. 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. **Figure D.6** shows a map of tornado impact in Mecklenburg County.

FIGURE D.6: TORNADO TRACKS IN MECKLENBURG COUNTY (1955 – 2017)



Source: National Centers for Environmental Information

TABLE D.12: HISTORICAL TORNADO IMPACTS IN MECKLENBURG COUNTY

Date	Magnitude	Deaths/Injuries	Property Damage	Details
2/18/1960	F1	0/0	$2,500	n/a
4/12/1961	F1	0/0	$25,000	n/a
8/10/1964	F1	0/0	$250	n/a
9/12/1965	F2	0/0	$25,000	n/a
6/7/1968	F2	0/0	$25,000	n/a
5/28/1973	F2	0/0	$250,000	n/a
5/28/1973	F1	0/1	$250,000	n/a
10/8/1975	F1	0/0	$25,000	n/a
9/16/1977	F1	0/0	$25,000	n/a
8/14/1978	F0	0/0	$2,500	n/a
5/3/1984	F1	0/0	$250,000	n/a
6/6/1985	F0	0/0	$250,000	n/a
11/28/1990	F1	0/0	$25,000	n/a
3/10/1992	F2	0/18	$2,500,000	n/a
3/20/1998	F0	0/0	$0	n/a
5/7/1998	F0	0/0	$50,000	A waterspout/tornado crossed Lake Norman from Lincoln county and moved through Cornelius. The roof of a grocery store was damaged and debris from the store damaged cars and other buildings across the street at a dealership.
8/1/1999	F0	0/0	$0	
9/7/2004	F2	0/0	$150,000	This tornado moved north from South Carolina, and produced widespread damage to trees and power lines along its 2-mile path across the southwest corner of Mecklenburg County. The roof of a well-constructed home was blown off, and several other homes incurred shingle damage. A sheet of wallboard was torn off a garage wall and blown away. There was additional damage to automobiles and homes due to fallen trees.
3/8/2005	F1	0/0	$50,000	A weak tornado developed within the squall line as it moved over Charlotte metro. The tornado developed near the intersection of 36th and North Tryon streets, where the roof of a building was torn off. In the same general area, the roofs of 2 trailers were partially torn off. Intermittent tree damage occurred along most of the remaining 3-miles of the track, with some trees falling on vehicles. At the end of the track, the roof was damaged and some windows blown out when a large oak tree fell on Cochrane Middle School. The roof cover was torn off of a business and some large pine trees and limbs were blown down just south of the school.

5/9/2008	EF1	0/0	$0	A tornado began on the south side of Gastonia in Gaston County. It produced damage to several structures in extreme eastern Gaston County before moving into Mecklenburg County, where the track become more intermittent. The public reporting several large trees blown down in the area around Woodlyn Dr in Northwest Charlotte. The path ended in the Beatties Ford Rd area north of Charlotte, where an outbuilding was lifted and blown 20 to 30 feet and 2 large dumpsters were overturned.
3/3/2012	EF2	0/4	$1,500,000	An NWS Storm Survey found the path of a strong tornado that developed rapidly over eastern portions of the Charlotte metro area during the early morning hours of March 3rd. The tornado touched down near the intersection of Dulin Creek Rd and Little Whiteoak Rd, moving just south of Plaza Rd extension. The tornado affected two subdivisions in Mecklenburg County. Four homes slid off their foundations and were completely destroyed. Twenty-nine homes were rendered uninhabitable from collapsed exterior walls. A total of 162 homes were damaged in the county. Four people were injured in this area. The tornado crossed I-485, just south of Plaza Rd Extension before moving into Cabarrus County. The total path length in Mecklenburg County was a little over 1.5 miles, while the maximum width was 200 yards.
5/15/2014	EF0	0/0	$10,000	Emergency managers' survey indicated a short tornado track on the south side of Charlotte. The tornado touched down at the end of Arrowpoint Blvd , where some siding was peeled off an industrial office building. The tornado tracked north/northeast along Arrowpoint Blvd, blowing down trees, tossing a large awning, |and tearing a glass panel from another industrial office building. The tornado then crossed Arrowood Rd within a half mile of I-77, where more than a dozen additional trees were blown down and the tops blown out of other trees. The tornado lifted in a wooded area just north/northeast of this point.
11/30/2016	EF1	0/0	$100,000	This weak tornado touched down along John Price Rd near Steele Creek. The tornado moved northeast along an intermittent path, downing numerous trees, moving a a mobile home from its foundation, and overturning a tractor trailer on Westinghouse Blvd. Some siding and shingles were removed from various buildings, and a few homes in the Ayrsley community (along S Tryon St just west of I-485) suffered broken windows. The tornado may have lifted briefly at this point. The damage path was picked up again east of I-485 along Microsoft Way. Multiple trees were felled, and several buildings received minor damage before the tornado dissipated near the intersection of Microsoft Way and W Arrowhead Rd. The path of this tornado was within a quarter mile of the last tornado that impacted the Charlotte area (May 2014).

Source: NCEI

Thunderstorms

According to NCEI, there have been 366 reported thunderstorm and high wind events since 1969 in Mecklenburg County[5]. These events caused over $1.6 million (2019 dollars) in damages. There were reports of fourteen injuries. **Table D.13** summarizes this information.

TABLE D.13: HISTORICAL THUNDERSTORM IMPACTS IN MECKLENBURG COUNTY

Location	Number of Occurrences	Deaths/Injuries	Property Damage
Charlotte	94	0/8	$1,183,500
Cornelius	13	0/0	$31,000
Davidson	9	0/0	$15,000
Huntersville	22	0/0	$89,000
Matthews	11	0/3	$50,000
Mint Hill	14	0/0	$0
Pineville	14	0/0	$21,000
Stallings	0	0/0	$0
Weddington	0	0/0	$0
Unincorporated Areas	189	0/3	$281,000
Mecklenburg County Total	**366**	**0/14**	**$1,670,500**

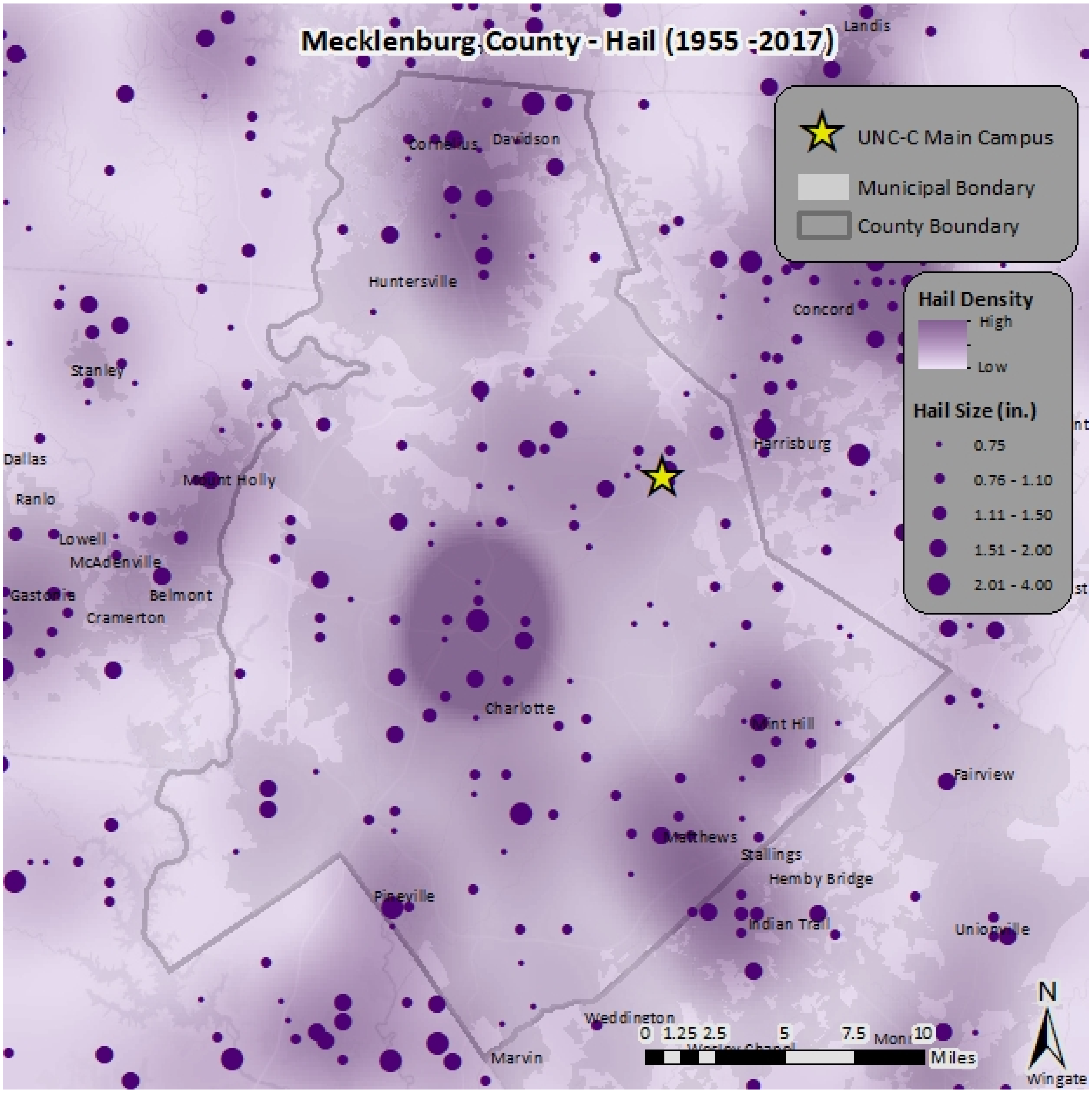
Hailstorms

According to the National Centers for Environmental Information, 228 recorded hailstorm events have affected Mecklenburg County since 1955 summarized in **Table D.14**[6]. In all, hail occurrences resulted in $1 million (2020 dollars) in property damages. Hail ranged in diameter from 0.75 inches to 3 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. **Figure D.7** shows a map of hailstorm occurrences in Mecklenburg County.

[5] 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 Mecklenburg County. As additional local data becomes available, this hazard profile will be amended.

[6] 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 Mecklenburg County. 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.

FIGURE D.7: HAIL OCCURANCES IN MECKLENBURG COUNTY



Source: National Centers for Environmental Information

TABLE D.14: HISTORICAL HAIL OCCURANCES IN MECKLENBURG COUNTY

Location	Number of Occurrences	Deaths/Injuries	Property Damage
Charlotte	50	0/0	$1,000,000
Cornelius	9	0/0	$0
Davidson	2	0/0	$0
Huntersville	17	0/0	$0
Matthews	13	0/0	$0
Mint Hill	12	0/0	$0
Pineville	11	0/0	$0
Stallings	0	0/0	$0
Weddington	0	0/0	$0
Unincorporated Areas	114	0/0	$0
Mecklenburg County Total	**228**	**0/0**	**$1,000,000**

Source: NCEI

Lightning

According to the National Centers for Environmental Information, there have been a total of 46 recorded lightning events in Mecklenburg County since 1973[7]. These events resulted in over $3.69 million (2020 dollars) in damages, as listed in summary **Table D.15**. Furthermore, lightning caused one death and ten injuries in the County.

It is certain that more than 46 events have impacted the Region. Lightning occurs with almost every spring and summer thunderstorm that impacts the County; however, 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.

[7] 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 Mecklenburg County. The State Fire Marshall's office was also contacted for additional information but none could be provided. As additional local data becomes available, this hazard profile will be amended.

TABLE D.15: HISTORICAL LIGHTNING IMPACTS IN MECKLENBURG COUNTY

Location	Number of Occurrences	Deaths/Injuries	Property Damage
Charlotte	23	0/5	$1,595,000
Cornelius	0	0/0	$0
Davidson	0	0/0	$0
Huntersville	4	0/2	$70,000
Matthews	4	3/1	$230,000
Mint Hill	0	0/0	$0
Pineville	0	0/0	$0
Stallings	0	0/0	$0
Weddington	0	0/0	$0
Unincorporated Areas	15	0/3	$1,800,000
Mecklenburg County Total	**46**	**3/11**	**$3,695,000**

Source: National Centers for Environmental Information

D.5.5.3 Probability of Future Occurrences

Tornadoes

According to historical information, tornado events are not an annual occurrence for the region. While the majority of the reported tornado events are small in terms of size, intensity, and duration, they do pose a significant threat should University of North Carolina Charlotte experience a direct tornado strike. The probability of future tornado occurrences affecting University of North Carolina Charlotte is possible (1 to 10 percent annual probability).

Thunderstorms

Given the high number of previous events, it is certain that thunderstorms will occur in the future. This results in a probability level of highly likely (100 percent annual probability) for future wind events for University of North Carolina Charlotte.

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 University of North Carolina Charlotte 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 Mecklenburg County 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), University of North Carolina Charlotte is located in an area of the country that experienced an average of 3 to 6 lightning flashes per square kilometer per year between 2008 and 2017. 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 could cause minor property damages at UNCC.

D.5.6 SEVERE WINTER WEATHER

D.5.6.1 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. University of North Carolina Charlotte 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 campus has uniform exposure to a winter storm.

D.5.6.2 Historical Occurrences

Winter weather has resulted in three disaster declarations Mecklenburg County. This includes the Blizzard of 1996, one previous winter storm in 1993, and a winter storm in 2009[8]. According to the National Centers for Environmental Information, there have been a total of 44 days of severe winter weather or storms in Mecklenburg County since 1996 (**Table D.16**)[9]. The National Centers for Environmental Information did not report any injuries, deaths, or property damages from these events.

TABLE D.16: WINTER STORM EVENTS IN MECKLENBURG COUNTY

Year	Winter Weather Events Reported	Days of Winter Weather Reported
1996	4	4
1997	3	3
1998	1	1
1999	1	1
2000	0	0
2002	0	0
2003	3	3
2004	1	1
2005	2	2
2006	0	0
2007	2	2
2008	2	2
2009	3	3
2010	4	4
2011	0	0
2012	0	0
2013	2	2
2014	4	4
2015	3	3

[8] A complete listing of historical disaster declarations, including the affected counties, can be found in Section 4: *Hazard Identification*.

[9] These ice and winter storm events are only inclusive of those reported by the National Centers for Environmental Information (NCEI). It is likely that additional winter storm conditions have affected Mecklenburg County.

2016	3	3
2017	2	2
2018	2	2
2019	1	1
TOTAL	**44**	**44**

Source: National Centers for Environmental Information

There have been several severe winter weather events to impact University of North Carolina Charlotte. The text below describes some of the major events.

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.

2014 Winter Weather – February 10, 2014
Light to moderate snow developed across the central and northern mountains during late morning and continued off and on through the afternoon. While most locations saw an inch or less, a small band of moderate to heavy snow developed during the afternoon from the high elevations of northern Mecklenburg County, through central Haywood, and central and southern Buncombe Counties, where two to four-inch amounts were common. Some high elevation areas saw as much as 5 inches in this area. Several accidents in the Balsam area resulted in major traffic problems on Highway 74 near the Haywood/Mecklenburg line.

2017 Winter Weather – December 8-9, 2017
As moisture associated with developing and strengthening low pressure over the northeast Gulf of Mexico overspread the western Carolinas, snow developed over the mountains of southwest North Carolina around daybreak on the 8th and quickly accumulated. By late morning, heavy snowfall accumulations were reported across the Smoky Mountains and Balsams and vicinity. Total accumulations generally ranged from 8-12 inches, with locally higher amounts well over a foot reported in the higher elevations, and lower amounts reported in the low valleys along the Tennessee border. While occasional flurries and light snow showers produced locally light additional accumulations into the early daylight hours of the 9th, the accumulating snow ended in most areas shortly after midnight.

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.

D.5.6.3 Probability of Future Occurrences

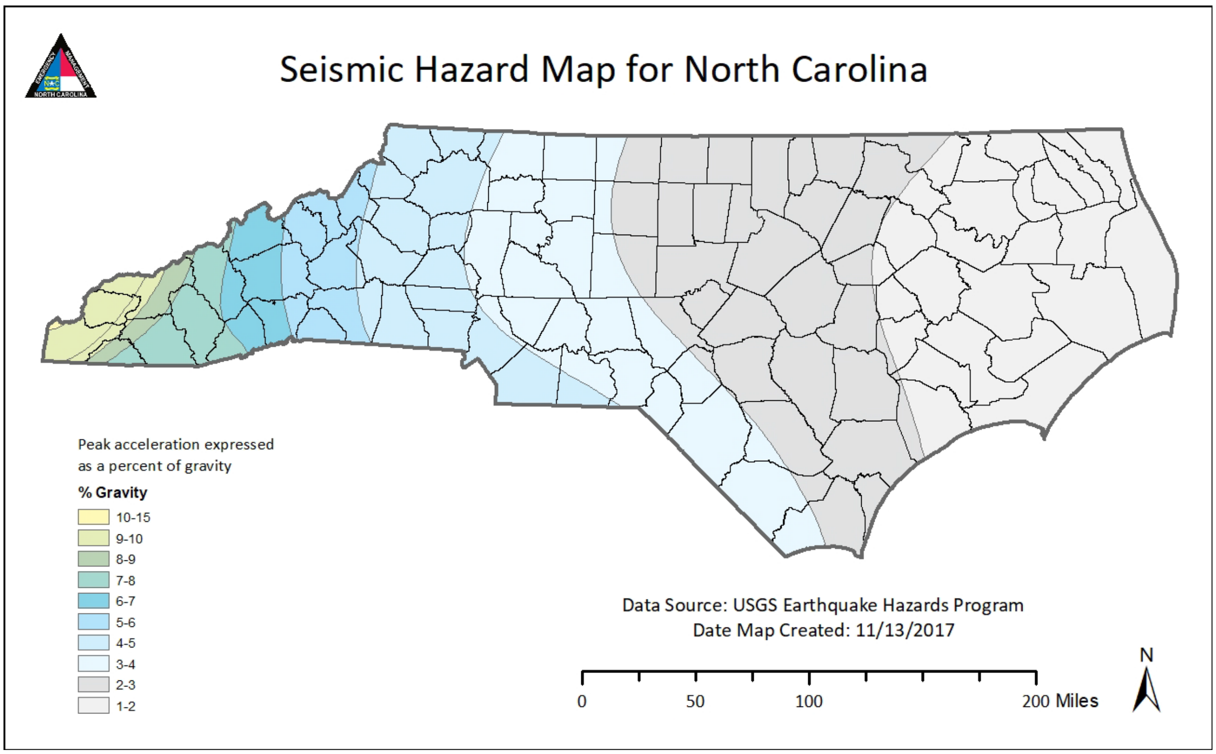
Winter storm events will remain a regular occurrence for University of North Carolina Charlotte due to its location in the western part of the state. According to historical information the University often experiences several winter storms events each year. Therefore, the annual probability is likely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

D.5.7 EARTHQUAKES

D.5.7.1 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 D.8** is a map showing geological and seismic information for North Carolina.

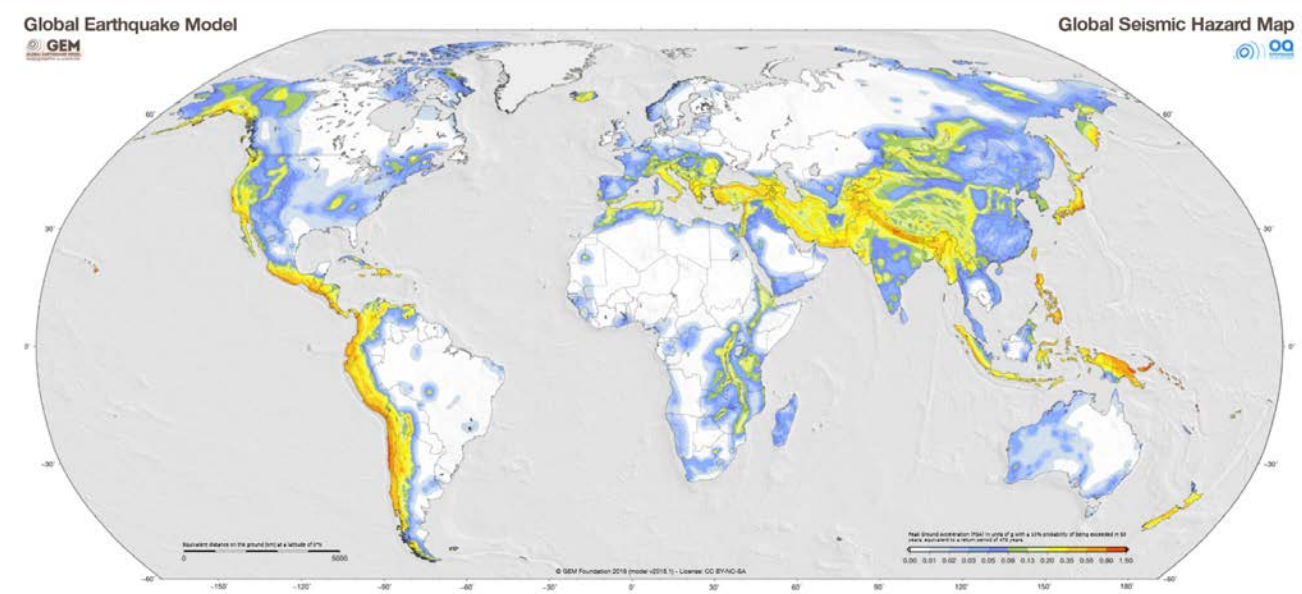
FIGURE D.8: GEOLOGICAL AND SEISMIC INFORMATION FOR NORTH CAROLINA



Source: North Carolina Geological Survey

Figure D.9 shows the intensity level associated with the world 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 campus as a whole exists within an area of moderate seismic risk.

FIGURE D.9: PEAK ACCELERATION WITH 10 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS



Source: Global Earthquake Model, 2018

D.5.7.2 Historical Occurrences

Since 1879 there have been 16 earthquakes, greater than 4.3 magnitude to occur in the area around UNCC. The strongest of these measured a VIII on the Modified Mercalli Intensity (MMI) Scale. **Table D.17** provides a summary of earthquake events reported by the United States Geological Survey.

TABLE D.17: EARTHQUAKES IMPACTING MECKLENBURG COUNTY

Date	Location	Richter Scale (Magnitude)	MMI (Intensity)
1879-12-13	Charlotte	*Unknown*	5
1886-9-1	Charlotte	*Unknown*	8
1898-11-12	Charlotte	*Unknown*	4
1996-02-21	Charlotte	*Unknown*	5
1924-10-20	Charlotte	*Unknown*	2
1928-12-23	Charlotte	*Unknown*	3
1928-11-03	Charlotte	*Unknown*	4
1969-11-20	Charlotte	4.3	5
1976-09-13	Charlotte	3.3	2
1945-07-26	Charlotte	5.6	4
1969-11-20	Charlotte	4.3	3
1974-11-22	Davidson	4.7	4
1969-11-20	Matthews	4.3	3
12-13-1879	Pineville	*Unknown*	5
1886-9-1	Pineville	*unknown*	4
1969-11-20	Pineville	4.3	3

Source: USGS; Earthquake Intensity Database

A list of earthquakes that have caused damage throughout North Carolina is presented below in **Table D.18.**

TABLE D.18: EARTHQUAKES WHICH HAVE CAUSED DAMAGE IN NC

Date	Location	Richter Scale (Magnitude)	MMI (Intensity)	MMI in North Carolina
12/16/1811 - 1	NE Arkansas	8.5	XI	VI
12/16/1811 - 2	NE Arkansas	8.0	X	VI
12/18/1811 - 3	NE Arkansas	8.0	X	VI
01/23/1812	New Madrid, MO	8.4	XI	VI
02/071812	New Madrid, MO	8.7	XII	VI
04/29/1852	Wytheville, VA	5.0	VI	VI
08/31/1861	Wilkesboro, NC	5.1	VII	VII
12/23/1875	Central Virginia	5.0	VII	VI
08/31/1886	Charleston, SC	7.3	X	VII
05/31/1897	Giles County, VA	5.8	VIII	VI
01/01/1913*	Union County, SC	4.8	VII	VI
02/21/1916*	Asheville, NC	5.5	VII	VII
07/08/1926	Mitchell County, NC	5.2	VII	VII
11/03/1928*	Newport, TN	4.5	VI	VI
05/13/1957*	McDowell County, NC	4.1	VI	VI
07/02/1957	Buncombe County, NC	3.7	VI	VI
11/24/1957	Mecklenburg 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
2020	Sparta, NC			

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).

D.5.7.3 Probability of Future Occurrences

The probability of significant, damaging earthquake events affecting the area surrounding University of North Carolina Charlotte 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 campus. The annual probability level for the campus 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, and for Mecklenburg County the likelihood was 5-6%.

D.5.8 GEOLOGICAL

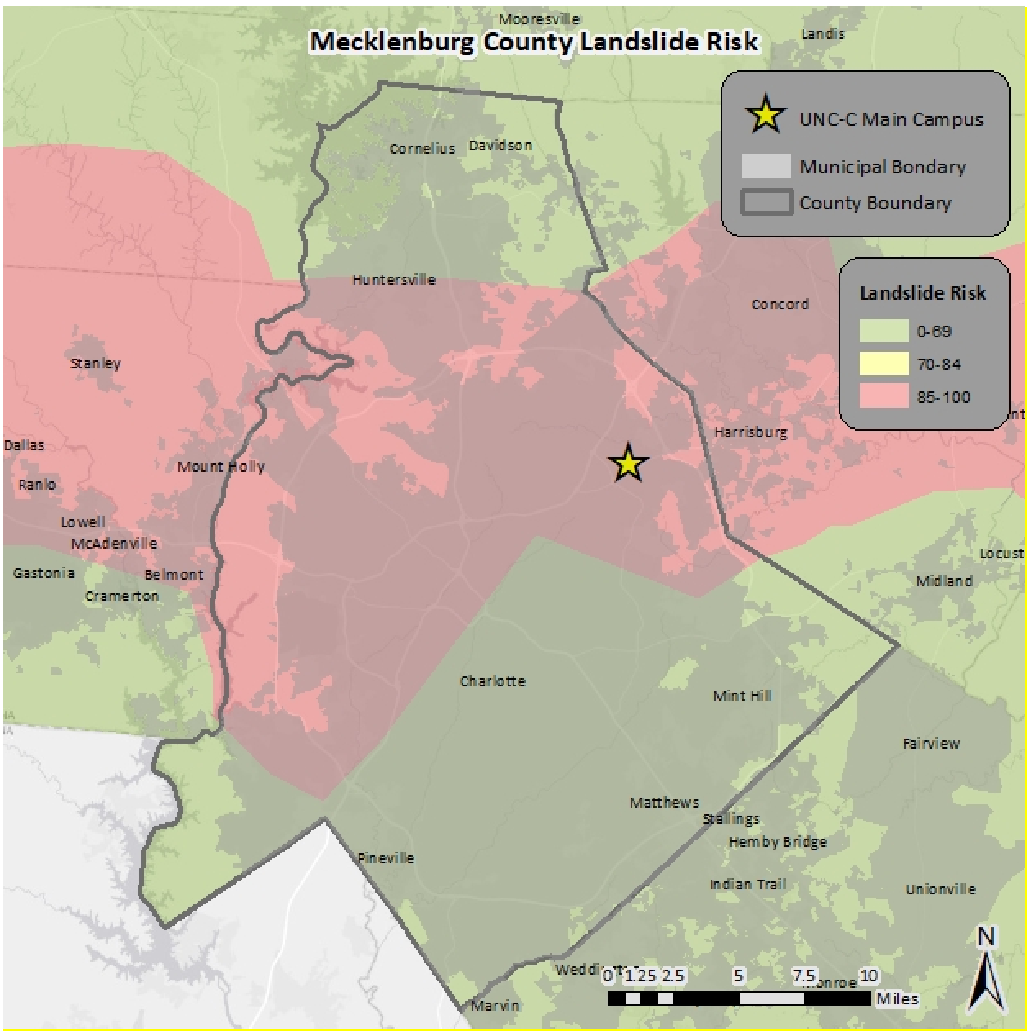
D.5.8.1 Location and Spatial Extent

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 Blue Ridge Mountains, making areas near University of North Carolina Charlotte susceptible to them as well.

According to **Figure D.10** below, much of Mecklenburg County, has moderate to high risk to landslides.

FIGURE D.10: LANDSLIDE SUSCEPTIBILITY AND INCIDENCE MAP OF MECKLENBURG COUNTY

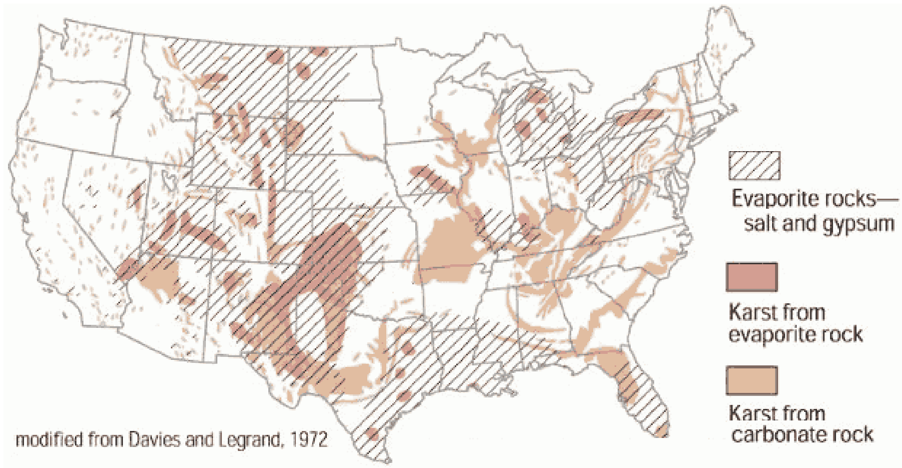


Source: United States Geological Survey

Sinkholes

Figure D.11 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 D.11: UNITED STATES GEOLOGICAL SURVEY OF KARST MODIFIED FROM DAVIES AND LEGRAND, 1972



Erosion

Erosion on the University of North Carolina Charlotte campus is typically caused by flash flooding events. Unlike coastal areas, where the soil is mainly composed of fine-grained particles such as sand, Mecklenburg County soils have much greater organic matter content. Furthermore, vegetation also helps to prevent erosion in the area. Erosion occurs on the University of North Carolina Charlotte campus, particularly along the banks of rivers and streams, but it is not an extreme threat to any of the buildings on campus. No areas of concern were reported by the Campus Hazard Mitigation Planning Team.

D.5.8.2 Historical Occurrences

Landslides

Steep topography in the area surrounding University of North Carolina Charlotte 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. There have been no landslide incidents reported by the UNCC Campus Hazard Mitigation Planning Team.

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 Mecklenburg County.

Erosion

Most historical occurrences of erosion are seen near the coast of North Carolina, but University of North Carolina Charlotte is still susceptible to the hazard. Several sources were vetted to identify areas of erosion at University of North Carolina Charlotte. This includes searching local newspapers, interviewing local officials, and reviewing previous hazard mitigation plans. Mecklenburg County have previous mitigation actions that address erosion including bank stabilization and meeting erosion control requirements. Such actions will continue to be implemented as necessary throughout the region. Erosion was referenced in the previous University of North Carolina Charlotte 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.

D.5.8.3 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 steep slopes and heavy rain, for example. This would increase the likelihood of occurrence. It should also be noted that some areas of the University of North Carolina Charlotte campus 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 in Mecklenburg County. While many sinkholes have been relatively small, it is still unlikely (between 1 and 33.3 percent annual probability) that the campus will continue to be affected in the future.

Erosion

Erosion remains a natural, dynamic, and continuous process for University of North Carolina Charlotte, and it will continue to occur. The annual probability level assigned for erosion is possible (between 1 and 10 percent).

D.5.9 DAM FAILURE

D.5.9.1 Location and Spatial Extent

The North Carolina Division of Energy, Mineral and 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 D.19** explains these classifications.

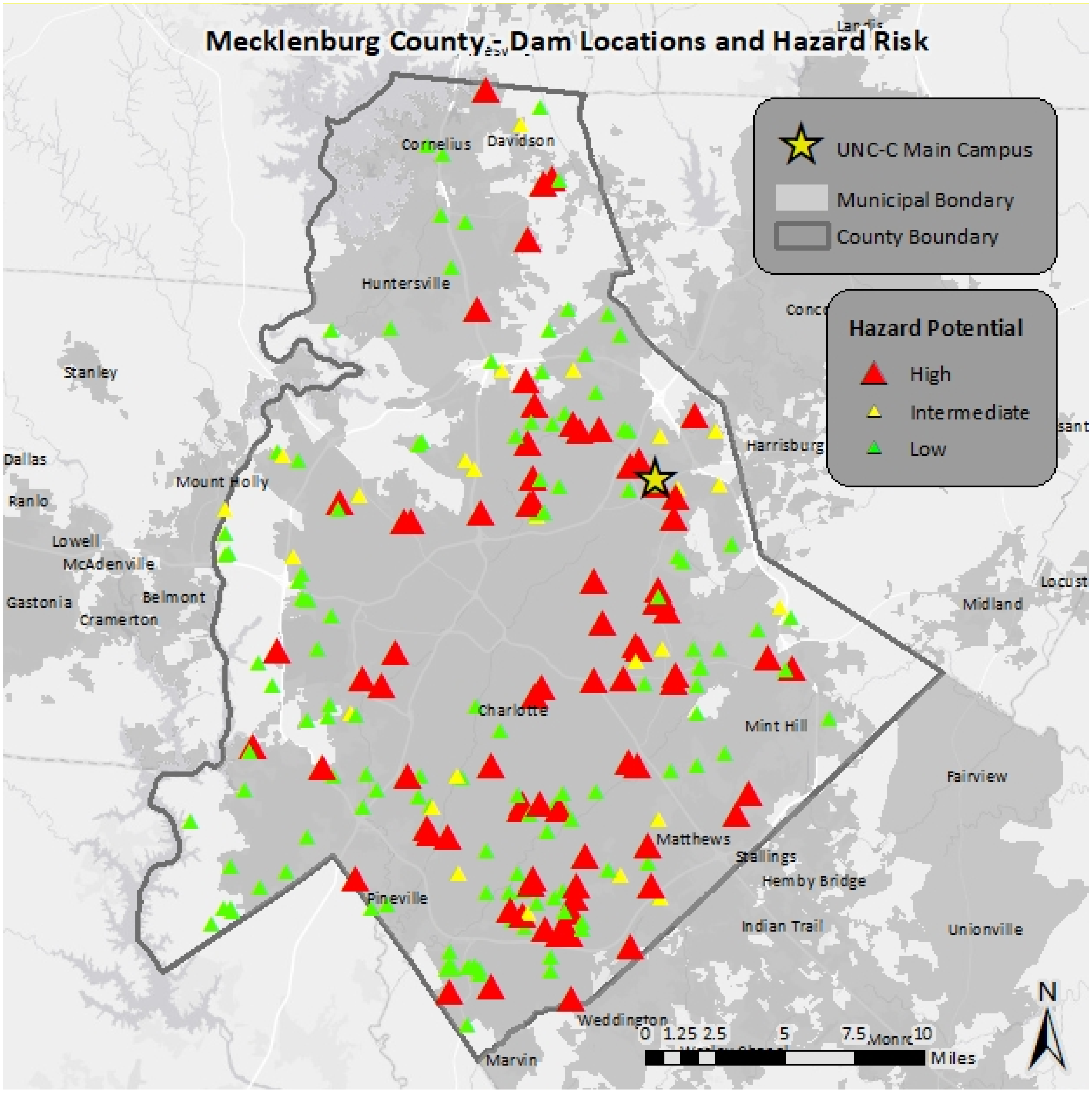
TABLE D.19: NORTH CAROLINA DAM HAZARD CLASSIFICATIONS

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 Management, there are 69 dams in Mecklenburg County. **Figure D.12** shows the dam location and the corresponding hazard ranking for each. Of these dams, 28 are classified as high hazard potential. These high hazard dams are listed in **Table D.20**. The two high hazard dams that are located closest to UNCC are the McGuire Lake Dam and the Hefner Dam. According to a consensus of the Campus Hazard Mitigation Planning Team, there is an extremely low possibility that any of these state-recognized dams would cause any damage whatsoever to University of North Carolina Charlotte should a dam breach or failure occur, despite the hazard classifications assigned to these dams by the state.

FIGURE D.12: MECKLENBURG COUNTY DAM LOCATION AND HAZARD RANKING



Source: North Carolina Division of Land Resources

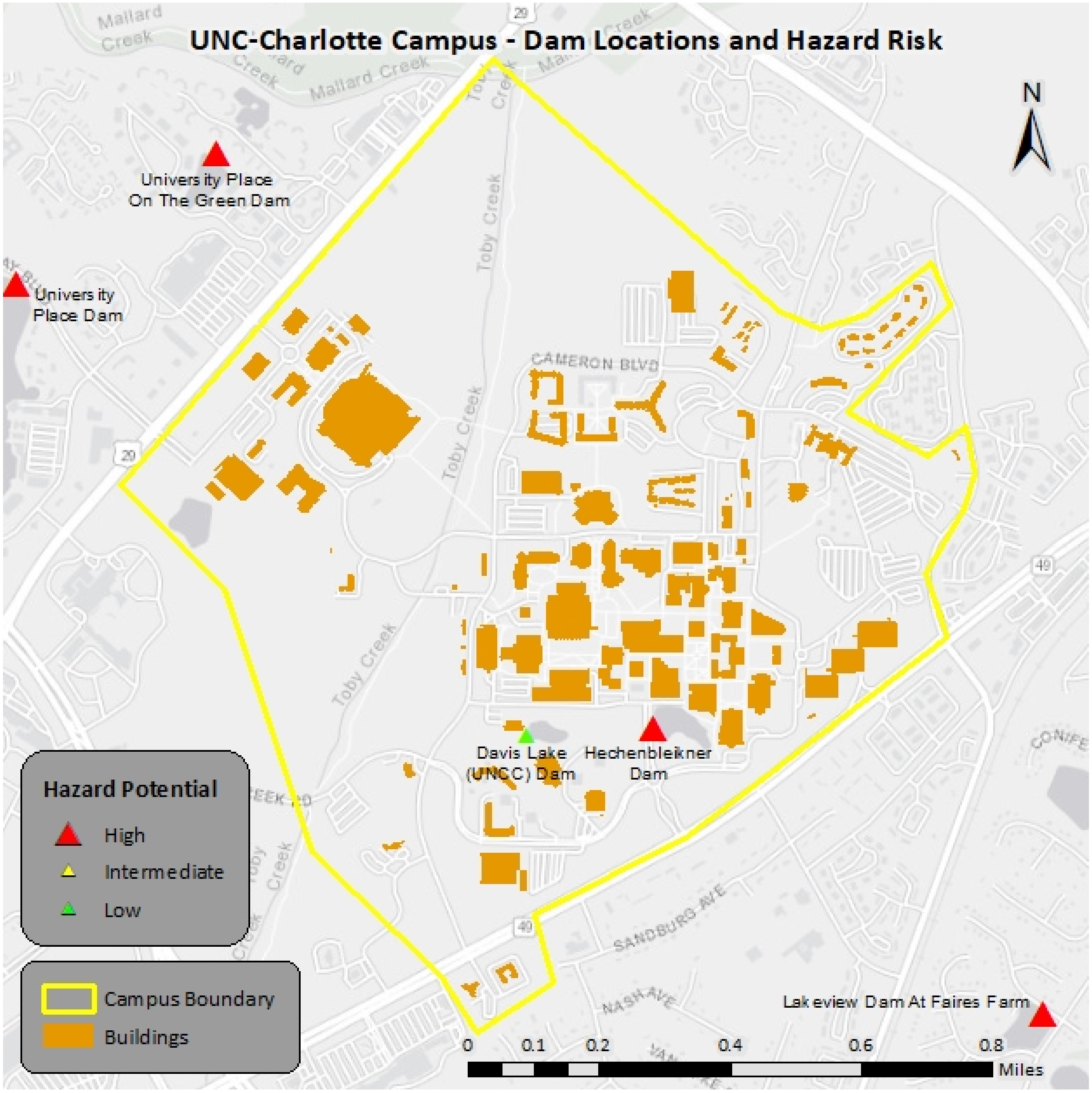

UNC-Charlotte Campus - Dam Locations and Hazard Risk
N
University Place On The Green Dam
University Place Dam
Davis Lake (UNCC) Dam
Hechenbleikner Dam
Lakeview Dam At Faires Farm
CAMERON BLVD
Toby Creek
Mallard Creek
SANDBURG AVE
NASH AVE
Hazard Potential
High
Intermediate
Low
Campus Boundary
Buildings
0
0.1
0.2
0.4
0.6
0.8
Miles

TABLE D.20: MECKLENBURG COUNTY HIGH HAZARD DAMS

Dam Name	Hazard Potential	Surface Area (acres)	Max Capacity (Ac-ft)
Quail Acres Dam	High	8.0	69
Cornwell Dam	High	23.0	358
Griffith Dam #1	High	0.0	108
Windermere Dam	High	5.0	52
Danga Lake Dam	High	2.5	59
Arrowood Quarry Dam	High	40.0	365
Billingsley Dam	High	0.8	10
Forest Lake Dam	High	8.8	60
Delta Lake Dam	High	7.8	68
Moody Pond Dam	High	0.0	38
Linda Lake Dam	High	4.8	45
Oakwood Lane Dam	High	6.1	46
Ardrey Park Dam	High	1.9	16
Lock Lane Dam	High	1.9	14
Sharon Lake Upper Dam	High	4.7	29
Lake Plaza Dam	High	3.3	30
Pellynwood Lake Dam	High	4.8	73
Giverney Dam	High	3.0	27
Methodist Home Dam	High	4.0	78
Reddmans Pier Dam	High	2.2	16
Lakeside Drive Dam	High	4.9	52
O'Dillon Lake Dam	High	7.0	76
Quail Hollow West Dam	High	3.9	23
Sharon Lake Lower Dam	High	4.5	60
Village Lake Dam	High	3.5	43
Lake Providence Dam	High	5.0	40
Hideaway Bay Dam	High	5.8	42
Ivey's Pond Dam	High	7.1	63
University Place Dam	High	10.7	193
Withrow Dam	High	4.2	48
Baucom Lake Dam	High	6.0	48
Davis Lake Subdivision Dam	High	13.5	173
Clearwater Lake Dam At Runaway Bay	High	4.0	25
Harris Pond Dam	High	0.7	3
Hidden Landing Dam	High	6.2	36
Raintree Dam #O	High	4.9	31
Raintree Dam #2	High	6.5	43
Raintree Dam #4	High	1.1	11
Raintree Dam #7	High	3.3	72
Radbourne Subdivision Dam	High	4.0	20
Maplecroft Dam	High	3.7	30
Woodrow Allen Dam	High	4.0	36
Windrow Dam	High	4.7	17

Dam Name	Hazard Potential	Surface Area (acres)	Max Capacity (Ac-ft)
Beverly Crest Dam	High	5.0	460
Winterbrooke Dam	High	2.0	20
Piper Glen Dam B	High	3.5	36
Franklin Treatment Plant 250 Mg Raw Water Reservoir	High	32.7	777
Fernhill Pond Dam	High	4.0	54
Francis Beatty Park Dam	High	7.5	67
Cobblestone Dam	High	2.0	17
Cottonwood Dam	High	1.4	8
Arnold Palmer Dam	High	1.0	9
Clarks Creek Subdivision Dam	High	22.2	228
Ballantrae At Piper Glen	High	1.3	8
Jordan Dam	High	2.1	16
University Place On The Green Dam	High	2.0	12
Beaty Dam	High	2.3	12
Peter's Lake Dam At The Villas	High	5.9	26
Carson Pond Dam	High	2.5	18
Franklin Treatment Plant Raw Water Reservoir	High	32.0	917
Lakeview Dam At Faires Farm	High	2.3	11
Irwin Creek Flood Protection Dike	High	0.0	0
Muddy Pond Dam	High	2.0	8
Pierson Pond Dam	High	0.8	9
Lakepointe Corporate Center Dam	High	1.7	10
Page's Pond Dam	High	2.8	26
Symphony Park Dam	High	1.7	23
Winery Lane Dam	High	1.7	7
Berewick Farm Pond Dam #2	High	1.2	15
Carolina Golf and Country Club Irrigation Dam	High	7.4	110
Resource Square WQ Pond Dam	High	2.6	25
Eastfield Station Dam	High	3.1	17
Hunter Acres Pond Dam	High	3.5	27
Hechenbleikner Dam	High	1.6	16
McDonald Dam	High	1.9	0
Samonds Dam	High	2.7	11
Walden Two Dam	High	3.5	32
Landtec Pond Dam	High	1.1	5

Source: North Carolina Division of Land Resources

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

D.5.9.2 Historical Occurrences

According to information from the North Carolina Division of Energy, Mineral and Land Resources, there have been have been five dam breaches in total in Mecklenburg County. Three of the five reported dam breaches were listed as “high hazard” dams by the North Carolina Division of Energy, Mineral and Land Resources. No other reports from the dam breaches could be found.

D.5.9.3 Probability of Future Occurrence

Given the current dam inventory and historic data, a dam breech is possible (between 1 and 10 percent annual probability) in the future. However, with regular monitoring, these events can be prevented as has been demonstrated in the past.

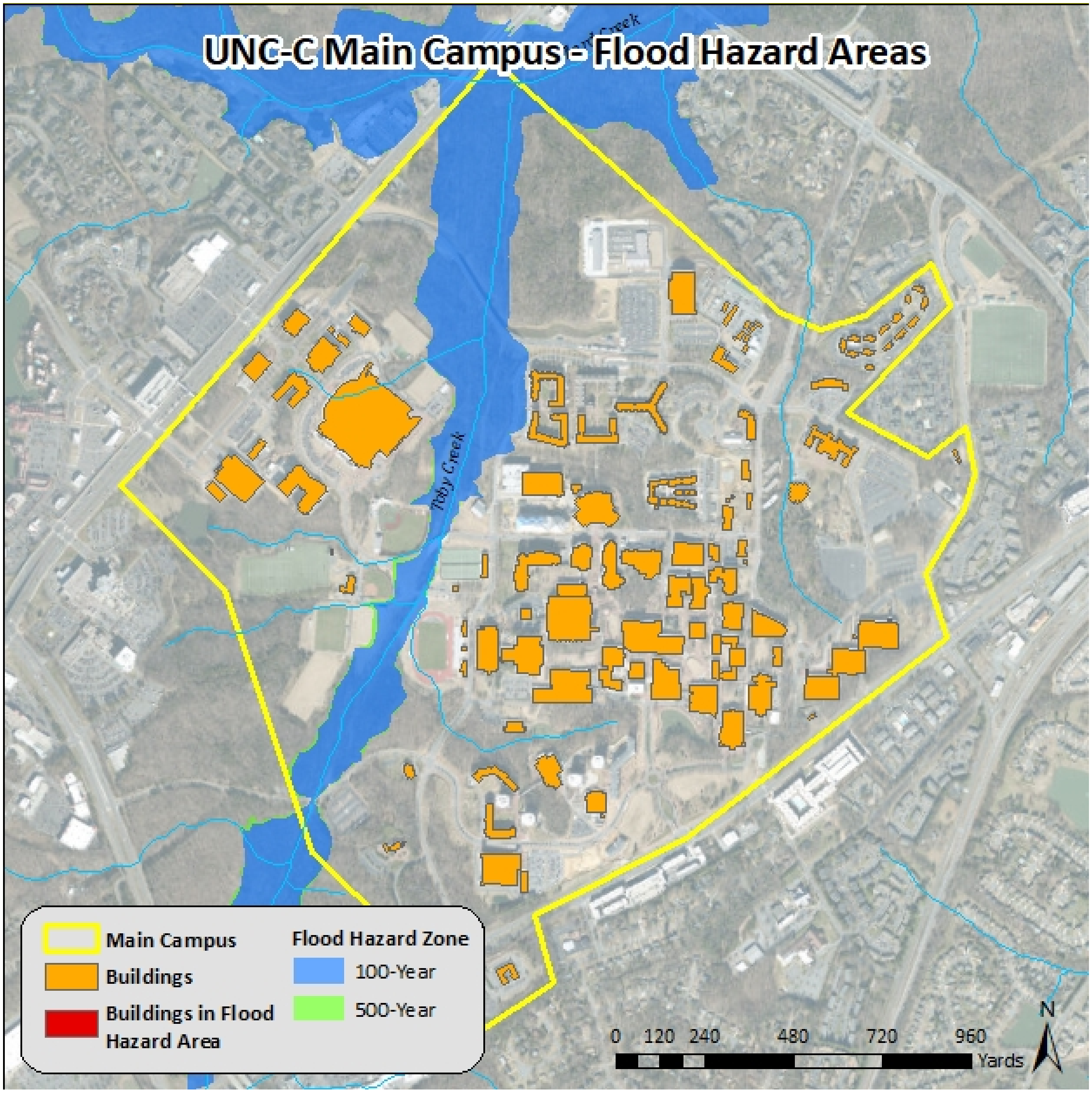
Inventories of statewide dam inundation data is an area that NCEM-RM is currently working hard to improve. At this time, there is geospatial data in final quality control review for 19 dams in North Carolina and that number is expected to increase significantly over the next several years. Additionally, NCEM is currently working with the USACE to acquire inundation data for 9 dams under the Corps’ management. As this data becomes available, detailed assessments can be run to better determine vulnerability to dam failures. The 2025 update of this plan may include a much more robust analysis of dam failure vulnerability at the County level.

D.5.10 FLOODING

D.5.10.1 Location and Spatial Extent

There are areas on the University of North Carolina Charlotte campus that are susceptible to flooding from Charlotte Creek. Special flood hazard areas on the University of North Carolina Charlotte campus were mapped using Geographic Information System (GIS) and FEMA Digital Flood Insurance Rate Maps (DFIRM). This includes the 1-percent annual chance floodplain (100-year), and the 0.2-percent annual chance floodplain (500-year). **Figure D.13** illustrates the location and extent of currently mapped special flood hazard areas for the campus based on best available FEMA DFIRM data from April 2010. 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 D.13: SPECIAL FLOOD HAZARD AREAS ON THE UNIVERSITY OF NORTH CAROLINA CHARLOTTE CAMPUS



Source: Federal Emergency Management Agency

None of the buildings on campus were found to lie in a special flood hazard area.

D.5.10.2 Historical Occurrences

The National Centers for Environmental Information reported a total of 105 events throughout Mecklenburg County since 1996[10]. A summary of these events is presented in **Table D.21**. These events accounted for six deaths, four injuries, and over $23 million in property damage throughout the county.

TABLE D.21: SUMMARY OF FLOOD OCCURRENCES

Location	Number of Occurrences	Deaths/Injuries	Property Damage (2020)
Charlotte	43	1/4	$1,610,000
Cornelius	1	0/0	$0
Davidson	0	0/0	$0
Huntersville	2	0/0	$10,500
Matthews	5	2/0	$155,000
Mint Hill	0	0/0	$0
Pineville	5	0/0	$41,000
Stallings	0	0/0	$0
Weddington	0	0/0	$0
Unincorporated Areas	49	3/4	$21,262,500
Mecklenburg County Total	**105**	**6/4**	**$23,079,000**

Source: National Centers for Environmental Information

D.5.10.3 Probability of Future Occurrences

Flood events will remain a threat to University of North Carolina Charlotte, and the probability of future occurrences will remain possible (between 1 and 10 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).

D.5.11 WILDFIRES

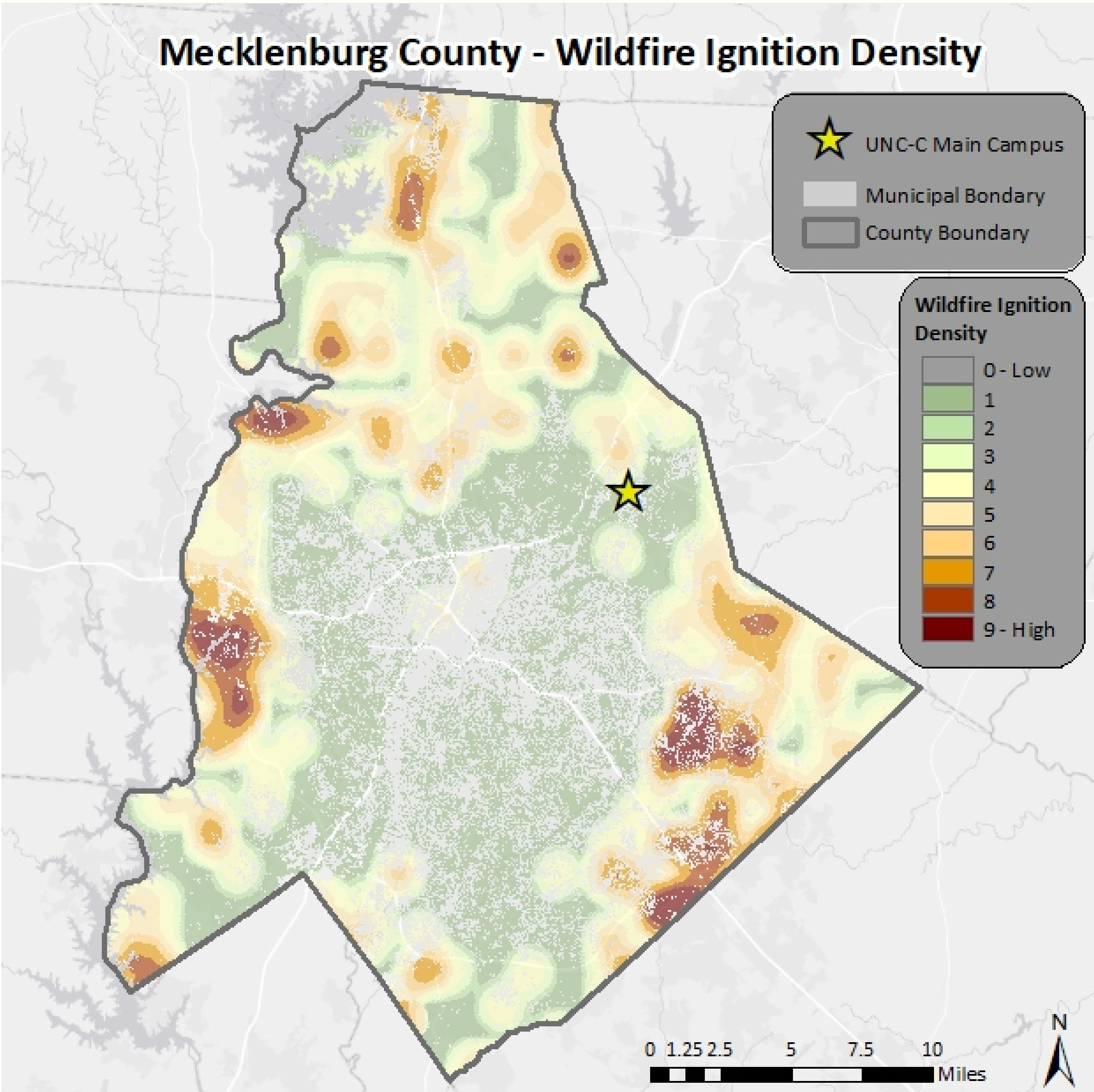
D.5.11.1 Location and Spatial Extent

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

Figure D.14 shows the Wildfire Ignition Density for Mecklenburg County 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.

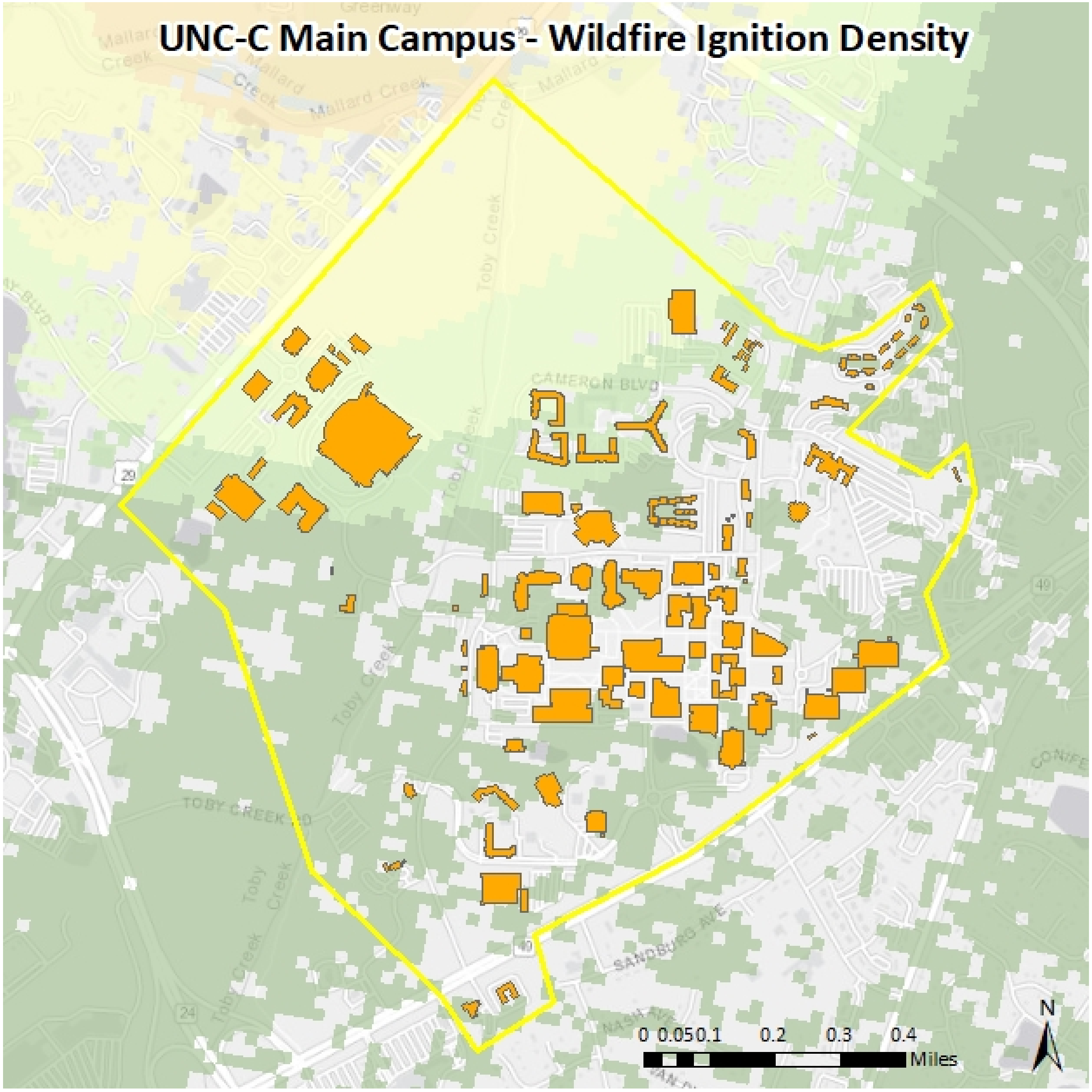
[10] These events are only inclusive of those reported by NCEI. It is likely that additional occurrences have occurred and have gone unreported.

FIGURE D.14: WILDFIRE IGNITION DENSITY IN MECKLENBURG COUNTY



Source: Southern Wildfire Risk Assessment

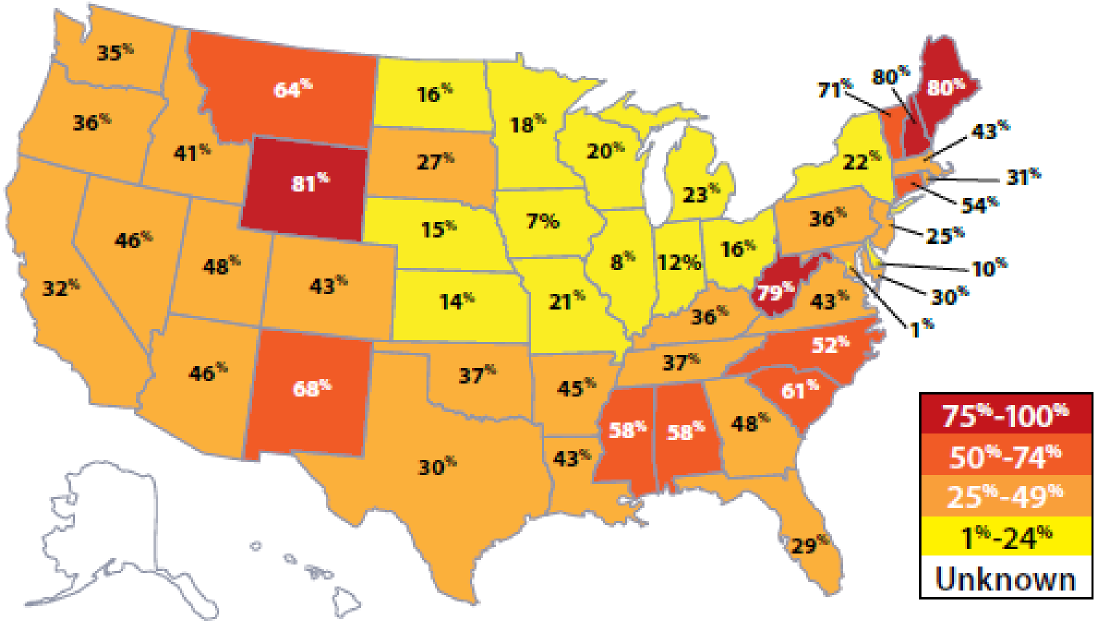
FIGURE D.15: UNCC CAMPUS WILDFIRE IGNITION DENSITY



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 D.16** 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.

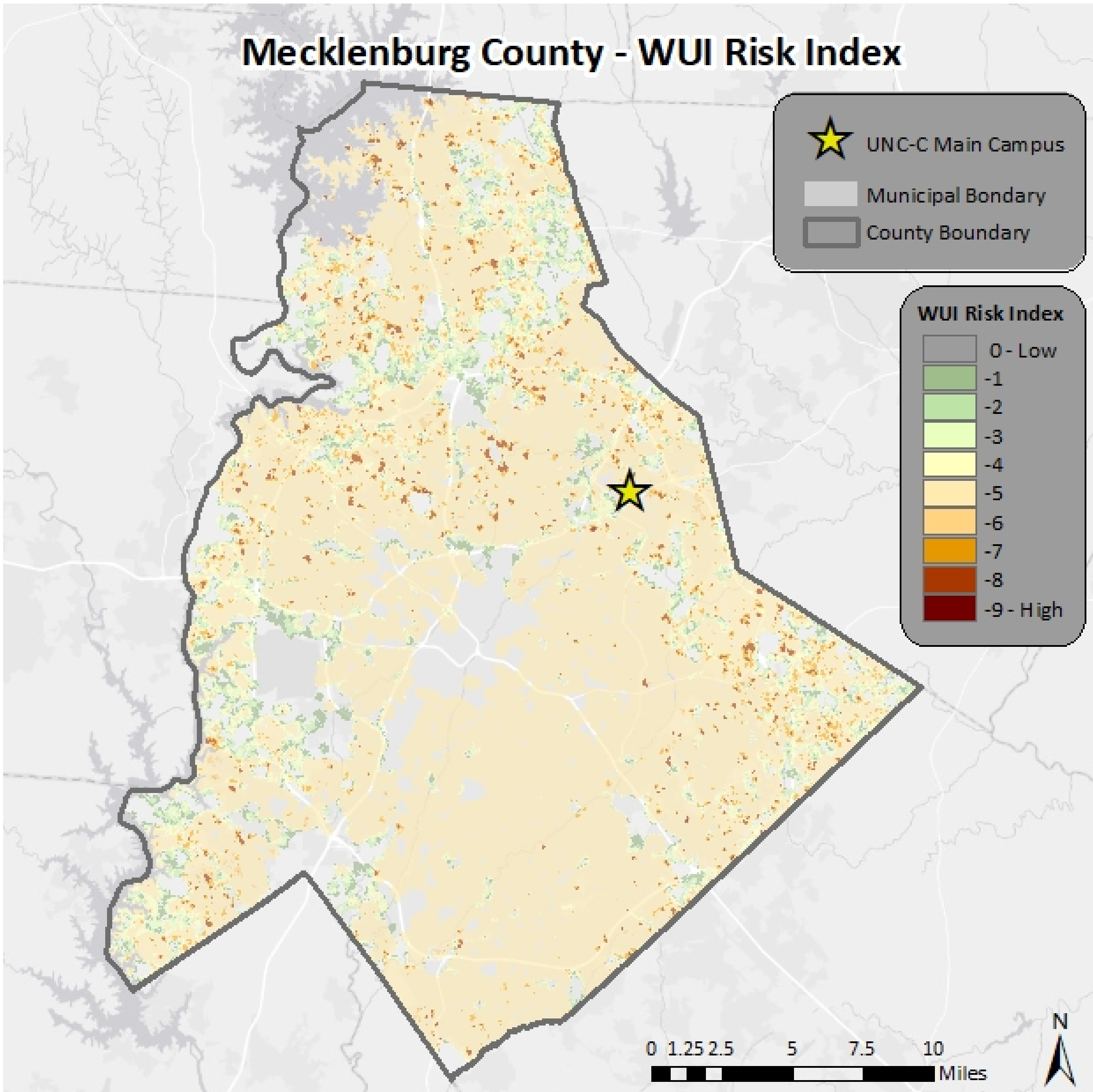
FIGURE D.16: % OF HOMES IN THE WILDLAND URBAN INTERFACE



Source: US Department of Agriculture

Below, **Figure D.17** displays the WUI Risk Index for Mecklenburg County.

FIGURE D.17: MECKLNEBURG COUNTY WUI RISK INDEX



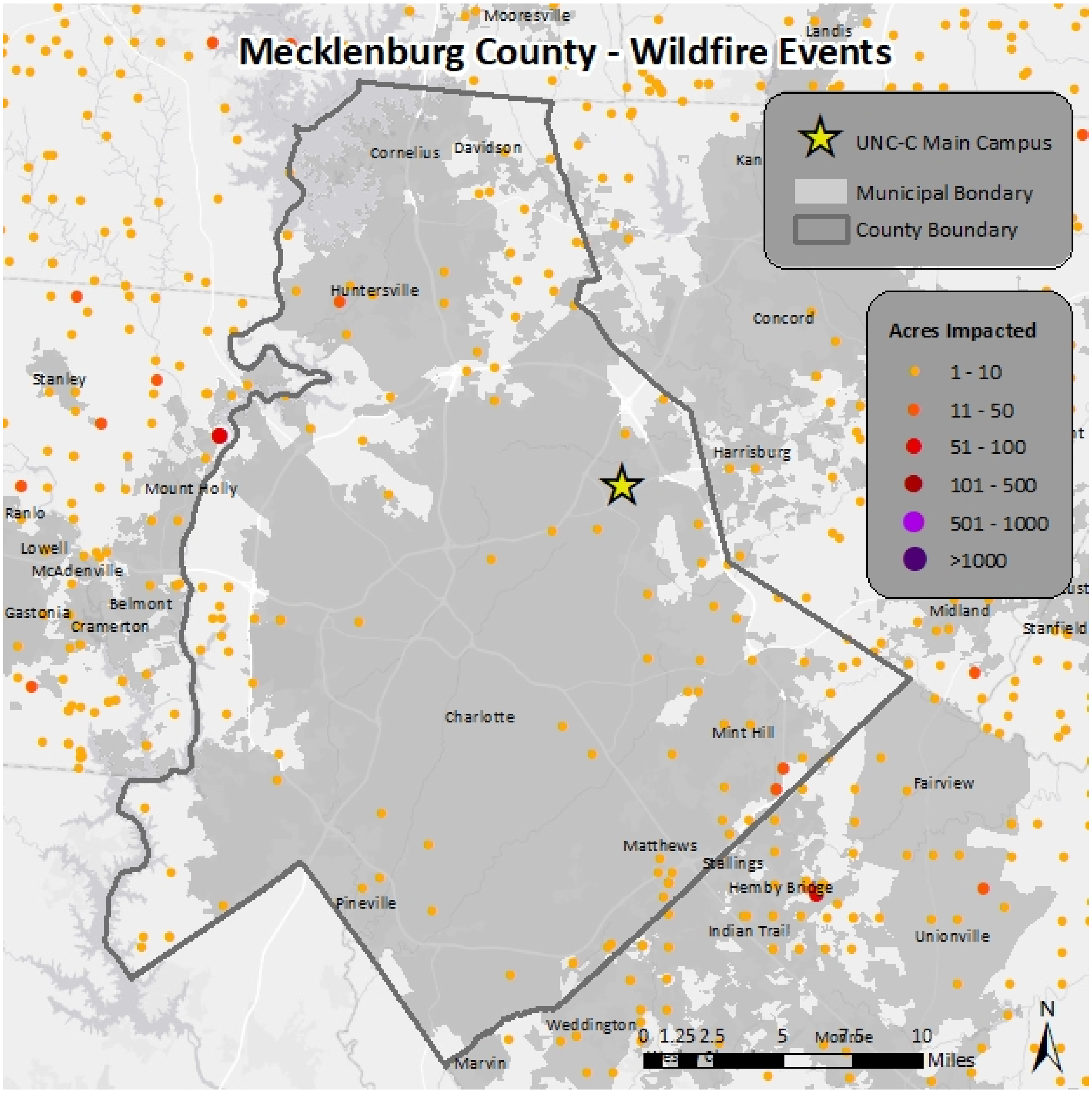
Source: Southern Wildfire Risk Assessment

D.5.11.2 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 198 events that impacted an area greater than 1 acre have occurred throughout the Mecklenburg County since (January 6, 2011)[11]. **Figure D.18** displays wildfire events in Mecklenburg County.

[11] These events are only inclusive of those reported by NASFI. It is likely that additional events have occurred and have gone unreported.

FIGURE D.18: WILDFIRE EVENTS IN MECKLENBURG COUNTY



Source: NASFI

Based on data from the North Carolina Division of Forest Resources from 2003 to 2018, the University of North Carolina Charlotte 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.

There is one incident of wildfire in the National Centers for Environmental Information database for Mecklenburg County. The event occurred on February 14, 2011 and was caused by a fallen tree onto an electrical line which caused a wildfire to break out in the Green Briar/ Rocky Knob area of Mecklenburg County. The winds, gusting as high as 62 mph at the Charlotte airport (KNTB), combined with low relative humidity to fan the fire. About 60 to 100 acres were burned but no homes were damaged. High winds and falling humidity behind a cold front were blamed for either causing or aggravating wildfires that broke out in several North Carolina counties.

D.5.11.3 Probability of Future Occurrences

Wildfire events will be an ongoing occurrence in Mecklenburg County and for the University of North Carolina Charlotte. 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 University of North Carolina Charlotte for future wildfire events are likely (10 to 100 percent annual probability).

D.5.12 INFECTIOUS DISEASE

D.5.12.1 Location and Spatial Extent

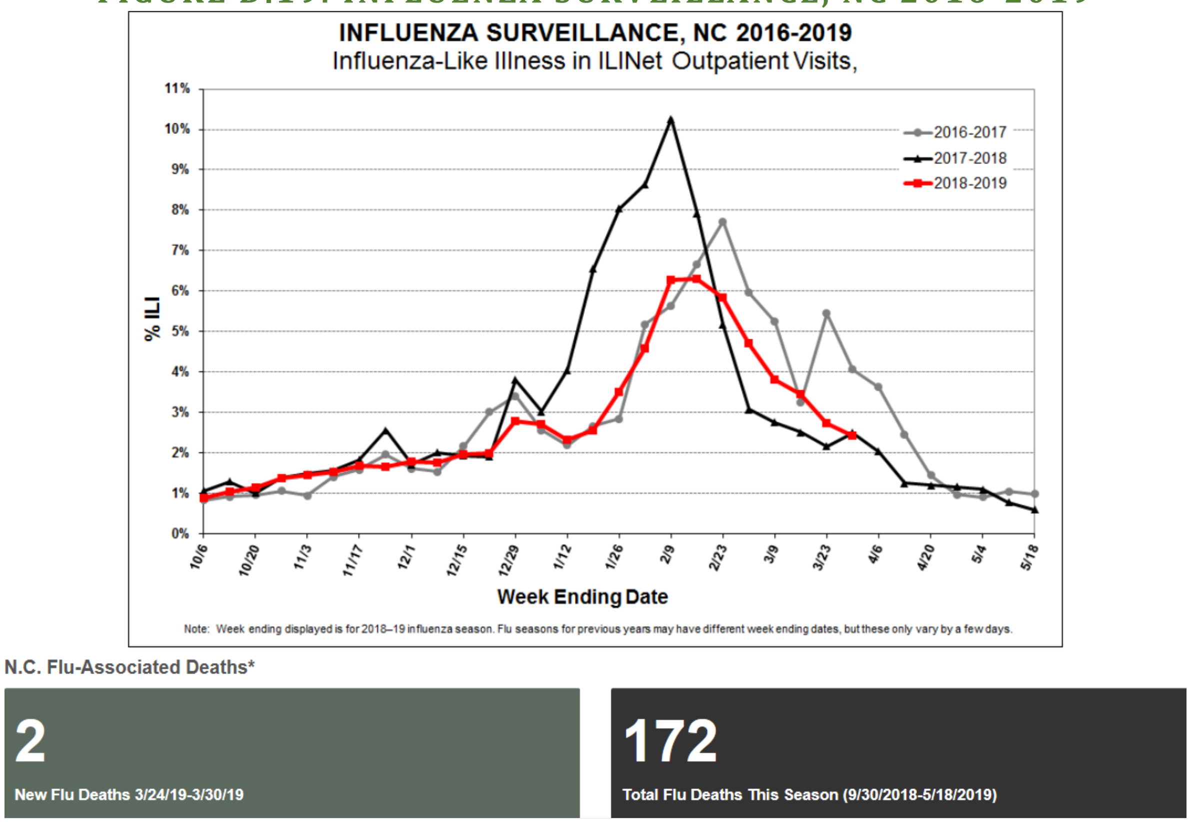
Extent is difficult to measure for an infectious disease event as the extent is largely dependent on the type of disease and on the effect that it has on the population. Extent can be somewhat defined by the number of people impacted, which depending on the type of disease could number in the tens of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

D.5.12.2 Historical Occurrences

Infectious Disease

Influenza is historically the most common infectious disease that has occurred in Mecklenburg County. Cases of the flu tend to occur in the late fall to early winter months. In recent years, cases of the influenza and influenza-like illnesses have been reported in hospitals. As seen in **Figure D.19** below, 172 people throughout North Carolina died from the flu between 2018 and 2019.

FIGURE D.19: INFLUENZA SURVEILLANCE, NC 2016-2019



Source: NC Department of Health and Human Services

Starting in 2020, the COVID-19 infectious disease pandemic began to impact North Carolina and Mecklenburg County. The NC Department of Health and Human Services has been actively monitoring and tracking cases since the first case arrived in the State. A Presidential disaster declaration was declared for North Carolina on March 24, 2020 for the COVID-19 pandemic. **Table C.22** provides a summary of confirmed cases of COVID–19 in Mecklenburg County as of the date of the final version of this plan in 2021. The COVID-19 pandemic is still evolving even though vaccines have been created that are slowing the spread. The pandemic unfolded as this plan was being developed, so the information below presents only a small sample of the pandemic's impacts on Mecklenburg County. On April 27, 2020, the UNC System made the decision to postpone in-person classes for the remainder of the school year. As a result, UNCC and all other universities in North Carolina, shifted to online courses. Due to Executive Order 135, which extended the existing statewide stay-at-home order through May 8, 2020; college campuses were asked to vacate any on-campus university housing.

TABLE D.22: SUMMARY OF CONFIRMED COVID – 19 CASES IN MECKLENBURG COUNTY

Location	Number of Cases	Number of Deaths*
Mecklenburg County	**112,120**	**952**

Source: North Carolina Department of Health and Human Services as of 5/14/21
** Deaths reflect deaths in persons with laboratory-confirmed COVID-19 reported by local health departments to the 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[12].

D.5.12.3 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 University of North Carolina Charlotte will experience an outbreak of infectious diseases in the future.

[12] https://www.ncdhhs.gov/news/press-releases/nc-prepared-zika-virus-risk-local-virus-carrying-mosquitoes-low

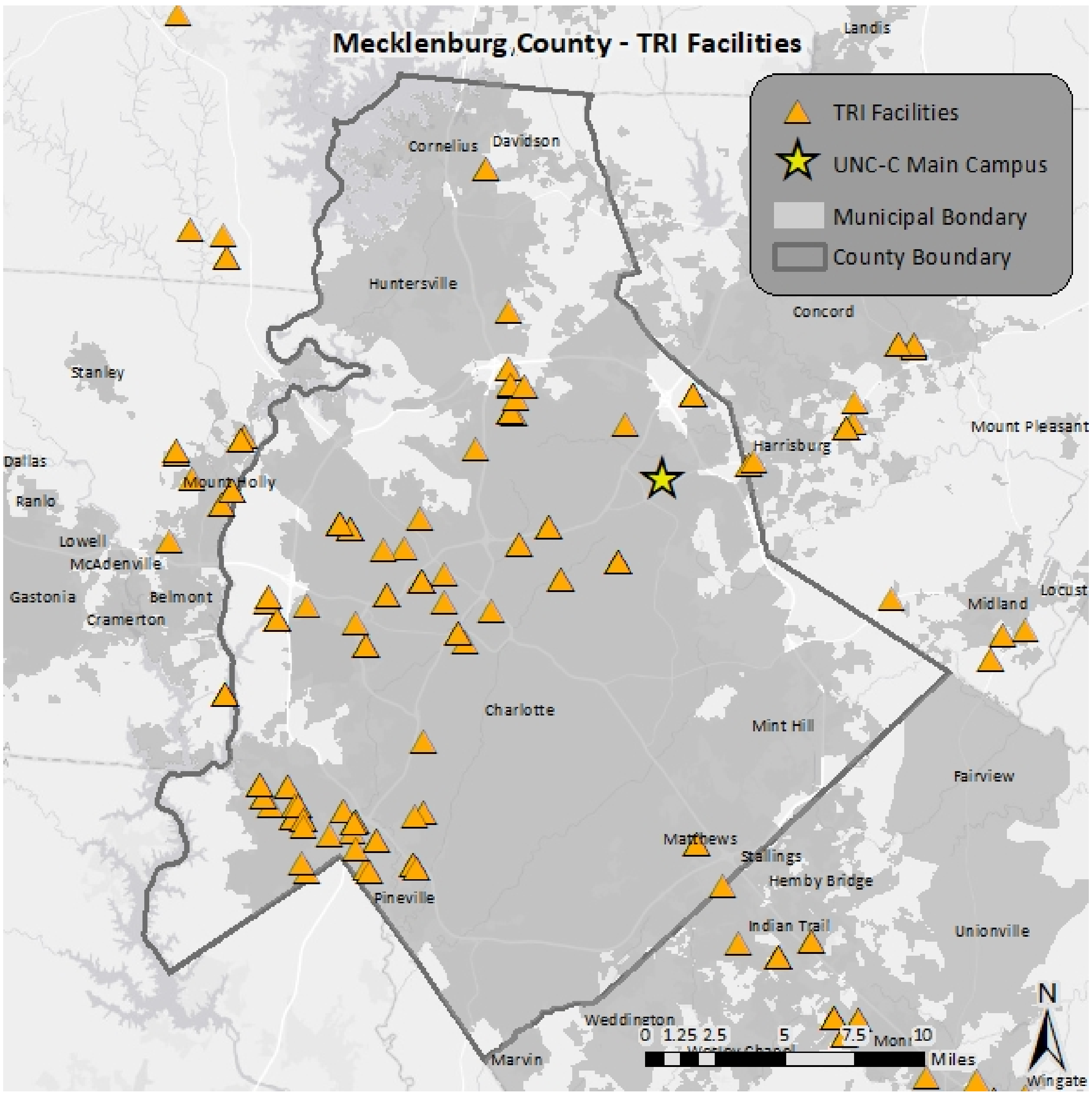
Technological Hazards

D.5.13 HAZARDOUS SUBSTANCES

D.5.13.1 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 collection information from industrial facilities on the releases and transfers of certain toxic agents. This information is then reported in the Toxic Release Inventory (TRI). TRI sites indicate where such activity is occurring. A map for Mecklenburg County TRI Facilities is shown in **Figure D.20.**

FIGURE D.20: TOXIC RELEASE INVENTORY (TRI) SITES



Source: EPA

D.5.13.2 Historical Occurrences

The U.S. Department of Transportation Pipeline and Hazard 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.

The Pipeline and Hazardous Materials Safety Administration (PHMSA) is an agency of the United States Department of Transportation that was established in 2004. The PHMSA maintains a database of hazardous materials incidents for communities across the United States. Summary results of their data for events that have occurred in Mecklenburg County can be found in **Table D.23.**

TABLE D.23: SUMMARY OF HAZMAT INCIDENTS IN MECKLENBURG COUNTY

Location	Incidents Reported	Injuries	Fatalities	Type	Costs
Charlotte	7648	0	0	Air, Highway, Rail	$6,281,160
Cornelius	0	0	0	n/a	$0
Davidson	1	0	0	Highway	$430
Huntersville	11	0	0	Highway	$66,683
Matthews	28	0	0	Highway	$69,263
Mint Hill	0	0	0	n/a	$0
Pineville	14	0	0	Highway, Rail	$64,828
Stallings	0	0	0	n/a	$0
Weddington	0	0	0	n/a	$0
Unincorporated Areas	0	0	0	n/a	$0
Mecklenburg County Total	**7702**	**0**	**0**		**$6,482,364**

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

D.5.13.3 Probability of Future Occurrence

Given the location of toxic release inventory sites in Mecklenburg County, it is possible (1 to 33.3 percent annual probability) that a hazardous material incident may occur. University officials are mindful of this possibility and take precautions to prevent such an event from occurring.

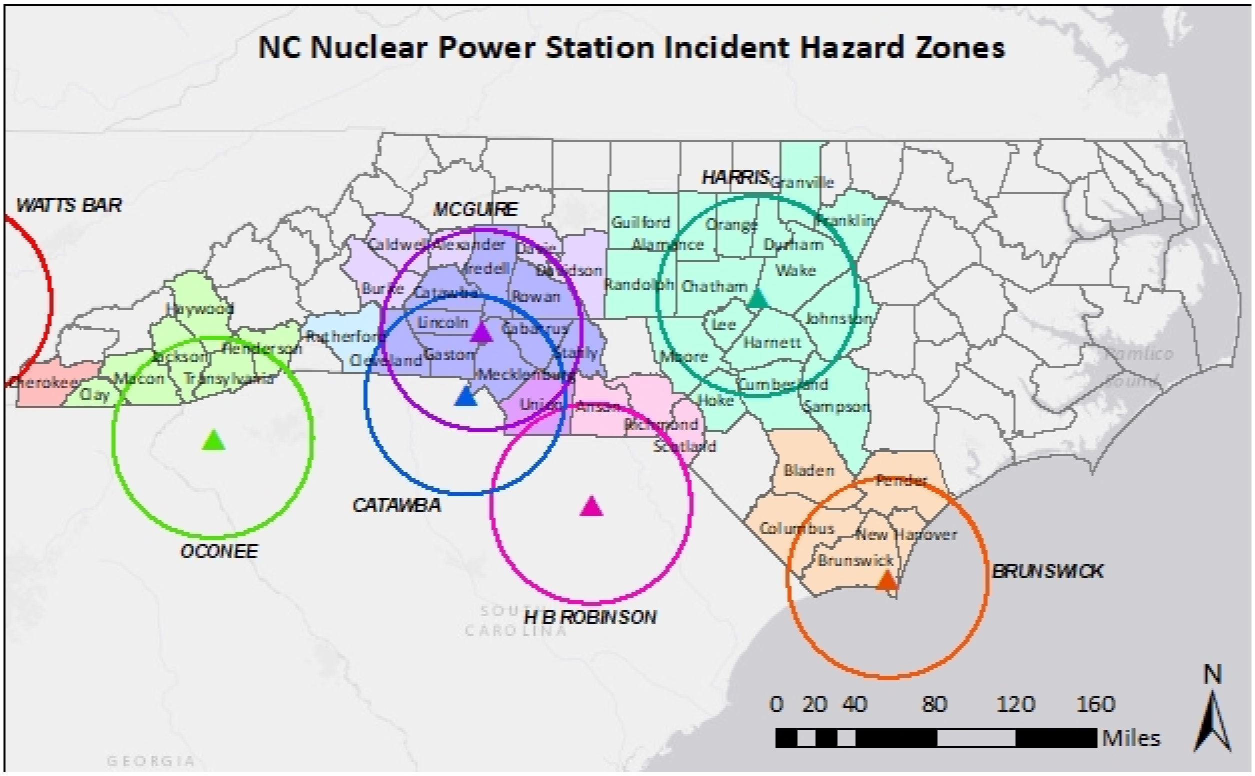
D.5.14 RADIOLOGICAL EMERGENCY – FIXED NUCLEAR FACILITIES

D.5.14.1 Location and Spatial Extent

Mecklenburg County and UNCC are both at risk to a nuclear accident. The entire County falls within the 50-mile radius of a fixed nuclear facility. 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 miles 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.

Mecklenburg County falls within the 10-mile radius of the McGuire Nuclear Facility and the Catawba Nuclear Plant, as seen in **Figure D.21** below.

FIGURE D.21: NORTH CAROLINA NUCLEAR POWER STATIONS AND INCIDENT HAZARD ZONES



Source: International Atomic Energy Agency

D.5.14.2 Historical Occurrences

Although there have been no major nuclear events at Catawba Nuclear Plant or McGuire Nuclear Facility, 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.

D.5.14.3 Probability of Future Occurrences

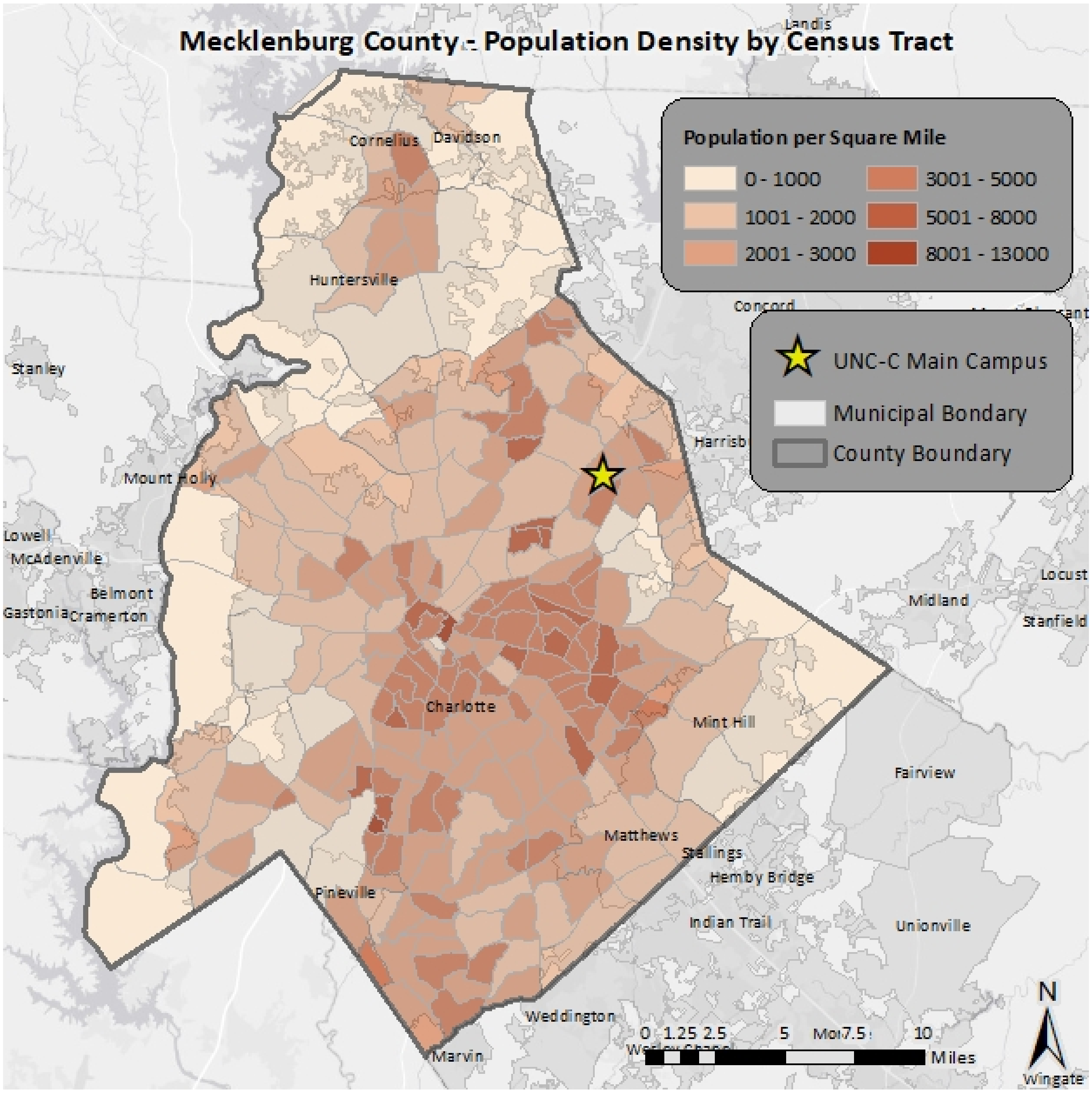
A nuclear event is a very rare occurrence in the United States due to the intense regulation of the industry. There have been incidents in the past, but it is considered unlikely (less than 1 percent annual probability).

D.5.15 TERRORISM

D.5.15.1 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 D.22** displays the population density in Mecklenburg County using census tract levels.

FIGURE D.22: POPULATION DENSITY



Source: US Census Bureau

Furthermore, the most recent population counts of each participating county and jurisdictions can be seen in **Table D.24** below.

TABLE D.24: 2018 POPULATION ESTIMATES FOR MECKLENBURG COUNTY

Location	2018 Population Estimate
Charlotte	885,708
Cornelius	30,257
Davidson	13,054
Huntersville	58,098
Matthews	33,138
Mint Hill	27,617
Pineville	9,028
Stallings	16,145
University of North Carolina at Charlotte	29,710
Weddington	11,182
Unincorporated Areas	26,129
Mecklenburg County Total	**1,110,356**

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

D.5.15.2 Historical Occurrences

No extreme cases of terror attacks have previously affected Mecklenburg County or University of North Carolina Charlotte. However, as the population in the area continues to increase, so does the chance of an attack. There is an ongoing concern on college campuses about active shooter events. Information from the National Center on Safe and Supportive Learning Environments, a recent study found between the 2001-2002 and 2015-2016 school years, 437 people were shot in 190 college campus shooting incidents.

D.5.15.3 Probability of Future Occurrence

Neither Mecklenburg County nor University of North Carolina Charlotte have experienced a 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.

D.5.16 CYBER

D.5.16.1 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. University of North Carolina Charlotte is susceptible to cyber-attacks.

D.5.16.2 Historical Occurrences

In North Carolina, 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. **Table D.25** displays the North Carolina Cybercrimes and Victim Counts in 2018.

TABLE D.25: NORTH CAROLINA CYBERCRIMES AND VICTIM COUNTS IN 2018

Crime Type by Victim Count			
Crime Type	*Victim Count*	*Crime Type*	*Victim Count*
Advanced Fee	436	Identity Theft	330
BEC/EAC	430	Investment	47
Charity	11	Lottery/Sweepstakes/Inheritance	213
Civil Matter	15	Malware/Scareware/Virus	49
Confidence Fraud/Romance	432	Misrepresentation	148
Corporate Data Breach	39	No Lead Value	246
Credit Card Fraud	306	Non-payment/Non-Delivery	1,647
Crimes Against Children	28	Other	172
Denial of Service/TDos	28	Overpayment	406
Employment	391	Personal Data Breach	1,125
Extortion	1,219	Phishing/Vishing/Smishing/Pharming	947
Gambling	4	Ransomware	29
Government Impersonation	255	Re-shipping	31
Hacktivist	2	Real Estate/Rental	286
Harassment/Threats of Violence	330	Spoofing	430
Health Care Related	9	Tech Support	361
IPR/Copyright and Counterfeit	30	Terrorism	2
Descriptors*			
Social Media	902	Virtual Currency	790

Source: FBI Internet Crime Compliant Center, 2018

Although University of North Carolina Charlotte has not reported any major catastrophic cyberattacks, the potential to experience one is unpredictable and can happen at any time.

D.5.16.3 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 at University of North Carolina Charlotte, and it is considered likely (between 10 and 100 percent annual probability) to experience one in the near future.

D.5.17 ELECTROMAGNETIC PULSE

D.5.17.1 Location and Spatial Extent

An EMP can happen in any location, and they are relatively unpredictable. Due to advancing technologies, densely populated areas may be more prone to damages from an EMP. Therefore, Charlotte and the University of North Carolina Charlotte campus may be more susceptible.

D.5.17.2 Historical Occurrences

There have been no reports of EMP occurrences at University of North Carolina Charlotte.

D.5.17.3 Probability of Future Occurrences

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

D.5.18 CONCLUSIONS ON HAZARD RISK

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

D.5.18.1 Hazard Extent

Table D.26 describes the extent of each natural hazard identified for University of North Carolina Charlotte. The extent of a hazard is defined as its severity or magnitude, as it relates to the planning area.

TABLE D.26 EXTENT OF UNIVERSITY OF NORTH CAROLINA CHARLOTTE 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. According to the North Carolina Drought Monitor Classifications, the most severe drought condition is Exceptional. Mecklenburg County did not report an Exceptional drought ranking over the ten-year reporting period. According to the NOAA, Mecklenburg County has had drought occurrences in eight of the last ten years (2010-2019).
Excessive Heat	The extent of excessive heat can be defined by the maximum temperature reached. The highest temperature recorded in Mecklenburg County is 104 degrees Fahrenheit (reported on June 29, 2012).

Hurricane and Coastal Hazards	Hurricane extent is defined by the Saffir-Simpson Scale which classifies hurricanes into Category 1 through Category 5. The greatest classification of hurricane to traverse directly through Mecklenburg County was Hurricane Hugo in 1989 which carried tropical force winds of 85 knots (approximately 97 miles per hour) upon arrival.
Tornadoes /Thunderstorms	Tornadoes: Tornado hazard extent is measured by tornado occurrences in the US provided by FEMA as well as the Fujita/Enhanced Fujita Scale. The greatest magnitude reported in Mecklenburg County was an F2 (reported in 2004). Thunderstorms: Thunderstorm extent is defined by the number of thunder events and wind speeds reported. According to a 63-year history from the National Centers for Environmental Information, the strongest recorded wind event in Mecklenburg County was reported on July 23, 1962 at 80 knots (approximately 92 mph). It should be noted that future events may exceed these historical occurrences. Lightning: According to the Vaisala flash density map, University of North Carolina Charlotte 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. Hailstorms: Hail extent can be defined by the size of the hail stone. The largest hail stone reported in Mecklenburg County was 3.0 inches (reported on March 3, 1974). It should be noted that future events may exceed this.
Severe Winter Weather	The extent of winter storms can be measured by the amount of snowfall received (in inches). The greatest 24-hour snowfall was reported in Mecklenburg County was 14 inches reported on February 15, 1902.
Earthquakes	Earthquake extent can be measured by the Richter Scale and the Modified Mercalli Intensity (MMI) scale and the distance of the epicenter to Mecklenburg County. According to data provided by the National Geophysical Data Center, the greatest MMI to impact Mecklenburg County was VIII (strong) with an unknown correlating Richter Scale measurement. The epicenter of this earthquake was located between 256 and 270 km away.
Geological	Landslide: As noted above in the landslide profile, the landslide data provided by the North Carolina Geological survey is incomplete. This provides a challenge when trying to determine an accurate extent for the landslide hazard. However, when using the USGS landslide susceptibility index, extent can be measured with incidence, which is high throughout most of Mecklenburg County. There is also at least moderate susceptibility throughout a majority of the region. Sinkhole: The western part of North Carolina and University of North Carolina Charlotte are susceptible to sinkholes; however, there are no historical records of sinkholes in Mecklenburg County.

<table>
<tr><td></td><td><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 Mecklenburg County or University of North Carolina Charlotte.</td></tr>
<tr><td>Dam Failure</td><td>Dam failure extent is defined using the North Carolina Division of Land Resources criteria. Of the 69 dams in Mecklenburg County, 28 are classified as high-hazard.</td></tr>
<tr><td>Flooding</td><td>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 7 percent of the total land area for University of North Carolina Charlotte. Flood depth and velocity are recorded via United States Geological Survey stream gages throughout the region. While a gauge does not exist on University of North Carolina Charlotte’s campus, there is one at or near many areas. The greatest peak discharge recorded for the area was reported in July 1916. Water reached a discharge of 28,000 cubic feet per second and the stream gage height was recorded at 22.1 feet. Peak discharge for the gage on the Mecklenburg River near Sugar Grove, NC is in the table below.
<table>
<tr><th>Location/Jurisdiction</th><th>Date</th><th>Peak Discharge (cfs)</th><th>Gage Height (ft)</th></tr>
<tr><td>Mecklenburg County</td><td></td><td></td><td></td></tr>
<tr><td>Mecklenburg River near Sugar Grove, NC</td><td>Jul-16</td><td>28,000</td><td>22.1</td></tr>
</table>
</td></tr>
<tr><th colspan="2">Other Hazards</th></tr>
<tr><td>Wildfires</td><td>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 Mecklenburg County.

The greatest number of fires to occur in any year was 29 in 2001.
The greatest number of acres to burn in a single year occurred in 2001 when 94 acres were burned.
The largest acres burned in a single incidence occurred in 2018 when 14 acres were burned.

Although this data lists the extent that has occurred, larger and more frequent wildfires are possible throughout Mecklenburg County.</td></tr>
<tr><td>Infectious Disease</td><td>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 University of North Carolina Charlotte is susceptible to infectious diseases such as the flu, which kills hundreds of people annually.

As of November 1, 2020, the number of COVID-19 cases in Mecklenburg County was 34,668 and the number of deaths related to COVID-19 was 393. On April 27, 2020, the UNC System made the decision to postpone in-person classes for the remainder of the school year. As a result, UNCC and all other universities in North Carolina, shifted on</td></tr>
</table>

	online classes. There is no tangible way of determining dollar losses due to the pandemic in Mecklenburg County.
Technological Hazards	
Hazardous Materials Incident	According to USDOT PHMSA, the largest hazardous materials incident reported in Mecklenburg County is 189,115.15 LGA released on the highway on January 14, 2016. It should be noted that larger events are possible.
Radiological Emergency – Fixed Nuclear Facilities	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 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 at University of North Carolina Charlotte, the entire campus 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 for University of North Carolina Charlotte. Technology usage, however, is increasing. A cyber-attack could potentially devastate the campus and could have lasting negative impacts.
Electromagnetic Pulse	Electromagnetic Pulse (EMP) occurrences have not taken place at University of North Carolina Charlotte, 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.

D.5.18.2 Priority Risk Index

In order to draw some meaningful planning conclusions on hazard risk for University of North Carolina Charlotte, the results of the hazard profiling process were used to generate hazard classifications according to a “Priority Risk Index” (PRI). The purpose of the PRI is to categorize and prioritize all potential hazards for University of North Carolina Charlotte 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 University of North Carolina Charlotte to consider as part of their proposed mitigation strategy.

The prioritization and categorization of identified hazards for University of North Carolina Charlotte 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 University of North Carolina Charlotte Campus Hazard Mitigation Planning Team in gaining consensus on the determination of those hazards that pose the most significant threat to the campus 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 at University of North Carolina Charlotte 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[13], as summarized in **Table D.27**. 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:

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

According to the weighting scheme and point system applied, the highest possible value for any hazard is 4.0. When the scheme is applied for University of North Carolina Charlotte, the highest PRI value is 3.3 (Severe Winter Weather). Prior to being finalized, PRI values for each identified hazard were reviewed and accepted by the members of the University of North Carolina Charlotte Campus Hazard Mitigation Planning Team.

TABLE D.27: PRIORITY RISK INDEX FOR THE UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE

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	3	

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

PRI Category	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
		damaged or destroyed. Complete shutdown of critical facilities for more than one week.		
	Catastrophic	High number of deaths/injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for 30 days or more.	4	
Spatial Extent	Negligible	Less than 1% of area affected	1	20%
	Small	Between 1 and 10% of area affected	2	
	Moderate	Between 10 and 50% of area affected	3	
	Large	Between 50 and 100% of area affected	4	
Warning Time	More than 24 hours	Self-explanatory	1	10%
	12 to 24 hours	Self-explanatory	2	
	6 to 12 hours	Self-explanatory	3	
	Less than 6 hours	Self-explanatory	4	
Duration	Less than 6 hours	Self-explanatory	1	10%
	Less than 24 hours	Self-explanatory	2	
	Less than one week	Self-explanatory	3	
	More than one week	Self-explanatory	4	

D.5.18.3 Priority Risk Index Results

Table D.28 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 Campus Hazard Mitigation Planning Team. The results were then used in calculating PRI values and making final determinations for the risk assessment.

TABLE D.28: SUMMARY OF PRI RESULTS FOR THE UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE

Hazard	Sub hazard(s) Assessed	Category/Degree of Risk					
		Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Natural Hazards							
Drought		Likely	Minor	Moderate	More than 24 hours	More than 1 week	2.3
Excessive Heat		Unlikely	Minor	Large	More than 24 hours	Less than 1 week	1.8
Hurricane and Coastal Hazards		Possible	Limited	Large	More than 24 hours	Less than 24 hours	2.3
Tornadoes/ Thunderstorms	Hailstorm, Lightning	Highly Likely	Critical	Large	Less than 6 hours	Less than 6 hours	3.2
Severe Winter Weather		High Likely	Critical	Large	More than 24 hours	Less than one week	3.3
Earthquakes		Possible	Minor	Moderate	Less than 6 hours	Less than 6 hours	2.3
Geological	Landslide, Sinkholes, Erosion	Possible	Limited	Small	Less than 6 hours	Less than 6 hours	2.3
Dam Failure		Unlikely	Critical	Moderate	More than 24 hours	Less than 6 hours	2.0
Flooding		Likely	Limited	Moderate	6 to 12 hours	Less than 24 hours	2.6
Other Hazards							
Wildfires		Likely	Limited	Small	Less than 6 hours	Less than 1 week	2.6
Infectious Disease		Unlikely	Minor	Small	More than 24 hours	More than 1 week	1.6
Technological Hazards							
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

D.5.19 FINAL DETERMINATIONS

The conclusions drawn from the hazard profiling process for University of North Carolina Charlotte, including the PRI results and input from the Campus 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 at University of North Carolina Charlotte. It should be noted that although some hazards are classified below as posing low risk, their occurrence of varying or unprecedented magnitudes is still possible in some cases and their assigned classification will continue to be evaluated during future plan updates.

Table D.29 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 University of North Carolina Charlotte Campus Hazard Mitigation Planning Team.

TABLE D.29: 2021 CONCLUSIONS ON HAZARD RISK FOR UNIVERSITY OF NORTH CAROLINA CHARLOTTE

HIGH RISK	Severe Winter Storm Tornadoes/Thunderstorms Flooding Wildfires Geological Hazards (Landslides)
MODERATE RISK	Hurricanes and Coastal Hazards Earthquakes Drought Terror Threat
LOW RISK	Hazardous Substances Dam Failure Geological Hazards (Erosion and Sinkholes) Radiological Emergency Electromagnetic Pulse Infectious Disease Cyber

D.6 Capability Assessment

The purpose of conducting a capability assessment for an institution of higher learning is to determine the ability of the institution to implement a comprehensive mitigation strategy and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs, or projects[14]. 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 the university's regulatory framework, level of administrative and technical support, access to fiscal resources, and current political climate.

A capability assessment is generally based upon two primary components: 1) an inventory of the university's relevant plans, programs and policies already in place and 2) an analysis of the university's capacity to carry them out. Careful examination of campus capabilities will detect any existing gaps, shortfalls, or weaknesses with ongoing 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 university, which should continue to be supported and enhanced through future mitigation efforts.

The capability assessment completed for UNCC 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.

Capability Assessment Findings and Conclusion

Collectively, UNCC's administrative, technical and fiscal capabilities are high. Some of the highlights of UNCC's capabilities include the following:

- Designated a StormReady Campus by the National Weather Service

UNCC's high capability will help ensure that the Mitigation Strategy is effectively carried out and that hazard risk reduction for the campus is an attainable goal. 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 Campus Hazard Mitigation Planning Committee considered not only their level of hazard risk, but also their existing capability to minimize or eliminate that risk.

[14] While the Final Rule for implementing the Disaster Mitigation Act of 2000 does not require a local capability assessment to be completed for hazard mitigation plans, it is a critical step in developing a mitigation strategy that meets the needs of the campus while taking into account their own unique abilities. The Rule does state that a 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)).

D.7 Mitigation Action Plan

The Mitigation Action Plan, or MAP, provides a functional plan of action for each building at the University of North Carolina at Charlotte. It is designed to achieve the mitigation goals established in Section 4, Mitigation Strategy, of the main plain and will be maintained on a regular basis according to the plan maintenance procedures established in Section 5, Plan Maintenance, of the main plan.

Each proposed mitigation action has been identified as an effective measure (policy or project) to reduce hazard risk to the buildings on UNCC's campus. 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's 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. 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.

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 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.
- Relative Cost
- Identification of University Department Responsible for each action
- Implementation Schedule—Date by which the action should be completed. More information is provided when possible.
- Implementation Status (2021)—Indication of completion, progress, deferment, or no change since the previous plan. If the action is new, that will be noted here.

All of the mitigation actions in this section have been assigned to Emergency Management and Facilities staff to ensure their implementation. Other University Departments will be consulted for input on an as-needed basis.

For the update of this plan, the UNCC Campus Hazard Mitigation Planning Team participated in three activities related to the mitigation strategy for the university. Those activities included the following:

1. Review and reapproval of previous mitigation goals for the UNC Western Campuses. All eight of the campuses in the Western region decided to leave the previous mitigation goals in place and unchanged.
2. Review and update of existing mitigation actions. The Campus Hazard Mitigation Planning Team reviewed each existing action to determine if it was still relevant, if the prioritization of the action remained the same and to provide an update on the status of implementation for the actions.
3. Identification of any new mitigation actions as determined necessary. The Campus Hazard Mitigation Team identified several new actions for inclusion in the plan. New mitigation actions for this update are marked as such in the Mitigation Action Plan.

The Mitigation Action Plan for UNCC is found on the following pages.

NOTE: The 2021 update of this plan represented a comprehensive update of the mitigation strategy. Many of the previous mitigation actions identified for UNCC were found to be no longer relevant or included in a recurring process. This has been noted for many of the previous mitigation actions.

Campus-Wide Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Prevention							
CW-P-1	Building Emergency Action Planning - Continue project for customizable building emergency action plans for each campus building and educate building occupants on the plan(s).	All Hazards	Moderate	$20,000	Emergency Management and Facilities	2021-2022	New action for the 2021 update of this plan.
Emergency Services							
CW-ES-1	Emergency Notification System Audio Enhancements - Establish a long-term solution to tie in the emergency notification system with building mass notification systems and exterior broadcast speakers.	All Hazards	High	$250,000	Emergency Management and Facilities	2022	New action for the 2021 update of this plan.
CW-ES-2	Emergency Notification System Visual Enhancements - Establish a long-term solution to tie in the emergency notification system with existing digital displays and expand digital displays campus-wide.	All Hazards	Moderate	$25,000	Emergency Management and Facilities	2023	New action for the 2021 update of this plan.

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
CW-ES-3	Severe Weather Shelter Area Identification - Identify and mark severe weather sheltering areas in all buildings on campus and educate building occupants on the location of these areas.	Tornadoes/Thunderstorms, Hurricanes and Coastal Hazards	Moderate	$55,000	Emergency Management and Facilities	2023	New action for the 2021 update of this plan.
CW-ES-4	Increase Emergency Shelter Resources - Acquire resources to support on campus shelter operations so that the University can be less reliant on county resources.	All Hazards	Low	$25,000	Emergency Management and Facilities	2022	New action for the 2021 update of this plan.
CW-ES-5	Debris Removal Contract - Establish a debris removal contract that is FEMA compliant to expedite the removal of debris from campus following a storm.	Severe Winter Weather, Tornadoes/Thunderstorms, Hurricanes and Coastal Hazards	Moderate	No additional costs	Emergency Management and Facilities	2022	New action for the 2021 update of this plan.
CW-ES-6	Large Mobile/Towable Generator - Purchase a large capacity (200kw+) generator, and prime mover, to be a deployable asset on campus and within the UNC System to power critical operations that do not have a dedicated backup power supply.	Tornadoes/Thunderstorms, Hurricanes and Coastal Hazards, Severe Winter Weather	Low	$250,000	Emergency Management and Facilities	2023	New action for the 2021 update of this plan.
CW-ES-7	Emergency/Backup Power for Critical Facilities and Critical Research Equipment - Evaluate and compile a list of locations that serve as critical	Tornadoes/Thunderstorms, Hurricanes and Coastal Hazards, Severe Winter Weather	Moderate	Unknown	Emergency Management and Facilities	2021-2025	New action for the 2021 update of this plan.

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
	facilities and/or have critical research equipment that need emergency/backup power to maintain critical operations or research in the event of power outage. As funding becomes available, projects identified from this evaluation should be performed.						
CW-ES-8	Develop or adopt a tracking and informational application for campus wide situational awareness for threats and hazards that could affect normal operations; emergency responses; and/or evacuations.	All Hazards	Moderate	$20,000	Emergency Management and Facilities	2021-2025	New action for the 2021 update of this plan.
CW-ES-9	Rewrite campus evacuation plans	All Hazards	Moderate	No additional costs	Emergency Management and Facilities	2021	New action for the 2021 update of this plan.
CW-ES-10	Coordinate with Mecklenburg County Storm Water Services to update Toby Creek's flood maps in and around main campus.	Flooding	Moderate	No additional costs	Emergency Management and Facilities	2021	New action for the 2021 update of this plan.
Property Protection							

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
CW-PP-1	As feasible and as funding is available, install generators/back-up power, for critical facilities campus wide	All Hazards	Moderate	$25,000-$100,000 per generator	Emergency Management and Facilities	2026	New action for the 2021 update.
Public Education and Awareness							
CW-PEA-1	Enhance Emergency Preparedness Education Program – Enhance all-hazards public education program to educate student, faculty, and staff for all hazards identified.	All	Moderate	$2,500	Emergency Management and Facilities	2021	New action for the 2021 update of this plan.

Atkins Library Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Prevention							
AL-P-1	Areas of the roof that have not been updated to new rubber membrane roof should be replaced.	Earthquake, Tornadoes/Thunderstorms, Severe Winter Weather, Flood, Drought	Moderate	>$100,000	Emergency Management and Facilities	Completed/no longer pursuing	Updated with PVC Roofing. Recent storms and wind events have not created any unusual damage and the current structures and installations are reviewed after each event greater than 45 mph.
AL-P-2	Windows should be replaced or reinforced with a shatter proof film to prevent the envelope from being breached during a high wind/storm event	Tornadoes/Thunderstorms, Severe Winter Weather	Moderate	$25,000-$100,000	Emergency Management and Facilities	Completed/no longer pursuing	Not aware of any upgrades to the windows. Recent storms and wind events have not created any unusual damage and the current structures and installations resisted breaches and are reviewed after each event greater than 45 mph.
Property Protection							
AL-PP-1	Consideration should be given to alternate fire suppression technologies in sensitive areas of the library such as the 9th floor rare books overflow collection or computing facilities	Earthquake, Tornadoes/Thunderstorms, Severe Winter Weather, Wildfire, Flood, Drought	Moderate	>$100,000	Emergency Management and Facilities	Completed/no longer pursuing	Clean agent (Sapphire) suppression and preaction systems are utilized in the rare books area and in the computer room facilities in Atkins.
AL-PP-2	All deteriorating caulk joints should be cleaned and repaired. Any deteriorating simulated stone façade elements	Earthquake, Tornadoes/Thunderstorms, Severe Winter Weather, Flood	Moderate	$25,000-$100,000	Emergency Management and Facilities	Completed/no longer pursuing	Precast spalding identified and migration activities are ongoing. Sol-tanium (vendor) upgraded the concrete facade several years

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
	should be replaced to prevent water intrusion and concrete spallation						ago, but additional work is needed.
AL-PP-3	The pine tree adjacent to the mechanical compound (cooling tower and generator) should be removed.	Earthquake, Tornadoes/Thunderstorms, Severe Winter Weather, Wildfire, Flood	Moderate	<$5,000	Emergency Management and Facilities	Completed/no longer pursuing	Completed. Pine tree removed and no longer poses an issue to the cooling and the generator.
AL-PP-4	Increase emergency exit egress to patrons by deactivating the door security or provide another corridor available to patrons for an evacuation. Also, have a wall mounted placard to show evacuation instructions in the event an exit is to be made through the rear of the facility.	Earthquake, Tornadoes/Thunderstorms, Severe Winter Weather, Wildfire, Flood Drought	Moderate	<$5,000	Emergency Management and Facilities	Completed/no longer pursuing	Egress pathways well marked and easy egress from the building is available and well marked throughout the building. EH&S performs routine building audits to assure appropriate egress access.

Barnhardt/Student Activity Center

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Prevention							
BSAC-P-1	Provide a backup or redundant drainage system. Alternatively, a portable emergency pumping system can relieve the demand on the storm water drainage system. The drainage system should be routinely serviced to ensure proper functioning	Severe Winter Weather, Flood	Moderate	$5,000-$25,000	Emergency Management and Facilities	Completed/no longer pursuing	No longer pursuing this initiative.
BSAC-P-2	The large windows should be reinforced using laminate film to prevent shattering and water intrusion in the event of windborne debris impact or high wind pressures	Earthquake, Tornadoes/Thunderstorms, Severe Winter Weather	Moderate	$5,000-$25,000	Emergency Management and Facilities	Completed/no longer pursuing	Not aware of any upgrades to the windows. Recent storms and wind events have not created any unusual damage and the current structures and installations resisted breaches and are reviewed after each event greater than 45 mph.
Property Protection							
BSAC-PP-1	The damaged roof soffit should be reinforced to ensure that it does not fail during a high wind event	Tornadoes/Thunderstorms, Severe Winter Weather	Moderate	<$5,000	Emergency Management and Facilities	Completed/no longer pursuing	No recent reinforcement performed. Recent storms and wind events have not created any unusual damage and the current structures and installations resisted breaches and are

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
							reviewed after each event greater than 45 mph..
BSAC-PP-2	The cause of the water intrusion should be remedied at the joint between the SAC and the Miltimore Wallis addition (this was being investigated at the time of the inspection)	Flood	Moderate	$5,000-$25,000	Emergency Management and Facilities	Completed/no longer pursuing	Tremco performed caulking mitigation, but more work is required. There are regular inspections of the building exterior to document, repair and address water intrusion problems.

Burson (Physical Science Building) Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Prevention							
BPSB-P1	Rooftop ventilation and climate control equipment should be regularly maintained to ensure anchorage and cable-stays are in good condition. Corroded connections and supports should be replaced with stainless or galvanized hardware.	All Hazards	Moderate	<$5,000	Emergency Management and Facilities	Completed/no longer pursuing	Burson roof top and interior air system mechanicals were upgraded in 2017-9. Many of the stabilization wires were replaced.
BPSB-P-2	The exterior windows in the chemical storage area should be reinforced using an impact resistant film to prevent the windows from failing during a high wind event and creating a breach in the façade.	Earthquake, Tornadoes/Thunderstorms, Severe Winter Weather, Wildfire, Flood, Drought	Moderate	<$5,000	Emergency Management and Facilities	Completed/no longer pursuing	No recent reinforcement performed. Recent storms and wind events have not created any unusual damage and the current structures and installations resisted breaches and are reviewed after each event greater than 45 mph.
Property Protection							
BPSB-PP-1	Future site work should endeavor to enhance vehicular access to the rear façade of the structure.	Earthquake, Tornadoes/Thunderstorms, Severe Winter Weather, Wildfire, Flood, Drought	Moderate	<$5,000	Emergency Management and Facilities	Completed/no longer pursuing	Building went through an upgrade, but the exterior was not a part of the upgrade.
BPSB-PP-2	Install fire suppression system in facility or at least in areas susceptible to fire as a result of chemical use or storage.	Earthquake, Tornadoes/Thunderstorms, Severe Winter Weather, Wildfire, Flood, Drought	Moderate	$25,000-$100,000	Emergency Management and Facilities	Completed/no longer pursuing	Fire suppression located throughout the Burson facility

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
BPSB-PP-3	Remove the large tree near mechanical equipment on southeast corner of facility.	Earthquake, Tornadoes/Thunderstorms, Severe Winter Weather, Wildfire, Flood, Drought	Moderate	<$5,000	Emergency Management and Facilities	Completed/no longer pursuing	Tree has not been removed, but this area has been identified and is regularly maintained to prevent drain blockage.

Cameron (Applied Science Center) Mitigation Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2020 Action Implementation Status
Property Protection							
CASC-PP-1	Laboratories and computer facilities containing sensitive equipment and valuable experiments should be provided with sufficient backup power and cooling to operate during extended outages. This could be accomplished by installing an additional generator or a larger generator.	Earthquake, Tornadoes/Thunderstorms, Severe Winter Weather, Wildfire, Flood, Drought	Moderate	$25,000-$100,000	Emergency Management and Facilities	Completed/no longer pursuing	Back-up 300KW generator is active for Cameron
CASC-PP-2	Cooling towers should have overhanging limbs pruned away and trees posing a danger during high wind events should be removed entirely. Cooling tower and generator access doors and electrical switchgear should be locked to prevent tampering.	High Wind/ Tornado, Winter Weather, Wildfire, Flood, Lightning, Drought	Moderate	<$5,000	Emergency Management and Facilities	Completed/no longer pursuing	Now included as a part of regular grounds maintenance.
CASC-PP-3	Rooftop HVAC equipment mounting and cable-stays should be regularly inspected and maintained to prevent wind damage.	All Hazards	Moderate	<$5,000	Emergency Management and Facilities	Completed/no longer pursuing	HVAC Shop has reviewed the equipment at each of the buildings to assure appropriate securing of equipment. Recent storms and wind events have not created any unusual damage and the current structures and installations resisted breaches and

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2020 Action Implementation Status
							are reviewed after each event greater than 45 mph.
CASC-PP-4	The mechanism of water infiltration through the façade should be identified and remedied.	Flood	Moderate	>$100,000	Emergency Management and Facilities	Completed/no longer pursuing	Cameron flashing and facade around the roof area was upgraded over the past several years.

Facilities Management Building Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2020 Action Implementation Status
Property Protection							
FM-PP-1	Provide backup power for the Archibus server and associated climate control systems so it can operate during extended power outages. A redundant HVAC system is required to provide cooling for the server in case one of the current units fails. As a minimum, provide environmental monitoring system for server room that can trigger server shutdown in the event of environmental control failure.	Earthquake, High Wind/ Tornado, Winter Weather, Wildfire, Flood, Lightning, Drought	Moderate	$25,000-$100,000	Emergency Management and Facilities	Completed/no longer pursuing	Complete battery back-up system installed and is operational for the HVAC and Dispatch office as well as several other critical telcom rooms that require cooling.
FM-PP-2	Vehicle fuel pumps should be moved away from the wooded area or the trees and undergrowth should be cut back to provide enough open space to protect the fuel pumps from a brush fire.	Earthquake, High Wind/ Tornado, Winter Weather, Wildfire, Flood, Lightning, Drought	Moderate	<$5,000	Emergency Management and Facilities	Completed/no longer pursuing	New canopy installed and the pumping area regraded to provide proper access and maintenance.

King Building Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2020 Action Implementation Status
Property Protection							
KB-PP-1	Provide a backup or redundant drainage system. The drainage system should be routinely serviced to ensure proper functioning. Alternatively, future site work could be used to direct site drainage away from the structure.	Flood	Moderate	$5,000-$25,000	Emergency Management and Facilities	Completed/no longer pursuing	Transitioned into a Plumbing shop model. The plumbing shop and Grounds work together to routinely address potential drainage issues.
KB-PP-2	Provide an alternative source of environmental control for areas of the building which provide vital business continuity functions.	Earthquake, Tornadoes/Thunderstorms, Severe Winter Weather, Wildfire, Flood, Drought	Moderate	$5,000-$25,000	Emergency Management and Facilities	Completed/no longer pursuing	Networking system has redundant capabilities and back-ups are frequently tested by OneIT
KB-PP-3	Roof drains should be regularly serviced to prevent excessive water ponding.	High Wind/ Tornado, Winter Weather, Flood	Moderate	<$5,000	Emergency Management and Facilities	Completed/no longer pursuing	Part of the normal routine roof maintenance performed by the General Trades shop. Recent storms and wind events have not created any unusual damage and the current structures and installations resisted breaches and are reviewed after each event greater than 45 mph.
KB-PP-4	Install a fire suppression system in the building.	Earthquake	Moderate	>$100,000	Emergency Management and Facilities	Completed/no longer pursuing	Maintained by the Fire Systems shop

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2020 Action Implementation Status
KB-PP-5	When the roof is replaced use a bonded system that does not require gravel ballast.	Earthquake, High Wind/ Tornado, Winter Weather, Wildfire, Flood, Lightning	Moderate	<$5,000	Emergency Management and Facilities	Completed/no longer pursuing	Action to be deleted. King Building roof is performing well and has a PVC roof. Not ballasted.

Power Substation Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2020 Action Implementation Status
Property Protection							
PS-PP-1	The storm water outlet causing soil erosion and retaining wall damage should be modified to mitigate any further damage. This could be accomplished by relocating the outlet or providing an appropriate outfall.	Earthquake, High Wind/ Tornado, Winter Weather, Flood	Moderate	$5,000-$25,000	Emergency Management and Facilities	Completed/no longer pursuing	Grounds and Duke Power Monitor routinely
PS-PP-2	High grasses surrounding the substation should be routinely cut to mitigate the potential for damage from brushfires.	Wildfire, Drought	Moderate	<$5,000	Emergency Management and Facilities	Completed/no longer pursuing	Grounds and Duke Power Monitor routinely
PS-PP-3	Tree limbs in the vicinity of the substation and transmission lines should be routinely pruned to remove damaged/dying limbs and to mitigate damage from high wind and ice events.	High Wind/ Tornado, Winter Weather	Moderate	<$5,000	Emergency Management and Facilities	Completed/no longer pursuing	Grounds and Duke Power Monitor routinely

Residence Hall (typ. 4 w/o sprinklers) Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2020 Action Implementation Status
Property Protection							
RH-PP-1	Enhance access around the building exterior for fire and rescue vehicles. This can be accomplished by removing tress or other obstructions and adding paved access roads. The installation of strategically located fire hydrants would also be beneficial.	Earthquake, Wildfire, Tornadoes/Thunderstorms, Drought	Moderate	$25,000-$100,000	Emergency Management and Facilities	Completed/no longer pursuing	Housing buildings have fire and rescue vehicle access.
RH-PP-2	Repair or replace existing windows and/or their seals to enhance resistance to failure and water infiltration.	Winter Weather, Flood	Moderate	>$100,000	Emergency Management and Facilities	Completed/no longer pursuing	Inspected on a regular basis and work requests are generated based on need.
RH-PP-3	Increase the amount of emergency power available to the buildings. This would allow the tenants to shelter in place during an outage. This can be accomplished through the installation of a larger generator or the installation of service connections that would permit additional generators to be connected to the buildings to provide power during an outage.	Earthquake, Tornadoes/Thunderstorms, Severe Winter Weather, Wildfire, Flood, Drought	Moderate	$25,000-$100,000	Emergency Management and Facilities	Completed/no longer pursuing	Emergency Generators are connected to all Housing buildings.

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2020 Action Implementation Status
RH-PP-4	Install a sprinkler system to protect occupants from fire.	Earthquake, Tornadoes/Thunderstorms Wildfire, Drought	Moderate	>$100,000	Emergency Management and Facilities	Completed/no longer pursuing	Action to be deleted. Sprinkler systems are located in all of the Housing Residences.

Regional Utilities Plant #1 and #2 Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2020 Action Implementation Status
Property Protection							
RUP-PP-1	Vehicle barriers such as bollards or curbs should be considered to protect the structural elements and site components of the RUPs facilities from vehicle impacts.	Earthquake, Tornadoes/Thunderstorms, Severe Winter Weather, Wildfire, Flood, Drought	Moderate	<$5,000	Emergency Management and Facilities	Completed/no longer pursuing	Structural elements are protected from vehicular traffic.
RUP-PP-2	RUP #1 should be evaluated for compliance with current code specified wind velocity of 90 mph.	Tornadoes/Thunderstorms, Severe Winter Weather	Moderate	$5,000-$25,000	Emergency Management and Facilities	Completed/no longer pursuing	No longer pursuing this initiative.
RUP-PP-3	RUP #1 should have a backup generator or facilities supplied by RUP #1 should have sufficient emergency climate control equipment to condition critical facilities in the event of a power outage or failure of RUP #1. Alternatively, connections could be installed which would permit temporary generators to be brought in during extended power outages.	Earthquake, Tornadoes/Thunderstorms, Severe Winter Weather, Wildfire, Flood, Drought	Moderate	>$100,000	Emergency Management and Facilities	Completed/no longer pursuing	RUP1& 2 have dedicated back-up generators with additional temporary connections for additional back-up capacity as needed.

Woodward Hall Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2020 Action Implementation Status
Property Protection							
WH-PP-1	Laboratories that contain valuable, environmentally sensitive experiments should be equipped with backup environmental control systems that can be powered by backup generators. Existing equipment (Photo 1) is not adequate to provide complete environmental control for extended periods.	Earthquake, High Wind/ Tornado, Winter Weather, Wildfire, Flood, Lightning, Drought	Moderate	$25,000-$100,000	Emergency Management and Facilities	Completed/no longer pursuing	Equipment has been upgraded for critical business research.
WH-PP-2	Provide a backup or redundant drainage system. Alternatively, a portable emergency pumping system can relieve the demand on the storm water drainage system. The drainage system should be routinely serviced to ensure proper functioning.	Winter Weather, Flood	Moderate	$5,000-$25,000	Emergency Management and Facilities	Completed/no longer pursuing	No longer pursuing this initiative.
WH-PP-3	The windows in the electrical room should be replaced or reinforced using laminate film to prevent water intrusion in the event of windborne debris impact.	Earthquake, High Wind/ Tornado, Winter Weather, Flood, Lightning	Moderate	<$5,000	Emergency Management and Facilities	Completed/no longer pursuing	Not aware of any upgrades to the windows. Recent storms and wind events have not created any unusual damage and the current structures and installations resisted breaches and are reviewed after each event greater than 45 mph.
WH-PP-4	The source of water infiltration in the building façade should be identified and remedied to prevent further damage.	(Winter Weather, Flood)	Moderate	<$5,000	Emergency Management and Facilities	Completed/no longer pursuing	Action completed. This was completed approximately 3 years ago.

Annex E UNC Greensboro

This section provides planning process, campus profile, hazard risk, vulnerability, capability, and mitigation action information specific to UNC Greensboro (UNCG). This section contains the following subsections:

- E.1 Planning Process Details
- E.2 Campus Profile
- E.3 Asset Inventory
- E.4 Hazard Identification
- E.5 Hazard Profiles, Analysis, and Vulnerability
- E.6 Capability Assessment
- E.7 Mitigation Strategy

E.1 Planning Process Details

The update of the campus hazard mitigation plan was conducted by a University Hazard Mitigation Planning Committee comprised of university staff and faculty. The committee followed a planning process prescribed by FEMA and participated in a series of meetings to update the plan. Details about the meetings help by the committee are provided below.

TABLE E.1: UNC GREENSBORO UNIVERSITY HAZARD MITIGATION PLANNING COMMITTEE

LAST NAME	FIRST NAME	TITLE	ATTENDED FIRST MEETING	ATTENDED SECOND MEETING
Ackerman	Mike	Associate Director Rec and Wellness	X	X
Allen	Julie	Paralegal	X	X
Baber	Kathy	Director SHS	X	X
Barker	Robert	Assistant Dean - Dean of Students Office	X	X
Barnett	Raina	Senior Associate Registrar		X
Beck	Joshua	Engineering Supervisor		X
Beville	Jill	Director Rec and Wellness	X	X
Carter	Brett	Dean of Students	X	X
Clegg	Shannon	Sr. Director Auxiliary Services	X	X
Coltrane	Desiree	Director of POCAM	X	
Currin	Andrew	Grounds Director	X	X
Douglas	Toni	Associate General Counsel	X	
Downs	Tammy	Risk Manager	X	X
Bloss	Eden	Senior Director, Media Services		X
Friedman	Dave	Engineering Supervisor		X

LAST NAME	FIRST NAME	TITLE	ATTENDED FIRST MEETING	ATTENDED SECOND MEETING
Goble	Lisa	Research and Economic Development Director		X
Glidewell	Steve	HRL Assistant Director of Facilities	X	X
Hawks	Dicky	Facilities Operations Director	X	X
Jasso	Christopher	Public Safety Supervisor	X	X
Johnson	Tim	Housing and Residence Life Director		X
Kapileshwari	Sameer	Facilities Operations Director		X
Kazeem	Sikirat	Associate Director Rec and Wellness	X	X
Aguilar	Jennifer	Associate Athletic Director		X
Lam	Saquang	Student Health Services	X	X
Lester	Paul	Chief of Police	X	
Littlefield	Kimberly	AVC Research and Economic Development		X
Logan	Michael	Director of Purchasing	X	X
MacCheyne	Sherri	Director of Operations	X	X
Madorin	Jeanne	AVC HR	X	X
Martinez	Mary	Research Operations Manager		X
McKinney	Mark	Director of Risk Management	X	X
McCloy	Jay	Assistant Director Health and Sport		X
Pearce	Ken	Director Facilities Design and Construction	X	
Porter	Bryce	Chief Information Security Officer	X	
Price-Erwin	Erin	Fire and Life Safety Manager	X	X
Slone	Tim	Director EHS	X	X
Smith*	Zach	EM Director	X	X
Soter	Jon	Director of Facilities Operations	X	X
Stewart	Kenny	EM Coordinator	X	X
Thurston	Andrew	EM Coordinator	X	X
Voorhees	Julie	Proposal Development	X	X
Whitney	Jennifer	Director SHS-CC	X	X
Wolford	Ron	UNCG PD Captain	X	
Woody	Sherry	IT Senior Manager	X	X

* Primary Point of Contact

December 12, 2019 – Project Kickoff Meeting

ESP Associates' Project Manager, Nathan Slaughter, 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 Campus Hazard Mitigation Planning Team and began by having attendees introduce themselves. The 33 attendees included faculty and staff from various departments at the University. 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 was managing the planning effort and had assigned ESP Associates, Inc. to manage the update.

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 on campus (buildings, infrastructure 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 a discussion about various mitigation techniques. He briefly explained the six different categories of mitigation techniques: emergency services, prevention, natural resource protection, structural projects, public education and awareness, and property protection. The attendees were then asked what types of mitigation projects would be needed the most at UNCG if FEMA funding was available. Most attendees felt that emergency services activities would be most needed on the campus. This helped demonstrate how priorities in mitigation actions should be considered for the plan.

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

- Coordinate between the eight participating campuses to update the existing plan,
- Update the plan to demonstrate progress and reflect current conditions,
- Complete the update in a timely manner because the existing plan expired in October of 2017,
- Increase public awareness and education,
- Maintain grant eligibility for participating campuses, and
- Maintain compliance with State and Federal requirements.

Mr. Slaughter reviewed the list of participating campuses with the group. He also explained the project tasks to be accomplished. These included the planning process, risk assessment, capability assessment, mitigation strategy, mitigation action plan, and plain maintenance procedures.

He explained that the project as being managed by a Campus Hazard Mitigation Steering Committee that had one representative from each of the eight campuses. For UNC-Greensboro, that representative was Zach Smith, EM Director. He explained that the group currently in the room would be known as the Campus Hazard Mitigation Planning Team.

Mr. Slaughter explained that this update would expand the scope of the plan to not only address natural hazards, as was previously done for the existing plan, but that it would also address manmade/technological hazards as well. This was done to ensure alignment with the State of North Carolina's Hazard Mitigation Plan as well as the Guilford County Hazard Mitigation Plan.

Mr. Slaughter explained that the plan would address campus vulnerability, where feasible, to identify specific types and numbers of campus assets that are at risk to the identified hazards. He said that an attempt would be made to address other types of vulnerability as well to include social, economic and environmental vulnerabilities.

He then discussed the capability assessment and how the plan would include a discussion on the University's capability to address their hazard vulnerability through mitigation. Next, he discussed the mitigation strategy and explained how that section of the plan would be reviewed and updated as required by FEMA.

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

Mr. Slaughter then reviewed the roles and responsibilities of ESP Associates, Inc, the campus leads and stakeholders. The presentation concluded with a discussion of the next steps to be taken in the project development. He explained that a Hazard Mitigation Public Survey was being developed and that it would be distributed soon. The next campus HMPT meeting was discussed and would be held sometime in the Spring or Summer of 2020. The purpose of the second meeting would be to discuss the findings of the risk and capability assessments and to begin updating existing mitigation actions and identify new goals.

November 9, 2020 – Mitigation Strategy Meeting – Zoom Meeting

Following a hiatus in the planning process caused by the onset, response and initial recovery from the COVID 19 pandemic, the UNCG Campus Hazard Mitigation Planning Team held an online Mitigation Strategy Meeting on November 9, 2020.

Mr. Slaughter began the meeting with brief introductions and an overview of the agenda for the day. He provided a brief refresher on the definition of mitigation and a recap of the Disaster Mitigation Act of 2000, the key objectives of the project and the project schedule (which remained somewhat delayed because of the COVID-19 pandemic, but still on track for completion of the final plan).

He then began providing more detailed information about the hazards that impact the University. He started by recapping the number of hazard events experienced since the previous plan and discussed the presidential disaster declarations that have been experienced since the previous update. These included one declaration for a winter storm, one for Hurricane Florence, one for a tornado/severe storm and one for the COVID-19 pandemic. He provided summary stats and slides for the following hazards: drought, hail, hurricanes and tropical storms, lightning, severe thunderstorms, tornadoes, flood, wildfire, winter storms and freeze, dam failure, earthquake, landslides, excessive heat, hazardous materials incident, public health hazards/infectious disease, cyber, nuclear power plants, electromagnetic pulse and terrorism.

Mr. Slaughter provided an overview of the Priority Risk Index. The PRI is a quantitative scoring of hazards which is used to focus in on the hazards of greatest concern for the University. Using the PRI, the following hazards were considered the be highest risk for the University: severe winter weather, severe thunderstorms/tornadoes, flood, hurricanes and coastal hazards, hazardous substances and infectious disease.

There was some discussion about how there are certain areas on campus that are susceptible to stormwater flooding, but not major problem areas. The Campus Hazard Mitigation Planning Team as a whole endorsed the elevation of cyber attacks as a high risk hazard for the University.

Following the hazard identification and PRI review, Mr. Slaughter reviewed the listing of key assets from the prior plan and discussed the need to update that ranking. He also mentioned that social vulnerability would be included in the plan to some extent and he presented slides on social vulnerability for Guilford County.

There was also a brief discussion about the capability assessment that would be included in the plan for the University. He mentioned how that assessment would be conducted and what it would try to capture (administrative, technical, fiscal, and political capabilities of the University).

The remainder of the meeting was spent discussing the Mitigation Strategy. Mr. Slaughter gave an overview of the process for updating the Mitigation Strategy and presented the existing mitigation goals for the UNC Western Campuses regional plan. He asked the UNCG Campus 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 goals were no longer relevant and new goals and associated objectives were developed, voted upon and accepted. It should be noted that these goals and objectives also align with those found in the UNC Eastern Campuses Hazard Mitigation Plan.

Mr. Slaughter then indicated that Campus Hazard Mitigation Planning Team would need to provide a status update for their existing mitigation actions (completed, deleted, or deferred) and a brief discussion of how that determination was made. Mr. Slaughter also discussed the Mitigation Action Worksheets to be completed for any new mitigation actions. Mr. Slaughter then presented sample mitigation actions for the committee members to consider to include in their plan update.

Mr. Slaughter mentioned the need to conduct public outreach measures to meet FEMA requirements and indicated that a public survey would be sent out soon and an online public meeting for the entire UNC Western Campuses region would be conducted before the plan was finalized.

Finally, Mr. Slaughter discussed the next steps in the planning process. These included returning mitigation action updates and delivery of a draft plan. Mr. Zach Smith indicated that he would take the lead in coordinating further planning efforts at the campus to include reviewing the PRI, updating existing mitigation actions and identifying any new mitigation actions. Mr. Slaughter then thanked the group for taking the time to attend and the meeting was adjourned.

Involving the Public

Because this plan update was developed during the COVID-19 pandemic, the planning teams had to get creative in order to solicit feedback from the public about the plan and their thoughts on hazard mitigation. A public survey instrument was developed to provide an opportunity for the public to provide comment on their concerns about hazard impacts on the campuses and their thoughts on how mitigation could help reduce vulnerability. The public survey was distributed by each campus through different means to outreach to faculty, staff and students.

For UNCG, 137 public survey responses were received and the results from those surveys were shared with the Campus Hazard Mitigation Planning Team. Feedback from the surveys was reviewed and considered for inclusion in this plan, as applicable, where determined to be relevant. A summary of the responses can be found in **Appendix B** and detailed survey responses can be obtained through North Carolina Emergency Management, Hazard Mitigation Planning staff.

E.2 Campus Profile

This section of the plan provides a general overview of the UNC Greensboro Campus and surrounding area.

E.2.1 Geography and the Environment

UNC Greensboro's campus includes more than 30 academic buildings and 30 residence buildings on 200-plus acres. Opportunities for students include more than 200 student organizations, 17 Division I athletic teams, intramurals, club sports, campus golf course, Outdoor Adventures program, fraternities and sororities and community service. Greensboro is the third most populated city in North Carolina and has a total area close to 140 square miles. The city is located in the rolling hills of North Carolina's Piedmont region and has a climate typical of a piedmont-area city in the south-eastern U.S. An orientation map of UNC Greensboro can be seen in **Figure E.1** and a map of the main-campus can be seen in **Figure E.2**.

FIGURE E.1: UNC GREENSBORO LOCATOR MAP

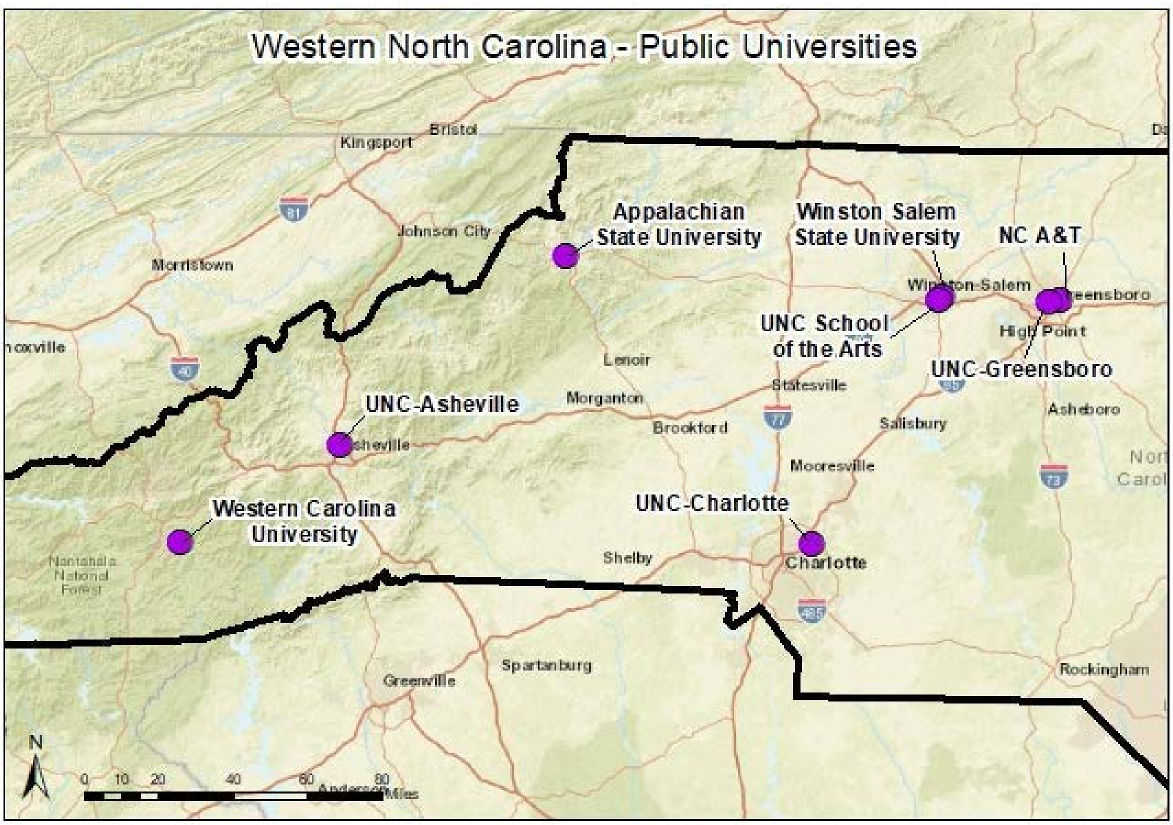
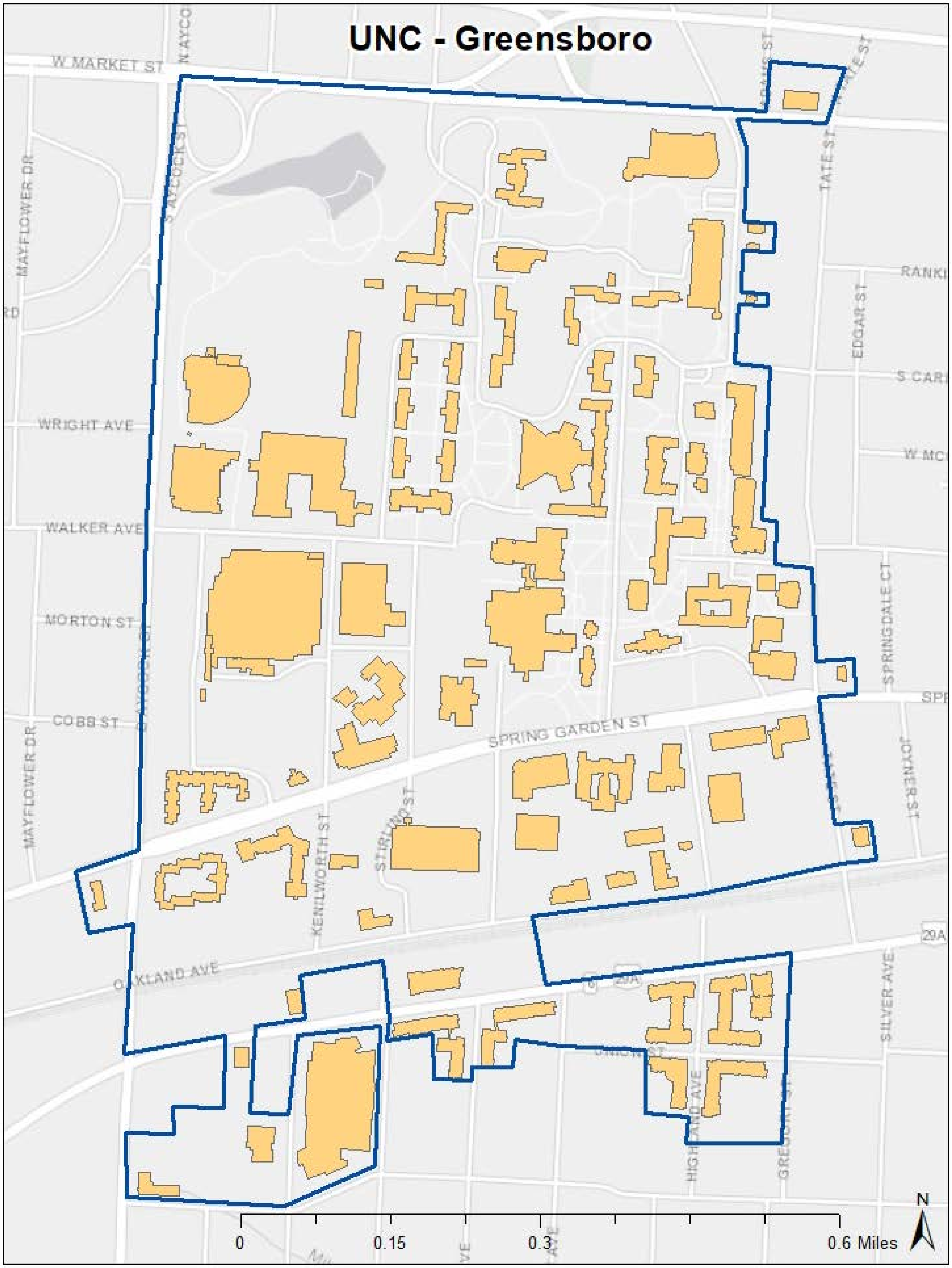


FIGURE E.2 UNCG MAIN CAMPUS MAP



Greensboro has a humid subtropical climate with four distinct seasons. Winters are short and generally cool with the January daily average of 38°F. Annually there are 75 nights per year that drop to, or below freezing, and only about 5 days per year fail to rise above freezing. Measurable snowfall occurs nearly every winter and accumulates to a normal of 7.5 inches although some winters fail to produce any winter precipitation. During the summer months Greensboro is hot and humid. The average high temperature in Greensboro is nearly 80°F in summer months. There is an average of 32 days per year where high temperatures reach 90°F or above. Thunderstorms are common during the humid spring and summer months, some being more severe than others. Tornados are not too common but are a lingering hazard to this area, historical storms have caused large amounts of destruction to property and Greensboro citizen's lives. The monthly averages for Greensboro are presented in **Table E.2**.

TABLE E.2 MONTHLY AVERAGES FOR GREENSBORO, NORTH CAROLINA

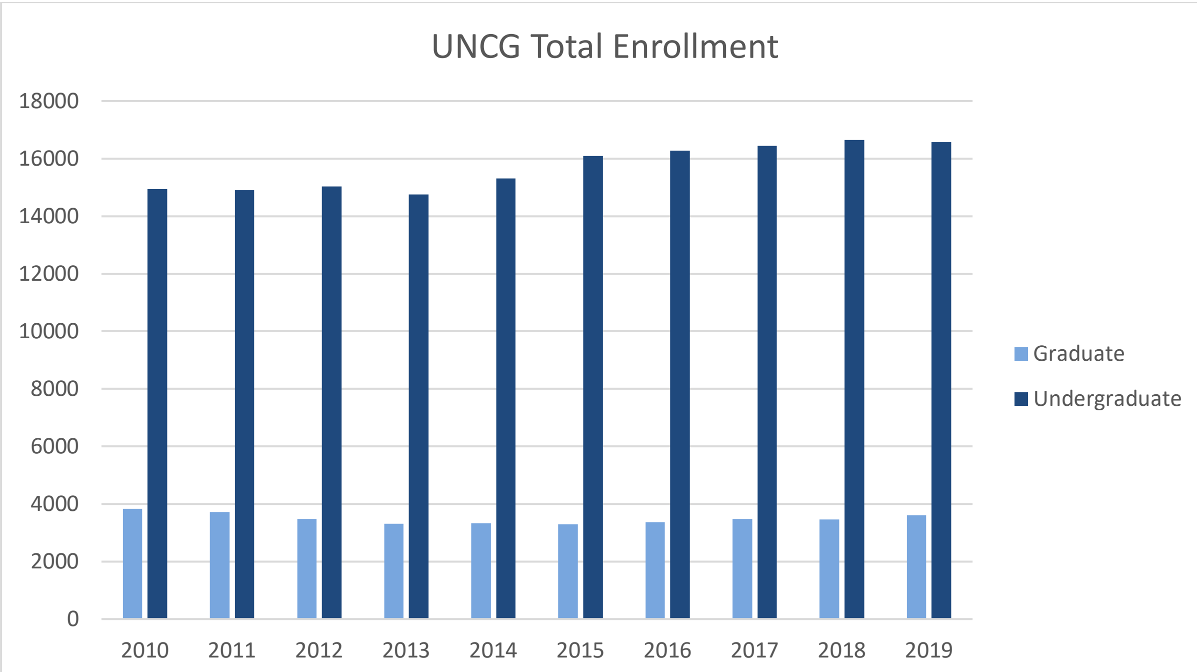
Month	Average High	Average Low	Average Precipitation
January	48°F	29°F	3.06 in
February	53°F	32°F	2.96 in
March	61°F	39°F	3.73 in
April	70°F	47°F	3.57 in
May	78°F	56°F	3.38 in
June	85°F	65°F	3.73 in
July	88°F	69°F	4.48 in
August	86°F	68°F	3.88 in
September	80°F	61°F	4.19 in
October	70°F	49°F	3.16 in
November	61°F	40°F	3.11 in
December	51°F	31°F	0.00 in

Source: National Weather Service

E.2.2 Population and Demographics

With more than 20,000 students and 2,700 faculty and staff, UNCG is the largest state university in the Piedmont Triad and has an annual economic impact of more than $1 billion. The total student enrollment at UNCG has been growing from 2013 to 2018 by 2.2% annually. This growth rate is ahead of that of ECU (1% annually) but behind that of UNCC (2.3% annually). UNC Greensboro has grown steadily over the years since being established in 1891. The Hispanic student population has seen the largest margin of growth during the period from 2013 to 2018. The Asian population has also seen an impressive increase in these five years. Native Hawaiian's make up the least represented group for this University. The enrollment trends over the past ten years can be seen in **Figure E.3**.

FIGURE E.3: TOTAL ENROLLMENT



Source: UNC System – Interactive Data Dashboards

For a breakdown of enrollment demographics in **Table E.3**.

TABLE E.3 ENROLLMENT DEMOGRAPHICS (2019)

Race/Ethnicity	Enrollment (Fall 2018)	Percentage
White	9,559	47.33%
Hispanic or Latino	2,065	10.22%
Black or African American	5,460	27.03%
Two or More Races	935	4.62%
Asian	965	4.77%
Nonresident Alien	631	3.12%
American Indian or Alaska Native	68	0.33%
Native Hawaiian or Other Pacific Islander	12	0.05%
Unknown	501	2.48%

Source: UNC System – Interactive Data Dashboards

E.3 Asset Inventory

An inventory of assets was compiled to identify the total count and value of property exposure on the UNCG campus. This asset inventory serves as the basis for evaluating exposure and vulnerability by hazard. Assets for analysis include buildings, critical facilities, and critical infrastructure.

E.3.1 Building Inventory

This section provides total building exposure for the campus, which was estimated by summarizing building footprints provided by North Carolina Emergency Management and property values derived from 2020 insurance assessment data. According to that data, there are 132 buildings associated with UNCG totaling a value of $2,040,054,322 (building and contents).

E.3.2 Critical Buildings and Infrastructure Exposure

Of significant concern with respect to any disaster event is the location of critical facilities and infrastructure in the planning area. Critical facilities are those essential services and lifelines that, if damaged during an emergency event, would disrupt campus continuity of operations or result in severe consequences to public health, safety, and welfare.

Critical buildings are a subset of the total building exposure and were identified by UNCG's HMPC representatives. The UNCG HMPC updated the list of critical facilities from the previous plan and ranked each facility on a set of standardized criteria designed to evaluate all critical buildings in the UNC System DRU plans. Factors considered for this ranking included:

- the building's use for emergency response,
- the building's use for essential campus operations
- the building's use as an emergency shelter or for essential sheltering services,
- the presence of a generator or generator hook-ups,
- the building's use for provision of energy, chilled water or HVAC for sensitive or essential systems,
- the storage of hazardous materials,
- the building's use for sensitive research functions,
- the building's cultural or historical significance, and
- building-specific hazard vulnerabilities

The UNC Greensboro was asked to evaluate all buildings on their campus using these criteria. The objective was to identify the top 10 most critical buildings on campus so specific mitigation measure could be considered for those buildings. This allowed campus officials and the Planning Committee to focus their time and planning efforts on these most critical buildings. **Table E.4** below lists the critical buildings as determined by campus officials.

TABLE E.4: UNCG CRITICAL BUILDINGS RANKING

Building Rank	Building
#1	Coleman Building
#2	Kaplan Center
#3	Police Building
#4	McNutt Building
#5	Jackson Library
#6	Sullivan Science Building
#7	Eberhart Building
#8	Moran Commons
#9	Gove Health Center
#10	Steam Plant

E.4 Hazard Identification

This section describes how the regional planning committee identified the hazards to be included this plan.

E.4.1 Hazard Identification

Upon a review of the full range of hazards suggested under FEMA planning guidance, the UNCG University Hazard Mitigation Planning Committee have identified a number of hazards that are to be addressed in its Hazard Mitigation Plan. These hazards were identified through a process that utilized input from the University Hazard Mitigation Planning Team members, research of past disaster declarations in the surrounding county, and review of the previous UNCG System Pre-Disaster Mitigation Plan. To maintain consistency, the Multi-Campus Hazard Mitigation Steering Committee and the Campus Hazard Mitigation Planning Team voted to assess the same hazards that were identified in the most recent update of the North Carolina State Hazard Mitigation Plan[1].

Therefore, since the development of the previous plan, the hazard identified and included in the plan have changed. A list of all previous hazards covered in the previous UNC Greensboro Pre-Disaster Mitigation Plan are viewable in **Table E.5**, along with a summary of the hazards assessed in this update. Readily available information from multiple reputable sources (such as federal and state agencies) was also evaluated to supplement information from these key sources.

[1] UNCG has included several additional hazards in their hazard identification and ranking that are not in the other university Annexes. These hazards are listed in Table E.5, profiled in this section and included in the UNCG Priority Risk Index. This hazard listing is different than the hazards included for the other universities in the West region, but were included to keep this plan consistent other University Emergency Management planning documents.

TABLE E.5: 2021 UNC GREENSBORO HAZARDS UPDATE

Identified Hazards for the 2010 UNC-G Hazard Mitigation Plan	Identified Hazards for the 2021 UNC-G Hazard Mitigation Plan		Sub hazards covered in 2021 Plan and Explanations
Drought	Natural Hazards	Separate hazards of Drought and Excessive Heat	Agricultural Drought, Hydrological Drought
Driving Rain			
Other High Wind Events including "Nor'easters"			
Hurricane		Hurricane and Coastal Hazards	Nor'easters, Storm Surge, Rip Currents
Tornado		Tornadoes/Thunderstorms	Hailstorm, Torrential Rain associated with Severe Thunderstorms, Thunderstorm Wind, Lightning, Waterspout, High Wind
Severe Winter Weather, including ice or snow events		Severe Winter Weather	Freezing Rain, Snowstorms, Blizzards, Wind Chill, Extreme Cold
		Dam Failures	
			Assessed under "Geological"
Flood		Flooding	
Earthquake		Earthquakes	
Geological Hazards		Geological Hazards	Landslides, Sinkholes
Landslide, Rockslide			
Wildfire		Wildfires	
		Building Fire	
		Extreme Temperatures	
Animal borne and other Infectious Diseases	Other Hazards	Infectious Disease	
	Technological Hazards	Hazardous Substances	Hazardous Materials, Hazardous Chemicals, Oil Spill
	Technological Hazards	Radiological Emergency – Fixed Nuclear Facilities	
		Terrorism	Chemical, Biological, Radiological, Nuclear, Explosive
		Technology System Disruption	Cyber attack/breach, Communication System Disruption
		Electromagnetic Pulse	
		Utility Interruption/Failure	
		Violent/Major Crime	Active Assailant, Terrorism
		Civil Disturbance/Unrest	
		Traffic/Transportation Accidents	
		Resource Shortage	
Accidental Explosions			

Identified Hazards for the 2010 UNC-G Hazard Mitigation Plan	Identified Hazards for the 2021 UNC-G Hazard Mitigation Plan		Sub hazards covered in 2021 Plan and Explanations
Electrical Storms			
Technological or Human-induced Hazards			

E.4.2 Disaster Declarations

Disaster declarations provide insight into the hazards that may impact UNCG. **Table E.6** shows every declared presidential disaster to impact Guilford County since 1973. There have been fourteen total disaster declarations in Guilford County since 1977.

TABLE E.6: GUILFORD COUNTY DISASTER DECLARATIONS

Year	Disaster Number	Description
1989	844	HURRICANE HUGO
1989	827	TORNADOES
1996	1087	BLIZZARD OF '96
1996	1103	WINTER STORM
1996	1134	HURRICANE FRAN
1999	1292	HURRICANE FLOYD MAJOR DISASTER DECLARAIONS
2000	1312	SEVERE WINTER STORM
2002	1448	SEVERE ICE STORM
2003	1457	ICE STORM
2004	1553	HURRICANE IVAN
2014	4167	SEVERE WINTER STORM
2018	4393	HURRICANE FLORENCE
2018	4364	TORNADO & SEVERE STORMS
2020	4487	COVID-19 PANDEMIC

E.4.3 Summary of Hazard Impacts Since Previous Plan

Since the approval of the previous UNC Greensboro Pre-Hazard Mitigation Plan (June 30th, 2010), there have been 275 hazard events recorded for the planning area in the National Centers for Environmental Storm Event Database. It is important to take note of those hazard events and consider them in the *Hazard Identification* section to help ensure that the appropriate hazards are being considered in the risk assessment sections in the Mitigation Strategy. **Table E.7** documents the hazard events recorded. Details for some these events are discussed in further detail in the *Hazard Profiles* section.

TABLE E.7: SUMMARY OF HAZARD EVENTS SINCE PREVIOUS PLAN

Hazard Type*	Number of Reported Events in Guilford County
Cold/Wind Chill	0
Flash Flood	51
Flood	2
Hail	34
Heavy Snow	0
High Wind	0
Lightning	2
Strong Wind	12
Thunderstorm Wind	144
Tornado	1
Tropical Storm	1
Winter Storm	14
Winter Weather	14
TOTAL NUMBER OF REPORTED EVENTS	**275**

* The hazard type names that NCEI uses are different than the names of hazards used in this plan; however, one can still get an understanding of the types of hazards that impact the region as the hazard types are similar in name.

E.4.4 Hazard Evaluation

Table E.8 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 furthered 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 further evaluations and updates of the risk assessment if deemed necessary by the University Core Planning Team and the University Campus Core Committee during the plan update process.

TABLE E.8: 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?
NATURAL HAZARDS			
Avalanche	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of the NC State Hazard Mitigation Plan • Review of the previous UNC Greensboro Pre-Disaster Mitigation Plan • Review of US Forest Service National Avalanche Center website	• The United States avalanche hazard is limited to mountainous western states including Alaska as well as some areas of low risk in New England. • Avalanche hazard was removed from the North Carolina State Hazard Mitigation Plan after determining the mountain elevation in Western North Carolina did have enough snow not to produce this hazard. • Avalanche is not included in the previous UNC Greensboro Pre-Disaster Mitigation Plan.
Drought	**YES**	• Review of the NC State Hazard Mitigation Plan • Review of the North Carolina Drought Monitor website • Review of the previous UNC Greensboro Pre-Disaster Mitigation Plan	• There are reports of drought conditions in each of the past nineteen years in Guilford County, according to the North Carolina Drought Monitor. • Droughts are discussed in NC State Hazard Mitigation.
Hailstorm	**YES (Assessed under Tornadoes/Thunderstorms)**	• Review of NC State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment	• Hailstorm events are discussed in the state plan under the Severe Thunderstorm hazard. • NCEI reports 70 hailstorm events (0.75-inch size hail to 2.75 inches) for Guilford County

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?
		• Review of NOAA NCEI Storm Events Database • Review of the previous UNC Greensboro Pre-Disaster Mitigation Plan	between 1959 and 2018. For these events there was over $1,750 in property damages. • Although hail is not addressed as an individual hazard in the previous hazard mitigation plan, it is addressed as a sub-item under tornadoes/ thunderstorms.
Extreme Temperature	**YES**	• Review of NOAA NCEI Storm Events Database • Review of the North Carolina State Hazard Mitigation Plan • Review of the previous UNC Greensboro Pre-Disaster Mitigation Plan	• NCEI reports at least one extreme heat event for Guilford County which resulted in one fatality. • The NC State Hazard Mitigation Plan includes Extreme Heat as a hazard. • Extreme Temperature was not addressed in the previous UNCG Pre-Disaster Mitigation Plan.
Hurricane and Coastal Hazards	**YES**	• Review of NC State Hazard Mitigation Plan • Analysis of NOAA historical tropical cyclone tracks and National Hurricane Center Website • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations • Review of the previous UNC Greensboro Pre-Disaster Mitigation Plan	• Hurricane and coastal hazard events are discussed in the state plan and are listed as a top hazard of concern. • NOAA historical records indicate 17 hurricane/coastal hazards have come within 25 miles of Guilford County since 1850. • Five out of fourteen disaster declarations in Guilford County are directly related to hurricane and costal hazard events. • The 50-year return period peak gust for hurricane and tropical storm events in Guilford County is between 63-68 mph.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
			• Hurricane hazards were addressed in the previous UNCG Pre-Disaster Mitigation Plan.
Lightning	**YES (Assessed under Tornadoes/ Thunderstorms)**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of NOAA NCEI Storm Events Database, NOAA lightning statistics • Review of the previous UNC Greensboro Pre-Disaster Mitigation Plan	• Lightning events are discussed in the state plan as part of the severe thunderstorm hazard. • NCEI reports 9 lightning events for Guilford County since 1996. These events have resulted in nearly $2.1 million in property damage. • Given the damage and reported death and injuries, individual analysis is warranted.
Nor'easter	**NO**	• Review of NC State Hazard Mitigation Plan • Review of the previous UNC Greensboro Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database	• Nor'easters are discussed in the state plan. • NCEI does not report any nor'easter activity for Guilford County. However, nor'easters may have affected the County as severe winter storms. In this case, the activity would be reported under winter storm events. • Nor'easters were not addressed in the previous UNCG Pre-Disaster Mitigation Plan.
Tornadoes/ Thunderstorm	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment	• Tornado events are discussed in the NC State Hazard Mitigation Plan.

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?
		• Review of NC State Hazard Mitigation Plan • Review of the previous UNC Greensboro Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations.	• NCEI reports 14 tornado events in Guilford County since 1954. These events have resulted in 1 death and 5 injuries and over $79.6 million (2018 dollars) in property damage with the most severe being an F1. • Tornado events were addressed in the previous UNCG Pre-Disaster Mitigation Plan.
Severe Thunderstorm	**YES (Assessed under Tornadoes/ Thunderstorms)**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous UNC Greensboro Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations.	• Severe thunderstorm events are discussed in the NC State Hazard Mitigation Plan. • NCEI reports 328 thunderstorm wind events in Guilford County since 1956. These events have resulted in 1 injury and over $1.4 million in property damage. • Severe thunderstorm events were addressed in the previous UNCG Pre-Disaster Mitigation Plan.
Severe Winter Weather	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous UNC Greensboro Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database	• Severe winter weather events, including snow storms and ice storms, are discussed in the state plan. They are listed as top hazards of concern. • NCEI reports that Guilford County has been affected by 43 snow and ice events since 1993. These events resulted in over $570,000 in damages.

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?
		• Review of historical presidential disaster declarations.	• Six of the county's fourteen disaster declarations were directly related to winter storm events. • Winter storm events were addressed in the previous UNCG Pre-Disaster Mitigation Plan.
Earthquakes	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous UNC Greensboro Pre-Disaster Mitigation Plan • Review of the National Geophysical Data Center USGS Earthquake Hazards Program website	• Earthquake events are discussed in the state plan. 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. • Earthquakes were addressed in the previous UNCG Pre-Disaster Mitigation Plan. • 6 events are known to have occurred in the region according to the National Geophysical Data Center. The greatest magnitude reported was a 4. In 2020, a strong earthquake in Sparta, NC was felt on campus. • According to USGS seismic hazard maps, the peak ground acceleration (PGA) with a 10% probability of exceedance in 50 years for the area is approximately 4%g. FEMA recommends that earthquakes be further evaluated for

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?
			mitigation purposes in areas with a PGA of 3%g or more.
Expansive Soils	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous UNC Greensboro Pre-Disaster Mitigation Plan • Review of USDA Soil Conservation Service's Soil Survey	• Expansive soils are not included in the State plan. • According to FEMA and USDA sources, UNCG is located in an area that has a "little to no" clay swelling potential. • The previous UNCG Pre-Disaster Mitigation Plan did not identify expansive soils as a potential hazard.
Geological (Landslides, Sinkholes, Erosion)	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous UNC Greensboro Pre-Disaster Mitigation Plan • Review of USGS Landslide Incidence and Susceptibility Hazard Map • Review of the North Carolina Geological Survey database of historic landslides	• Landslide/debris flow events are discussed in the state plan. • USGS landslide hazard maps indicate "low" to "moderate" landslide risk for Guilford County. • Data provided by NCGS indicate no recorded landslide events in the UNCG or Guilford County. • Geological hazards were addressed in the previous UNCG. Geological hazards were addressed in the previous UNC Greensboro Pre-Disaster Mitigation Plan.
Land Subsidence	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan	• The state plan delineates certain areas that are susceptible to land subsidence hazards in North Carolina; however, none of these areas are located in Guilford County.

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?
		• Review of the previous UNC Greensboro Pre-Disaster Mitigation Plan	• The state plan delineates certain areas that are susceptible to land subsidence hazards in North Carolina; however, none of these areas are located in Guilford County. • Land Subsidence was not addressed in the previous UNCG Pre-Disaster Mitigation Plan
Tsunami	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous UNC Greensboro Pre-Disaster Mitigation Plan • Review of FEMA "How-to" mitigation planning guidance (Publication 386-2, "Understanding Your Risks – Identifying Hazards and Estimating Losses).	• Tsunamis are included as a hazard in the state plan; however, they are not a risk for Guilford County. • Tsunamis were not addressed in the previous UNCG Pre-Disaster Mitigation Plan. • No record exists of a catastrophic Atlantic basin tsunami impacting the mid-Atlantic coast of the United States. • Tsunami inundation zone maps are not available for communities located along the U.S. East Coast. • 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.
Volcano	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment	• There are no active volcanoes in North Carolina and are not addressed in the state plan.

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?
		• Review of NC State Hazard Mitigation Plan • Review of USGS Volcano Hazards Program website	• There has not been a volcanic eruption in North Carolina in over 1 million years. • No volcanoes are located near UNCG.
Dam Failure	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous UNC Greensboro Pre-Disaster Mitigation Plan • Review of North Carolina Division of Land Management website	• Dam failure is discussed in the state plan as a hazard of concern for UNCG. • Of the 320 dams reported on the National Inventory of Dams in Guilford County, 76 are high hazard, (High hazard is defined as "where failure or mis operation will probably cause loss of human life.") • Dam failure was not addressed in the previous UNCG Pre-Disaster Mitigation Plan.
Erosion	**YES (Referenced in Geological Hazards)**	• Review of NC State Hazard Mitigation Plan • Review of the previous UNC Greensboro Pre-Disaster Mitigation Plan	• Riverine erosion is addressed in the previous UNCG Pre-Disaster Mitigation Plan. • Coastal erosion is discussed in the state plan but only for coastal areas (there is no discussion of riverine erosion).
Flooding	**YES**	• Review of NC State Hazard Mitigation Plan • Review of historical disaster declarations • Review of NOAA NCEI Storm Events Database	• The flood hazard is thoroughly discussed in the state plan. • Five of the fourteen Presidential Disaster Declarations for Guilford County were directly related to flooding events. • NCEI reports that Guilford County have been affected by

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?
		• Review of FEMA's NFIP Community Status Book and Community Rating System (CRS) • Review of the previous UNC Greensboro Pre-Disaster Mitigation Plan	100 flood events since 1996. These events in total caused over $18.1 million in property damages. • Flooding was addressed in the previous UNCG Pre-Disaster Mitigation Plan.
Storm Surge	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous UNC Greensboro Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database	• Storm surge is discussed in the state plan but is not a risk to Guilford County. • Storm surge was not addressed in the previous UNCG Pre-Disaster Mitigation Plan. • No historical events were reported by NCEI • Given the inland location of UNCG, storm surge would not affect the area.
OTHER HAZARDS			
Wildfires	**YES**	• Review of NC State Hazard Mitigation Plan • Review of the previous UNC Greensboro Pre-Disaster Mitigation Plan • Review of Southern Wildfire Risk Assessment (SWRA) Data • Review of the NC Division of Forest Resources website	• Wildfires occur in virtually all parts of the United States. Wildfire hazard risk will increase as low-density development along the urban/wildland interface increases. • Wildfires were not addressed in the previous UNCG Pre-Disaster Mitigation Plan. • According to the North Carolina Division of Forest Resources, Guilford County experiences an

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?
			average of 17 fires each year which burn a combined 41 acres
Hazardous Substances	**YES**	• Review of NC State Hazard Mitigation Plan • Review of the previous UNC Greensboro Pre-Disaster Mitigation Plan • Review of the Guilford County Hazard Mitigation Plan	• Review of Pipeline and Hazardous Materials Safety Administration data indicates 55 HAZMAT incidents occurred in Guilford County. • Guilford County has record of 5,547 Facility Registry Services Sites in the County. • This update assesses hazardous materials, hazardous chemicals, and oil spills under this hazard.
Infectious Disease	**YES**	• Review of the previous UNC Greensboro Pre-Disaster Mitigation Plan • Review of the NC State Hazard Mitigation Plan.	• Infectious Disease is identified as a hazard in the state plan. • Although the previous UNCG Pre-Disaster Mitigation Plan did not include infectious disease as a hazard, it is assessed in this update to maintain consistency with the NC State Hazard Mitigation Plan • Infectious Disease has caused one of the eighteen disaster declarations in Guilford County
TECHNOLOGICAL HAZARDS			
Violent/Major Crime (Active assailant, Terrorism)	**YES**	• Review of the NC State Hazard Mitigation Plan • Review of previous UNC Greensboro Pre-Disaster Mitigation Plan • Review of local official knowledge	• Although the previous hazard mitigation plan for UNCG did not include violent/major crime as a hazard, it is assessed in this update as a result with UNCG Emergency Management staff.

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?
			• This hazard will assess chemical, biological, radiological, nuclear, and explosive terrorism events.
Radiological Emergency – Fixed Nuclear Facilities	**YES**	• Review of the previous UNC Greensboro Pre-Disaster Mitigation Plan • Review of IAEA list of fixed nuclear power stations in the United States • Discussion with local officials about location of nuclear power stations	• Portions of Guilford County are located within the 50 IPZ for Shearon Harris Nuclear Power Plant. • Although radiological emergencies are not identified in any previous plans, local officials expressed a desire to address them in this plan • 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 50-mile evacuation zone for the Shearon Harris Nuclear Power Plant
Technology System Disruption (Cyber attack/breach, Communication System Disruption)	**YES**	• Discussion with UNCG Emergency Management staff • Review of NC State Hazard Mitigation Plan	• Changing future conditions encourage the assessment of the possibility of a technology system disruption with the increase in global technology
Civil Disturbance/ Unrest	**Yes**	• Discussion with UNCG Emergency Management	• UNCG includes civil disturbance/unrest in their all-hazards emergency management planning

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?
Utility Interruption/ Failure	**Yes**	• Discussion with UNCG Emergency Management	• UNCG includes utility interruption/failure in their all-hazards emergency management planning
Electromagnetic Pulse	**YES**	• Review of NC State Hazard Mitigation Plan	• Changing future conditions encourage the assessment of the possibility of an electromagnetic pulse with the increase in global technology

E.5 Hazard Profiles, Analysis, and Vulnerability

This section includes detailed hazard profiles for each of the hazards identified in the Hazard Identification section as significant enough for further evaluation in the UNC Greensboro Hazard Mitigation Plan. It contains the following subsections:

- E.5.1 Overview
- E.5.2: Drought
- E.5.3 Extreme Temperature
- E.5.4 Hurricane and Coastal Hazards
- E.5.5 Tornadoes/Thunderstorms
- E.5.6 Severe Winter Weather
- E.5.7 Earthquakes
- E.5.8 Geological
- E.5.9 Dam Failure
- E.5.10 Flooding
- E.5.11 Wildfires
- E.5.12 Infectious Disease
- E.5.13 Hazardous Substances
- E.5.14 Radiological Emergency – Fixed Nuclear Facilities
- E.5.15 Terrorism
- E.5.16 Technology System Disruption
- E.5.17 Electromagnetic Pulse
- E.5.18 Conclusions on Hazard Risk
- E.5.19 Final Determinations

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

E.5.1 OVERVIEW

This section includes detailed hazard profiles for each of the hazards identified in the Hazard Identification section as significant enough for further evaluation in the UNC Greensboro 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 Campus Hazard Mitigation Planning Team as it relates to unique historical or anecdotal hazard information as it applies specifically for UNCG.

After reviewing the list of assessed hazards from the previous plan, the UNC Greensboro Campus Hazard Mitigation 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**
  - 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

Much of the information in this section begins with a review of how the hazards impact Guilford County because that is the level at which the most readily-available and best-available information is provided. Where feasible, County-level information is supplemented with campus-specific details.

Natural Hazards

E.5.2 DROUGHT

E.5.2.1 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, 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. It is also notable that drought conditions typically do not cause significant damage to the built environment.

E.5.2.2 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 E.9.**

TABLE E.9: 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 NOAA and the North Carolina Drought Monitor, Guilford County has had drought occurrences in every year in the last nineteen years (2000-2019) (**Table E.10**). The National Center for Environmental Information did not report any drought conditions for Guilford County. 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 E.10: SUMMARY OF DROUGHT OCCURRENCES IN GUILFORD COUNTY (2000-2019)

Year	Guilford County
2000	Severe Drought
2001	Extreme Drought
2002	Exceptional Drought
2003	Abnormally Dry
2004	Abnormally Dry
2005	Severe Drought
2006	Severe Drought
2007	Exceptional Drought
2008	Exceptional Drought
2009	Moderate Drought
2010	Moderate Drought
2011	Severe Drought
2012	Moderate Drought
2013	Abnormally Dry
2014	Abnormally Dry
2015	Moderate Drought
2016	Abnormally Dry
2017	Moderate Drought
2018	Moderate Drought
2019	Moderate Drought

Source: NOAA, Storm and Weather Events Database

E.5.2.3 Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of Guilford County, including the UNC Greensboro campus, 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[2].

[2] *U.S. Seasonal Drought Outlook. National Weather Service Climate Prediction Center. http://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php*

E.5.3 EXTREME TEMPERATURE

E.5.3.1 Location and Spatial Extent

Excessive temperatures typically impact a large area and cannot be confined to any geographic or political boundaries. The entire UNC Greensboro campus is susceptible to extreme temperature conditions.

E.5.3.2 Historical Occurrences

Data from the National Centers for Environmental Information showed that there has been one reported fatality due to excessive heat event in Guilford County. Typical weather conditions in Greensboro, North Carolina, where the campus is located, tend to rise above 79 degrees Fahrenheit. **Table E.11** shows the average maximum temperatures from 2001 to 2019.

TABLE E.11: AVERAGE MAXIMUM TEMPERATURE IN GREENSBORO, NORTH CAROLINA

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
48°F	53°F	61°F	70°F	78°F	85°F	88°F	86°F	80°F	70°F	61°F	51°F

Source: State Climate Office of North Carolina

The highest temperature ever recorded in Greensboro, was 106°F on July 20, 1926. The lowest temperature on record was -8 degrees Fahrenheit (reported on 1/21/1985).[3]

E.5.3.3 Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of Guilford County, including the UNC Greensboro campus, has a probability level of likely (10 to 100 percent annual probability) for future extreme temperature events to impact the region.

E.5.4 HURRICANE AND COASTAL HAZARDS

E.5.4.1 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 UNCG Campus.

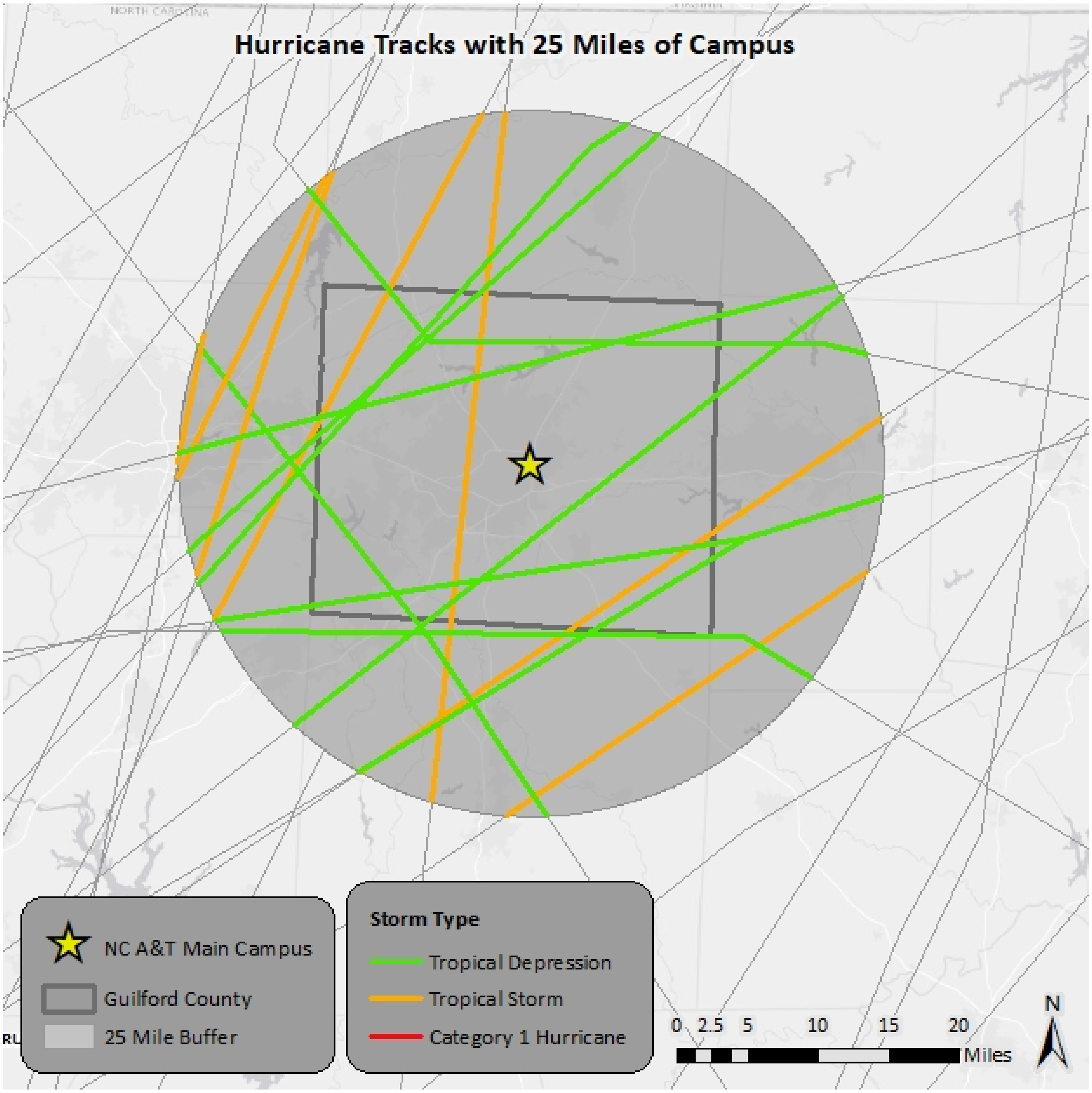
E.5.4.2 Historical Occurrences

According to the National Hurricane Center's historical storm track records, 17 tropical depressions or tropical storm tracks have passed within 25 miles of UNCG campus since 1850[4]. This includes 9 tropical depressions, 8 tropical storms. These storm events are shown in **Figure E.4.** Furthermore, **Table E.12** provides for each event the date of occurrence, name (if applicable), maximum wind speed (as recorded within 25 miles of Guilford County) and Category of the storm based on the Saffir-Simpson Scale.

[3] *http://climate.ncsu.edu/*

[4] 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 E.4: HISTORICAL HURRICANE STORM TRACKS WITHIN 25 MILES OF UNC GREENSBORO



Source: National Oceanic and Atmospheric Administration; National Hurricane Center

TABLE E.12: HISTORICAL STORM TRACKS WITHIN 25 MILES OF UNC GREENSBORO (1850–2018)

Year	Storm Name	Maximum Wind Speed (knots)	Storm Category
1859	UNNAMED	40	Tropical Storm
1863	UNNAMED		Tropical Storm
1878	UNNAMED	60	Tropical Storm
1882	UNNAMED	40	Tropical Storm
1886	UNNAMED	35	Tropical Depression
1893	UNNAMED	65	Tropical Storm
1911	UNNAMED	25	Tropical Depression
1920	UNNAMED	35	Tropical Depression
1928	UNNAMED	30	Tropical Depression
1952	ABLE	40	Tropical Storm
1964	CLEO	25	Tropical Depression
1968	ABBY	25	Tropical Depression
1979	DAVID	45	Tropical Storm
1985	BOB	45	Tropical Storm
1985	DANNY	25	Tropical Depression
1999	DENNIS	30	Tropical Depression
2004	JEANNE	20	Tropical Depression

Source: National Hurricane Center

The National Centers for Environmental Information did record 4 hurricane events and one tropical storm event in Guilford County between 1996 and 2018. Hurricane and tropical storm events have caused 5 disaster declarations in Guilford County. While these were not recorded in the database, effects from these types of storms were likely still felt in other hazards, including thunderstorms and flooding. Flooding is generally the greatest hazard of concern with hurricane and tropical storm events in the area near UNC Greensboro. 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.

E.5.4.3 Probability of Future Occurrences

Given the inland location of the campus, it is more likely to be affected by remnants of hurricane and tropical storm systems (as opposed to a major hurricane) which may result in flooding or high winds. The probability of being impacted is less than coastal areas, but still remains a real threat to UNCG due to induced events like flooding and land sliding. Based on historical evidence, the probability level of future occurrence is likely (between 10 and 100 percent annual probability). However, when the area is impacted, the damage could be severe, threatening lives and property on campus.

E.5.5 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 hailstorms and lightning.

E.5.5.1 Location and Spatial Extent

Tornadoes

Tornadoes occur throughout the state of North Carolina, and thus in the area surrounding UNCG. 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 area surrounding the UNCG campus 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 UNC Greensboro typically experiences several straight-line wind events each year. These wind events can and have caused significant damage. It is assumed that the area surrounding the UNC Greensboro campus 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 all of the area surrounding the UNCG campus is uniformly exposed to severe thunderstorms; therefore, the campus itself is also 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 area surrounding the UNCG campus is uniformly exposed to lightning.

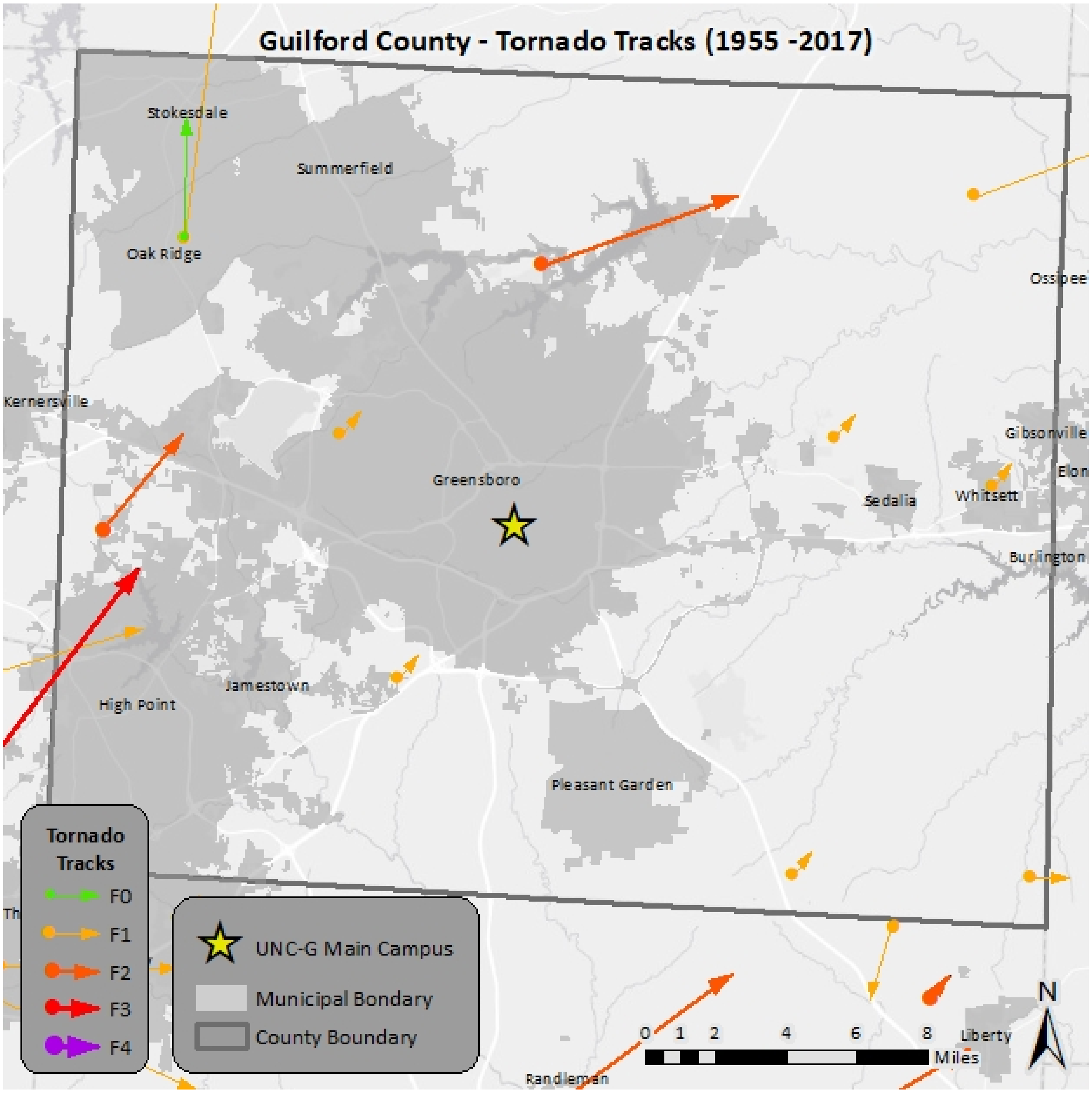
E.5.5.2 Historical Occurrences

Tornadoes

Tornadoes are a somewhat rare occurrence; however, they have and do occur in the area. According to the National Centers for Environmental Information, there have been 14 recorded tornado events in Guilford County since 1954 (**Table E.13**), resulting in over $79.6 million in property damages[5]. In addition, 1 death and 5 injuries were reported. The magnitude of these tornadoes ranges from F0 to F1 in intensity, although an F5 event is possible but not likely. 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. **Figure E.5** shows a map of tornado impact in Guilford County.

[5] 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 Guilford County. As additional local data becomes available, this hazard profile will be amended.

FIGURE E.5: TORNADO TRACKS IN GUILFORD COUNTY (1950 – 2017)



Source: National Centers for Environmental Information

TABLE E.13: HISTORICAL TORNADO IMPACTS IN GUILFORD COUNTY

Location	Date	Magnitude	Deaths / Injuries	Property Damage	Details
Guilford County	6/16/1954	F2	0/1	$2,500	n/a
Guilford County	4/5/1957	F1	0/1	$250,000	n/a
Guilford County	9/29/1959	F1	0/0	$25,000	n/a
Guilford County	6/12/1962	F1	0/0	$2,500	n/a
Guilford County	4/17/1967	F1	0/0	$25,000	n/a
Guilford County	5/14/1967	F1	0/0	$250,000	n/a
Guilford County	10/8/1976	F1	0	$25,000	n/a
Greensboro Arpt	5/7/1998	F1	0/0	$100,000	A tornado touched down approximately 1 mile southeast of the Piedmont-Triad International Airport near Greensboro. The first damage occurred just south of West Friendly Avenue. The tornado moved to the southeast and lifted at Jamestown Road approximately 1.5 miles from its initial touchdown. Damage was rated at F1 initially and F0 at the point it rose back into the thunderstorm. This tornado was produced by the same parent storm that produced the Clemmons tornado less than an hour before this one.
Climax	5/7/1998	F1	0/0	$0	A tornado touched down in extreme southeast Guilford County and tracked to the southeast for approximately 2.5 miles. It moved into extreme northeast Randolph county before lifting about 2 miles north of Liberty. The tornado F1 damage. The exact path stretched from Lake Juno to Liberty Grove Road
Stokesdale	9/17/2004	F1	0/0	$0	A tornado touched down near the intersection of Harrell Road and Lee's Glen Road. The tornado then tracked north across Meadows Drive and Haw Meadows Drive when falling trees caused significant damage to at least three homes, one of which was a total loss. The tornado continued north to Prince Edward Road where about 70 percent of the trees in a heavily wooded area were snapped or downed. In Guilford County, three houses suffered total losses, nine homes sustained major damage, and 52 sustained minor damage.
Oak Ridge	7/7/2005	F0	0/0	$0	A tornado blew down trees from Oak Ridge to Stokesdale.

Location	Date	Magnitude	Deaths / Injuries	Property Damage	Details
Deep River	5/8/2008	EF2	1/3	$4,000,000	The tornado, originally an EF-0, initially touched down just north of Squire Davis Park near the intersection of Sandy Ridge Road and Johnson Street. From there the tornado tracked northeast and intensified to EF-1 intensity as it approached the Farmers Market and Interstate 40. The tornado overturned several cars and tractor trailers as it crossed Interstate 40. As the tornado moved further northeast into an industrial complex, it further strengthened to EF-2 with winds estimated around 130 mph based on damage to warehouses. Numerous warehouses along Little Santee Road, Capital Drive, and West Market Street sustained significant damage. Numerous vehicles and tractor trailers were also overturned in the industrial complex. At its widest point, the tornado was just over 200 yards wide. The tornado quickly lifted off of the ground after crossing West Market Street near the post office. The tornado was on the ground for about four miles. One fatality occurred along West Market Street next to the Lamination Service Building located at 8717 West Market Street. The fatality occurred as a 51-year-old man slept in the rig of his tractor trailer. Three other injuries were reported, two of which occurred in automobiles and another in the I.H. Caffey Warehouse Distribution Center.
High Point	3/28/2010	EF3	0/0	$10,000,000	The tornado initially touched down as an EF1 with winds around 100 mph near Old Plank Road in southwest Guilford County. It was in this area where the Apple Tree Academy sustained significant damage and two vehicles including a small bus were rolled 50 yards across the street. From this point the tornado continued northeast across Highway 311. The next area to experience damage was just north of Highway 311 and south of Old Mill Road along Langdale, Imperial and Impala Drives. Tornado damage in this area continued to indicate EF1 winds with numerous trees down along with a number of homes with roof and siding damage. The tornado intensified to an EF2 as it crossed Old Mill Road towards Johnson Street. The EF2 tornado severely damaged numerous homes along Brandon Drive. EF2 tornado damage continued north of Old Mill Road to Skeet Club Road along either side of Johnson Road with winds around 130 mph for most of its duration but briefly reached EF3 intensity with winds of 138 mph near Hampton Park Drive at 1278 Silverstone Court where the upper level of a two story home was blown off. The tornado finally lifted off the ground north of Kendale Road. In total 603 single family homes were damaged with 21 homes being completely destroyed. Thirty-one multifamily homes were damaged with 16 reported destroyed.

Location	Date	Magnitude	Deaths / Injuries	Property Damage	Details
Greensboro	4/15/2018	EF2	0/0	$65,000,000	The tornado initially touched down on the north side of I-40 near where Willow Road crosses I-40. Damage at this point consisted of snapped trees and was consistent with 90 mph wind speeds, or EF-1 on the Enhanced Fujita Scale. The tornado remained on the ground as it traveled north toward Peeler Elementary School. Numerous homes in this area were damaged along with substantial tree damage. The tornado wind speeds at this location were estimated to be approximately 100 mph. The tornado continued traveling north and reached a peak intensity and maximum path width in the Hampton Community and near Hampton Elementary School. The tornado then continued north-northeast and mostly remained on the ground all the way to the Guilford/Rockingham County line. The tornado appeared to produce minor tree damage (with wind speeds 80 mph or less) just before crossing into Rockingham County. Finally, the aforementioned path length (16 miles) consists of just the Guilford County path. The tornado continued into Rockingham County, and remained on the ground for an additional 17.6 miles.

Source: National Centers for Environmental Information

Thunderstorms

According to NCEI, there have been 328 reported thunderstorm and high wind events since 1956 in Guilford County[6]. These events caused over $1.4 million (2019 dollars) in damages. There were reports of one injury. **Table E.14** summarizes this information.

TABLE E.14: HISTORICAL THUNDERSTORM IMPACTS IN GUILFORD COUNTY

Location	Date	Deaths	Injuries	Property Damage
GUILFORD COUNTY	1956-08-02	0	0	$0
GUILFORD COUNTY	1957-07-17	0	0	$0
GUILFORD COUNTY	1960-05-25	0	0	$0
GUILFORD COUNTY	1962-08-09	0	0	$0
GUILFORD COUNTY	1963-03-19	0	0	$0
GUILFORD COUNTY	1964-07-03	0	0	$0
GUILFORD COUNTY	1964-07-13	0	0	$0
GUILFORD COUNTY	1965-04-27	0	0	$0
GUILFORD COUNTY	1965-07-04	0	0	$0
GUILFORD COUNTY	1966-05-01	0	0	$0
GUILFORD COUNTY	1967-05-29	0	0	$0

[6] 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 Guilford County. As additional local data becomes available, this hazard profile will be amended.

Location	Date	Deaths	Injuries	Property Damage
GUILFORD COUNTY	1967-08-04	0	0	$0
GUILFORD COUNTY	1969-06-24	0	0	$0
GUILFORD COUNTY	1970-07-04	0	0	$0
GUILFORD COUNTY	1971-06-29	0	0	$0
GUILFORD COUNTY	1975-03-24	0	0	$0
GUILFORD COUNTY	1976-02-18	0	0	$0
GUILFORD COUNTY	1976-07-15	0	0	$0
GUILFORD COUNTY	1976-08-14	0	0	$0
GUILFORD COUNTY	1976-08-14	0	0	$0
GUILFORD COUNTY	1979-07-04	0	0	$0
GUILFORD COUNTY	1979-08-21	0	0	$0
GUILFORD COUNTY	1980-08-01	0	0	$0
GUILFORD COUNTY	1980-08-15	0	0	$0
GUILFORD COUNTY	1981-06-06	0	0	$0
GUILFORD COUNTY	1981-07-28	0	0	$0
GUILFORD COUNTY	1982-05-29	0	0	$0
GUILFORD COUNTY	1983-03-06	0	0	$0
GUILFORD COUNTY	1984-07-10	0	0	$0
GUILFORD COUNTY	1984-07-26	0	0	$0
GUILFORD COUNTY	1984-07-26	0	0	$0
GUILFORD COUNTY	1985-06-03	0	0	$0
GUILFORD COUNTY	1985-06-05	0	0	$0
GUILFORD COUNTY	1985-06-05	0	0	$0
GUILFORD COUNTY	1985-07-04	0	0	$0
GUILFORD COUNTY	1985-07-04	0	0	$0
GUILFORD COUNTY	1985-07-10	0	0	$0
GUILFORD COUNTY	1985-10-15	0	0	$0
GUILFORD COUNTY	1985-10-15	0	0	$0
GUILFORD COUNTY	1986-06-28	0	0	$0
GUILFORD COUNTY	1986-07-29	0	0	$0
GUILFORD COUNTY	1986-07-29	0	0	$0
GUILFORD COUNTY	1987-04-15	0	0	$0
GUILFORD COUNTY	1987-06-01	0	0	$0
GUILFORD COUNTY	1987-09-10	0	0	$0
GUILFORD COUNTY	1988-05-10	0	0	$0
GUILFORD COUNTY	1988-05-17	0	0	$0
GUILFORD COUNTY	1988-05-23	0	0	$0
GUILFORD COUNTY	1988-06-26	1	0	$0
GUILFORD COUNTY	1988-07-10	0	0	$0
GUILFORD COUNTY	1988-07-10	0	0	$0
GUILFORD COUNTY	1989-04-26	0	0	$0
GUILFORD COUNTY	1989-05-05	0	0	$0

Location	Date	Deaths	Injuries	Property Damage
GUILFORD COUNTY	1989-05-05	0	0	$0
GUILFORD COUNTY	1989-05-06	0	0	$0
GUILFORD COUNTY	1989-05-06	0	0	$0
GUILFORD COUNTY	1989-05-06	0	0	$0
GUILFORD COUNTY	1989-05-23	0	0	$0
GUILFORD COUNTY	1989-06-16	1	0	$0
GUILFORD COUNTY	1989-06-16	0	0	$0
GUILFORD COUNTY	1989-07-12	0	0	$0
GUILFORD COUNTY	1990-02-10	0	0	$0
GUILFORD COUNTY	1990-05-01	0	0	$0
GUILFORD COUNTY	1990-07-01	0	0	$0
GUILFORD COUNTY	1990-07-11	0	0	$0
GUILFORD COUNTY	1990-08-29	0	0	$0
GUILFORD COUNTY	1990-10-18	0	0	$0
GUILFORD COUNTY	1991-04-09	0	0	$0
GUILFORD COUNTY	1991-04-29	0	0	$0
GUILFORD COUNTY	1991-07-03	0	0	$0
GUILFORD COUNTY	1991-07-03	0	0	$0
GUILFORD COUNTY	1992-03-10	0	0	$0
GUILFORD COUNTY	1992-03-10	0	0	$0
GUILFORD COUNTY	1992-04-24	0	0	$0
GUILFORD COUNTY	1992-08-11	0	0	$0
GUILFORD COUNTY	1992-08-11	0	0	$0
GUILFORD COUNTY	1992-11-22	0	0	$0
Greensboro	1993-08-12	0	0	$0
Greensboro	1993-08-17	0	0	$0
Greensboro	1993-08-26	0	0	$0
Gibsonville	1993-08-26	0	0	$0
Brownes Summit	1995-06-08	0	0	$0
Julian	1995-10-27	0	0	$0
COUNTYWIDE	1996-01-19	0	0	$0
GREENSBORO	1996-04-20	0	0	$0
GREENSBORO	1996-05-11	0	0	$200,000
GREENSBORO	1996-05-24	0	0	$0
GREENSBORO	1997-03-05	0	0	$50,000
CLIMAX	1997-07-16	0	0	$0
SUMMERFIELD	1997-07-28	0	0	$0
GREENSBORO	1997-07-28	0	0	$10,000
GREENSBORO	1998-06-16	0	0	$0
GREENSBORO	1998-06-30	0	1	$0
GREENSBORO	1999-07-07	0	0	$0
PLEASANT GARDEN	2000-03-11	0	0	$0

Location	Date	Deaths	Injuries	Property Damage
HIGH PT	2000-05-20	0	0	$0
GIBSONVILLE	2000-05-20	0	0	$0
GREENSBORO ARPT	2000-05-25	0	0	$0
HIGH PT	2000-05-25	0	0	$0
GREENSBORO	2000-05-25	0	0	$0
SUMMERFIELD	2000-06-15	0	0	$0
JAMESTOWN	2000-06-15	0	0	$0
OAK RIDGE	2000-06-15	0	0	$0
GREENSBORO	2000-08-10	0	0	$0
GIBSONVILLE	2000-08-18	0	0	$0
STOKESDALE	2000-09-14	0	0	$0
GREENSBORO ARPT	2000-09-14	0	0	$0
PLEASANT GARDEN	2001-05-22	0	0	$0
SUMMERFIELD	2002-05-13	0	0	$0
GREENSBORO	2002-06-01	0	0	$0
GREENSBORO	2003-06-27	0	0	$0
GREENSBORO	2003-06-27	0	0	$0
SEDALIA	2003-07-13	0	0	$0
COLFAX	2003-08-17	0	0	$0
STOKESDALE	2004-08-12	0	0	$0
HIGH PT	2005-03-08	0	0	$0
SEDALIA	2005-03-08	0	0	$0
MONTICELLO	2005-07-13	0	0	$0
GREENSBORO	2006-04-03	0	0	$0
HIGH PT	2006-04-17	0	0	$0
GREENSBORO	2006-04-17	0	0	$0
HIGH PT	2006-04-17	0	0	$0
CLIMAX	2006-05-18	0	0	$0
GREENSBORO	2006-06-11	0	0	$0
GREENSBORO	2006-06-11	0	0	$0
GREENSBORO	2006-06-11	0	0	$0
GREENSBORO	2006-06-11	0	0	$0
GREENSBORO	2006-06-11	0	0	$0
OAK RIDGE	2006-07-04	0	0	$0
JAMESTOWN	2006-07-14	0	0	$0
MC LEANSVILLE	2006-07-19	0	0	$0
HIGH PT	2006-07-19	0	0	$0
JAMESTOWN	2006-07-19	0	0	$0
GIBSONVILLE	2006-07-20	0	0	$0
JAMESTOWN	2006-07-22	0	0	$0
SUMMERFIELD	2006-07-28	0	0	$0
GREENSBORO	2006-08-03	0	0	$0

Location	Date	Deaths	Injuries	Property Damage
PLEASANT GARDEN	2006-08-07	0	0	$0
GREENSBORO	2006-08-30	0	0	$0
SUMMERFIELD	2006-08-30	0	0	$0
GREENSBORO	2006-09-28	0	0	$0
GREENSBORO	2006-11-16	0	0	$0
GREENSBORO	2007-04-15	0	0	$0
GREENSBORO	2007-06-04	0	0	$0
GREENSBORO	2007-06-04	0	0	$0
GREENSBORO	2007-06-04	0	0	$0
GREENSBORO	2007-06-05	0	0	$0
GIBSONVILLE	2007-06-11	0	0	$0
STOKESDALE	2007-06-19	0	0	$0
MC LEANSVILLE	2007-06-27	0	0	$0
GIBSONVILLE	2007-06-27	0	0	$0
STOKESDALE	2007-06-27	0	0	$0
OAK RIDGE ARPT	2007-06-27	0	0	$0
STOKESDALE	2007-08-21	0	0	$0
GREENSBORO	2007-08-21	0	0	$0
GUILFORD	2008-03-04	0	0	$0
DEEP RIVER	2008-03-04	0	0	$0
HAMILTON LAKES	2008-03-04	0	0	$0
(GSO)GREENSBORO RGNL	2008-05-08	0	0	$0
MONTICELLO	2008-05-08	0	0	$0
GREENSBORO MAY ARPT	2008-06-23	0	0	$0
PLEASANT GARDEN	2008-07-08	0	0	$0
COLFAX	2009-05-06	0	0	$0
PLEASANT GARDEN	2009-05-09	0	0	$0
RUDD	2009-06-03	0	0	$0
HAMILTON LAKES	2009-06-03	0	0	$0
DEEP RIVER	2009-06-03	0	0	$0
GREENSBORO	2009-06-03	0	0	$0
GUILQUARRY	2009-06-10	0	0	$0
HIGH PT	2009-07-13	0	0	$15,000
CLIMAX	2009-08-05	0	0	$0
BRIGHTWOOD	2009-08-20	0	0	$0
BROWNS SUMMIT	2009-09-28	0	0	$0
BROWNS SUMMIT	2009-09-28	0	0	$0
COLFAX	2010-04-08	0	0	$0
POMONA	2010-06-14	0	0	$1,000
PINECROFT	2010-06-14	0	0	$0

Location	Date	Deaths	Injuries	Property Damage
SCALESVILLE	2010-06-15	0	0	$0
GREENSBORO MAY ARPT	2010-06-15	0	0	$0
HAMILTON LAKES	2010-06-16	0	0	$0
PLEASANT GARDEN	2010-06-23	0	0	$5,000
SUMMERFIELD	2010-06-24	0	0	$0
SUMMERFIELD	2010-06-24	0	0	$10,000
GUILFORD	2010-07-13	0	0	$0
DEEP RIVER	2010-07-16	0	0	$5,000
PLEASANT GARDEN	2010-07-20	0	0	$0
HILL TOP	2010-08-05	0	0	$0
GREENSBORO ARPT	2010-08-11	0	0	$0
COLFAX	2010-11-16	0	0	$0
HIGH PT	2011-04-05	0	0	$250,000
PLEASANT GARDEN	2011-04-28	0	0	$0
BESSEMER	2011-04-28	0	0	$0
HILLSDALE	2011-04-28	0	0	$0
MONTICELLO	2011-04-28	0	0	$0
GREENSBORO MAY ARPT	2011-05-26	0	0	$0
OAK RIDGE	2011-05-26	0	0	$0
OAK RIDGE	2011-05-27	0	0	$0
MC LEANSVILLE	2011-06-11	0	0	$0
HILLSDALE	2011-06-18	0	0	$0
GREENSBORO MAY ARPT	2011-06-18	0	0	$0
BESSEMER	2011-06-22	0	0	$0
GREENSBORO	2011-06-22	0	0	$0
DEEP RIVER	2011-06-28	0	0	$0
SEDALIA	2011-07-04	0	0	$0
COLFAX	2011-07-24	0	0	$0
SUMMERFIELD	2011-07-24	0	0	$0
WHITSETT	2011-08-14	0	0	$0
GUILQUARRY	2012-02-22	0	0	$0
GREENSBORO MAY ARPT	2012-02-22	0	0	$0
BATTLE GROUND	2012-02-24	0	0	$0
GREENSBORO ARHRBR AR	2012-03-24	0	0	$0
HIGH PT	2012-06-01	0	0	$0
TERRA COTTA	2012-06-01	0	0	$15,000
BATTLE GROUND	2012-06-22	0	0	$0

Location	Date	Deaths	Injuries	Property Damage
CLIMAX	2012-07-20	0	0	$0
WHITSETT	2012-07-21	0	0	$0
GBSNVLL MC LEAN ARPT	2012-08-08	0	0	$0
BATTLE GROUND	2012-09-02	0	0	$0
PINECROFT	2012-09-02	0	0	$0
GIBSONVILLE	2012-09-02	0	0	$0
OAK RIDGE ARPT	2012-09-08	0	0	$0
HILLSDALE	2012-10-18	0	0	$0
DEEP RIVER	2013-01-30	0	0	$500
GROOMTOWN	2013-04-19	0	0	$500
OAK RIDGE ARPT	2013-04-19	0	0	$0
GUILFORD	2013-06-10	0	0	$0
GUILQUARRY	2013-06-13	0	1	$200,000
BATTLE GROUND	2013-06-25	0	0	$0
SEDGEFIELD	2013-06-28	0	0	$2,000
GREENSBORO	2013-07-21	0	0	$0
OAK RIDGE ARPT	2013-08-10	0	0	$0
OAK RIDGE	2013-08-10	0	0	$1,000
OAK RIDGE	2013-08-10	0	0	$1,000
SEDGEFIELD	2013-08-10	0	0	$0
VANDALIA	2013-09-01	0	0	$1,000
HAMILTON LAKES	2014-02-21	0	0	$3,000
(GSO)GREENSBORO RGNL	2014-03-12	0	0	$5,000
HAMILTON LAKES	2014-06-10	0	0	$1,000
BRIGHTWOOD	2014-06-16	0	0	$0
GUILQUARRY	2014-06-19	0	0	$0
OAK RIDGE	2014-06-19	0	0	$0
HIGH PT	2014-06-19	0	0	$0
HIGH PT	2014-06-19	0	0	$0
BATTLE GROUND	2014-09-16	0	0	$0
HILLSDALE	2015-04-20	0	0	$0
DEEP RIVER	2015-06-30	0	0	$25,000
MC LEANSVILLE	2015-06-30	0	0	$0
(GSO)GREENSBORO RGNL	2015-07-13	0	0	$0
HIGH PT	2015-08-05	0	0	$4,000
SEDGEFIELD	2015-08-05	0	0	$0
JAMESTOWN	2015-08-05	0	0	$0
PLEASANT GARDEN	2015-08-05	0	0	$0
VANDALIA	2015-08-05	0	0	$0

Location	Date	Deaths	Injuries	Property Damage
GREENSBORO MAY ARPT	2015-08-05	0	0	$0
SEDGEFIELD	2016-02-24	0	0	$0
GUILFORD	2016-05-02	0	0	$5,000
BATTLE GROUND	2016-05-02	0	0	$0
GUILFORD	2016-05-02	0	0	$25,000
HIGH PT	2016-05-03	0	0	$5,000
GREENSBORO MAY ARPT	2016-05-12	0	0	$1,000
SUMMERFIELD	2016-05-21	0	0	$2,000
OSCEOLA	2016-06-24	0	0	$500
BATTLE GROUND	2016-07-08	0	0	$0
COLFAX	2016-07-08	0	0	$0
GUILQUARRY	2016-07-27	0	0	$5,000
COLFAX	2016-07-27	0	0	$0
FOUR MILE	2016-08-27	0	0	$2,500
VANDALIA	2016-08-27	0	0	$0
GREENSBORO	2017-05-05	0	0	$0
BATTLE GROUND	2017-05-05	0	0	$10,000
MONTICELLO	2017-05-05	0	0	$10,000
BROWNS SUMMIT	2017-05-05	0	0	$100,000
TERRA COTTA	2017-05-05	0	0	$0
HILLSDALE	2017-05-05	0	0	$10,000
OSCEOLA	2017-05-31	0	0	$2,000
GUILQUARRY	2017-06-13	0	0	$10,000
GUILFORD	2017-06-13	0	0	$3,000
BATTLE GROUND	2017-06-14	0	0	$5,000
ALLEN JAY	2017-06-18	0	0	$500
PINECROFT	2017-06-18	0	0	$0
MC LEANSVILLE	2017-07-13	0	0	$5,000
HILL TOP	2017-07-23	0	0	$5,000
GIBSONVILLE	2018-06-20	0	0	$50,000
BESSEMER	2018-07-06	0	0	$0
SEDALIA	2018-07-06	0	0	$2,500
OAK RIDGE ARPT	2018-07-21	0	0	$0
SUMMERFIELD	2018-07-21	0	0	$0
MONTICELLO	2018-07-22	0	0	$2,500
MC LEANSVILLE	2018-08-07	0	0	$0
BROADVIEW	2018-09-01	0	0	$1,500
GREENSBORO	2018-09-01	0	0	$0
HIGH PT	2019-04-12	0	0	$2,000
BESSEMER	2019-04-12	0	0	$3,000

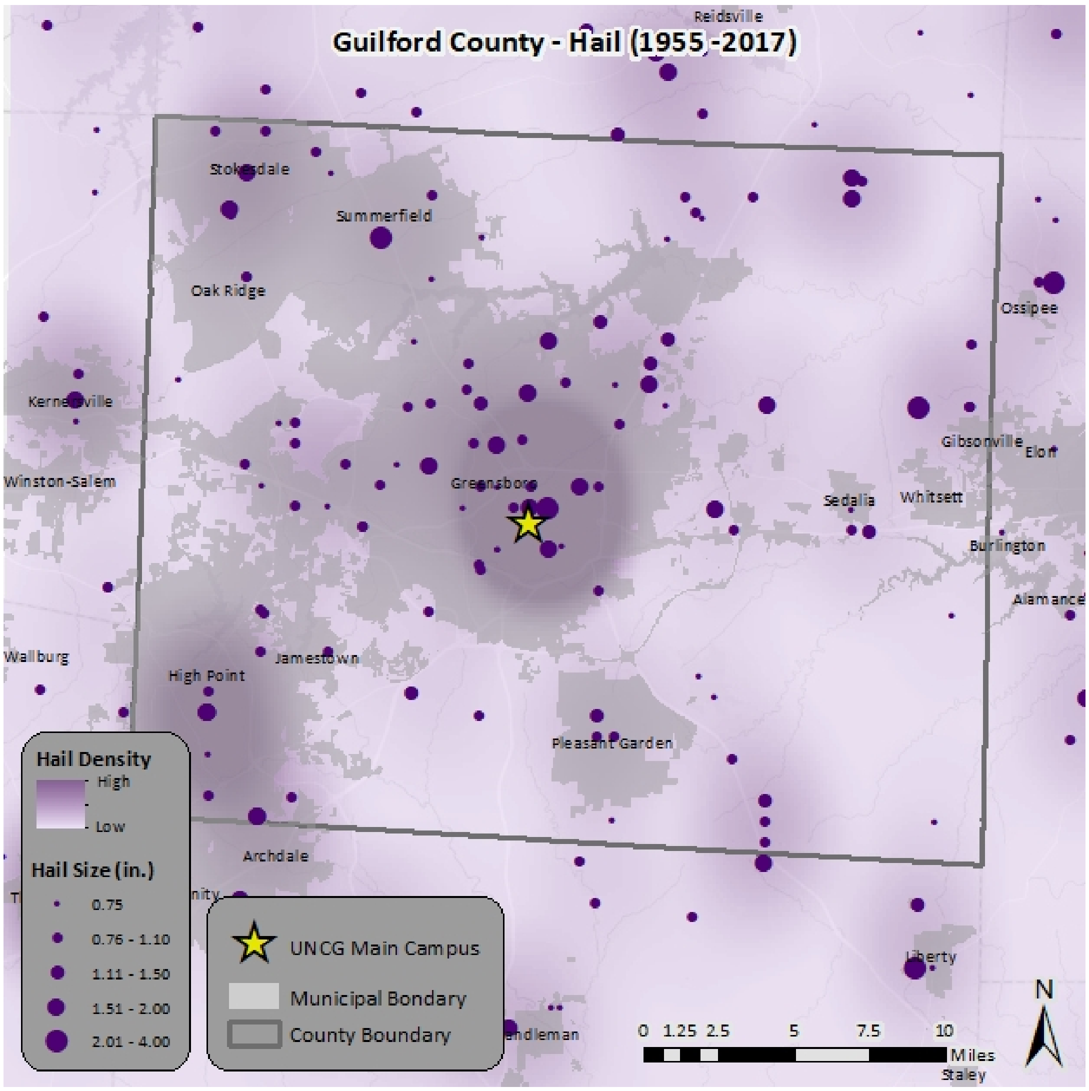
Location	Date	Deaths	Injuries	Property Damage
OAK RIDGE	2019-04-15	0	0	$4,000
JAMESTOWN	2019-04-19	0	0	$0
GREENSBORO	2019-04-19	0	0	$0
SCALESVILLE	2019-04-19	0	0	$0
SCALESVILLE	2019-04-19	0	0	$0
FOUR MILE	2019-05-31	0	0	$10,000
TERRA COTTA	2019-05-31	0	0	$3,000
SUMMERFIELD	2019-06-20	0	0	$2,500
HILLSDALE	2019-06-20	0	0	$0
GUILFORD	2019-06-20	0	0	$1,500
BROWNS SUMMIT	2019-06-20	0	0	$0
BROADVIEW	2019-06-20	0	0	$10,000
BESSEMER	2019-06-20	0	0	$0
BROADVIEW	2019-06-20	0	0	$0
BROADVIEW	2019-06-20	0	0	$10,000
BATTLE GROUND	2019-07-23	0	0	$0
KOONTZVILLE	2019-08-01	0	0	$15,000
TERRA COTTA	2019-08-01	0	0	$0
HAMILTON LAKES	2019-08-19	0	0	$3,000
SCALESVILLE	2019-08-21	0	0	$0
GREENSBORO ARHRBR AR	2019-08-21	0	0	$0
RUDD	2019-08-21	0	0	$0
TERRA COTTA	2019-08-21	0	0	$0
MC LEANSVILLE	2019-08-21	0	0	$10,000
(GSO)GREENSBORO RGNL	2019-08-22	0	0	$0
SUMMERFIELD	2019-08-22	0	0	$35,000
GREENSBORO	2019-10-31	0	0	$20,000
BATTLE GROUND	2019-10-31	0	0	$0
BATTLE GROUND	2019-10-31	0	0	$25,000
GROOMTOWN	2019-10-31	0	0	$10,000
PLEASANT GARDEN	2019-10-31	0	0	$0
CLIMAX	2019-10-31	0	0	$0
HILLSDALE	2020-01-11	0	0	$10,000
POMONA	2020-01-11	0	0	$5,000
(GSO)GREENSBORO RGNL	2020-02-06	0	0	$200,000

Source: National Center for Environmental Information

Hailstorms

According to the National Centers for Environmental Information, 70 recorded hailstorm events have affected Guilford County since 1967 summarized in **Table E.15.** [7] In all, hail occurrences resulted in over $1,750 (2020 dollars) in property damages. Hail ranged in diameter from 0.75 inches to 2.75 inches. It should be noted that hail is notorious for causing substantial damage to cars, roofs, and other areas of the built environment that may not be reported to the National Centers for Environmental Information. **Figure E.6** shows a map of hailstorm occurrences in Guilford County.

FIGURE E.6: HAIL OCCURANCES IN GUILFORD COUNTY



Source: National Centers for Environmental Information

[7] 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 Guilford County. 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 E.15: HISTORICAL HAIL OCCURANCES IN GUILFORD COUNTY

Location	Date	Magnitude (in)	Deaths	Injuries	Property Damage*
GUILFORD COUNTY	1967-08-07	0.75 "	0	0	$0
GUILFORD COUNTY	1978-06-22	1.00 "	0	0	$0
GUILFORD COUNTY	1979-08-21	1.00 "	0	0	$0
GUILFORD COUNTY	1982-04-27	1.00 "	0	0	$0
GUILFORD COUNTY	1982-05-29	1.75 "	0	0	$0
GUILFORD COUNTY	1983-04-02	2.75 "	0	0	$0
GUILFORD COUNTY	1984-04-14	1.75 "	0	0	$0
GUILFORD COUNTY	1984-05-06	1.75 "	0	0	$0
GUILFORD COUNTY	1985-05-15	0.75 "	0	0	$0
GUILFORD COUNTY	1985-05-22	2.50 "	0	0	$0
GUILFORD COUNTY	1985-06-03	1.00 "	0	0	$0
GUILFORD COUNTY	1985-06-05	1.25 "	0	0	$0
GUILFORD COUNTY	1985-06-05	1.00 "	0	0	$0
GUILFORD COUNTY	1987-04-12	1.75 "	0	0	$0
GUILFORD COUNTY	1987-06-01	1.75 "	0	0	$0
GUILFORD COUNTY	1988-05-16	0.75 "	0	0	$0
GUILFORD COUNTY	1988-05-17	0.75 "	0	0	$0
GUILFORD COUNTY	1988-05-17	0.75 "	0	0	$0
GUILFORD COUNTY	1988-05-17	0.75 "	0	0	$0
GUILFORD COUNTY	1988-05-17	1.00 "	0	0	$0
GUILFORD COUNTY	1988-06-21	0.75 "	0	0	$0
GUILFORD COUNTY	1988-07-10	1.75 "	0	0	$0
GUILFORD COUNTY	1989-04-27	0.75 "	0	0	$0
GUILFORD COUNTY	1989-06-02	1.00 "	0	0	$0
GUILFORD COUNTY	1990-05-01	1.00 "	0	0	$0
GUILFORD COUNTY	1990-05-01	1.00 "	0	0	$0
GUILFORD COUNTY	1990-05-27	1.00 "	0	0	$0
GUILFORD COUNTY	1990-05-27	1.75 "	0	0	$0
GUILFORD COUNTY	1990-07-01	1.75 "	0	0	$0
GUILFORD COUNTY	1992-04-30	0.75 "	0	0	$0
GUILFORD COUNTY	1992-06-26	0.75 "	0	0	$0
High Point	1994-08-27	0.75 "	0	0	$0
Julian	1995-10-27	1.50 "	0	0	$0
JULIAN	1996-05-29	1.75 "	0	0	$0
HIGH POINT	1996-07-18	0.75 "	0	0	$0
GREENSBORO	1996-09-13	0.75 "	0	0	$0
JULIAN	1996-10-18	0.75 "	0	0	$0
GREENSBORO	1997-03-05	0.75 "	0	0	$0
STOKESDALE	1997-07-24	1.00 "	0	0	$0

Location	Date	Magnitude (in)	Deaths	Injuries	Property Damage*
GREENSBORO	1997-08-25	0.75 "	0	0	$0
GIBSONVILLE	1998-04-03	0.75 "	0	0	$0
HIGH PT	1998-04-17	0.88 "	0	0	$0
MONTICELLO	1998-05-01	0.75 "	0	0	$0
HIGH PT	1998-05-07	0.88 "	0	0	$0
GREENSBORO	1998-05-20	1.75 "	0	0	$0
GUILFORD	1998-05-20	1.00 "	0	0	$0
GREENSBORO	1998-05-26	0.75 "	0	0	$0
GREENSBORO	1998-06-15	0.75 "	0	0	$0
HIGH PT	2000-06-03	1.75 "	0	0	$0
SUMMERFIELD	2000-08-18	2.50 "	0	0	$0
OAK RIDGE	2001-05-12	0.88 "	0	0	$0
GREENSBORO	2001-05-25	1.00 "	0	0	$0
GREENSBORO	2001-05-25	1.00 "	0	0	$0
PLEASANT GARDEN	2002-07-01	1.50 "	0	0	$0
HIGH PT	2002-07-02	0.88 "	0	0	$0
STOKESDALE	2002-07-03	1.75 "	0	0	$0
GREENSBORO	2002-07-04	0.88 "	0	0	$0
GREENSBORO	2002-07-04	0.75 "	0	0	$0
JAMESTOWN	2003-04-26	0.88 "	0	0	$0
GREENSBORO	2003-04-26	1.25 "	0	0	$0
HIGH PT	2003-04-30	0.75 "	0	0	$0
HIGH PT	2003-05-02	0.75 "	0	0	$0
GREENSBORO	2003-05-31	1.00 "	0	0	$0
SUMMERFIELD	2003-07-13	0.88 "	0	0	$0
STOKESDALE	2003-07-19	0.88 "	0	0	$0
GREENSBORO	2003-08-05	0.75 "	0	0	$0
GREENSBORO	2003-08-22	0.88 "	0	0	$0
GREENSBORO	2004-05-09	0.75 "	0	0	$0
GIBSONVILLE	2004-05-23	0.88 "	0	0	$0
HIGH PT	2004-07-04	0.75 "	0	0	$0
HIGH PT	2004-07-17	1.00 "	0	0	$0
OAK RIDGE	2005-03-23	1.00 "	0	0	$0
GREENSBORO	2005-03-23	1.75 "	0	0	$0
SEDALIA	2005-09-20	0.75 "	0	0	$0
SUMMERFIELD	2005-10-21	0.75 "	0	0	$0
GREENSBORO	2006-04-03	0.75 "	0	0	$0
GREENSBORO	2006-05-14	0.88 "	0	0	$0
GREENSBORO	2006-05-14	0.88 "	0	0	$0
GIBSONVILLE	2006-05-14	0.88 "	0	0	$0
GREENSBORO	2006-05-14	0.88 "	0	0	$0

Location	Date	Magnitude (in)	Deaths	Injuries	Property Damage*
GREENSBORO	2006-05-14	1.00 "	0	0	$0
GIBSONVILLE	2006-05-14	0.88 "	0	0	$0
GREENSBORO	2006-05-14	1.00 "	0	0	$0
GREENSBORO	2006-05-14	0.88 "	0	0	$0
HIGH PT	2006-05-14	1.00 "	0	0	$0
GREENSBORO	2006-05-14	1.75 "	0	0	$0
GREENSBORO	2006-05-14	1.75 "	0	0	$0
GREENSBORO	2006-05-15	0.75 "	0	0	$0
GREENSBORO	2006-05-26	1.00 "	0	0	$0
HIGH PT	2006-06-08	0.75 "	0	0	$0
GREENSBORO	2006-06-11	0.75 "	0	0	$0
STOKESDALE	2006-06-11	0.75 "	0	0	$0
STOKESDALE	2006-06-11	0.75 "	0	0	$0
GREENSBORO	2006-06-11	1.50 "	0	0	$0
GREENSBORO	2006-06-11	0.75 "	0	0	$0
MC LEANSVILLE	2006-06-23	1.75 "	0	0	$0
GREENSBORO	2006-06-23	0.88 "	0	0	$0
HIGH PT	2006-06-23	0.88 "	0	0	$0
GREENSBORO	2006-06-23	1.00 "	0	0	$0
GREENSBORO	2006-06-23	1.00 "	0	0	$0
GREENSBORO	2006-06-23	0.75 "	0	0	$0
STOKESDALE	2006-07-04	1.00 "	0	0	$0
PLEASANT GARDEN	2006-08-07	0.75 "	0	0	$0
HIGH PT	2006-08-30	1.00 "	0	0	$0
GREENSBORO	2006-08-30	0.75 "	0	0	$0
HIGH PT	2006-08-30	0.75 "	0	0	$0
GREENSBORO	2006-09-28	0.88 "	0	0	$0
STOKESDALE	2006-09-28	0.75 "	0	0	$0
SUMMERFIELD	2006-09-28	0.75 "	0	0	$0
GREENSBORO	2007-04-15	0.88 "	0	0	$0
GREENSBORO	2007-06-27	0.75 "	0	0	$0
GREENSBORO	2007-06-27	0.75 "	0	0	$0
CLIMAX	2008-03-04	0.75 "	0	0	$0
GREENSBORO MAY ARPT	2008-03-04	0.75 "	0	0	$0
COLFAX	2008-03-04	0.75 "	0	0	$0
HIGH PT	2008-04-20	1.00 "	0	0	$0
BROWNS SUMMIT	2008-05-08	0.75 "	0	0	$0
BATTLE GROUND	2008-05-08	1.75 "	0	0	$0
BROWNS SUMMIT	2008-05-09	0.75 "	0	0	$0
SHERWOOD VLG	2008-05-20	0.88 "	0	0	$0

Location	Date	Magnitude (in)	Deaths	Injuries	Property Damage*
BATTLE GROUND	2008-05-31	0.75 "	0	0	$0
SUMMERFIELD	2008-05-31	0.75 "	0	0	$0
BATTLE GROUND	2008-05-31	0.88 "	0	0	$0
GUILFORD	2008-05-31	1.00 "	0	0	$0
BATTLE GROUND	2008-05-31	0.88 "	0	0	$0
PINECROFT	2008-05-31	1.00 "	0	0	$0
BATTLE GROUND	2008-05-31	1.25 "	0	0	$0
BATTLE GROUND	2008-05-31	1.00 "	0	0	$0
GREENSBORO	2008-05-31	1.00 "	0	0	$0
GUILFORD	2008-06-22	0.75 "	0	0	$0
BATTLE GROUND	2008-06-22	0.75 "	0	0	$0
HAMILTON LAKES	2008-06-22	0.88 "	0	0	$0
HAMILTON LAKES	2008-06-22	0.88 "	0	0	$0
WHITSETT	2008-06-22	0.75 "	0	0	$0
PLEASANT GARDEN	2009-05-09	0.88 "	0	0	$0
BATTLE GROUND	2009-06-03	1.00 "	0	0	$0
BROADVIEW	2009-06-03	0.75 "	0	0	$0
BESSEMER	2009-06-03	1.00 "	0	0	$0
CLIMAX	2009-06-09	1.00 "	0	0	$0
OAK RIDGE ARPT	2009-07-20	1.75 "	0	0	$0
HILLSDALE	2009-07-20	0.75 "	0	0	$0
GREENSBORO	2009-08-19	0.75 "	0	0	$0
BROWNS SUMMIT	2010-03-28	1.00 "	0	0	$1,250
DEEP RIVER	2010-05-15	1.00 "	0	0	$0
DEEP RIVER	2010-05-15	1.00 "	0	0	$0
VANDALIA	2010-05-15	1.00 "	0	0	$0
GREENSBORO ARPT	2011-04-27	0.75 "	0	0	$0
HAMILTON LAKES	2011-04-27	0.75 "	0	0	$0
GREENSBORO ARPT	2011-04-27	0.88 "	0	0	$0
BROWNS SUMMIT	2011-06-09	1.50 "	0	0	$0
FOUR MILE	2011-09-27	1.00 "	0	0	$0
GREENSBORO ARPT	2012-03-24	1.00 "	0	0	$0
GROOMTOWN	2012-03-24	1.00 "	0	0	$0
CLIMAX	2012-03-24	1.00 "	0	0	$0
GREENSBORO	2012-06-01	1.75 "	0	0	$0
PINECROFT	2012-06-01	1.00 "	0	0	$0
PLEASANT GARDEN	2013-04-19	1.00 "	0	0	$0
POMONA	2013-06-25	1.75 "	0	0	$500
GROOMTOWN	2014-06-10	1.25 "	0	0	$0
KOONTZVILLE	2014-06-16	1.25 "	0	0	$0
BRIGHTWOOD	2014-06-16	1.75 "	0	0	$0

Location	Date	Magnitude (in)	Deaths	Injuries	Property Damage*
BRIGHTWOOD	2014-06-16	1.25 "	0	0	$0
BRIGHTWOOD	2014-06-16	1.50 "	0	0	$0
BROADVIEW	2014-06-16	1.00 "	0	0	$0
OAK RIDGE ARPT	2015-04-20	1.00 "	0	0	$0
SCALESVILLE	2016-04-28	1.00 "	0	0	$0
GREENSBORO ARPT	2016-05-02	0.88 "	0	0	$0
GUILFORD	2016-05-02	0.88 "	0	0	$0
(GSO)GREENSBORO RGNL	2016-05-02	1.00 "	0	0	$0
GUILFORD	2016-05-02	1.00 "	0	0	$0
GUILQUARRY	2016-05-12	1.00 "	0	0	$0
GUILQUARRY	2016-06-29	1.00 "	0	0	$0
OSCEOLA	2016-09-28	1.00 "	0	0	$0
GREENSBORO	2016-09-28	1.75 "	0	0	$0
SEDALIA	2016-09-28	1.00 "	0	0	$0
SEDALIA	2016-09-28	1.25 "	0	0	$0
CLIMAX	2017-04-06	1.00 "	0	0	$0
GUILFORD	2019-05-31	0.88 "	0	0	$0
(GSO)GREENSBORO RGNL	2019-05-31	1.75 "	0	0	$0
HAMILTON LAKES	2019-05-31	1.25 "	0	0	$0

Source: National Centers for Environmental Information

Lightning

According to the National Centers for Environmental Information, there have been a total of 9 recorded lightning events in Guilford County since 1994[8]. These events resulted in nearly $2.1 million (2019 dollars) in damages, as listed in summary **Table E.16**. Furthermore, lightning caused one injury in the County.

It is certain that more than 9 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.

[8] 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 Guilford County. The State Fire Marshall's office was also contacted for additional information but none could be provided. As additional local data becomes available, this hazard profile will be amended.

TABLE E.16: HISTORICAL LIGHTNING IMPACTS IN GUILFORD COUNTY

Location	Date	Deaths	Injuries	Property Damage*	Details
OAK RIDGE	1997-07-28	0	0	$0	Lightning hit a home in Oak Ridge. No damage details were available
GREENSBORO	2002-03-26	0	0	$220,000	Lightning started a fire that destroyed the third floor of a home
SEDGEFIELD	2002-05-01	0	0	$300,000	A lightning strike started a fire that severely damaged a historic home.
OAK RIDGE	2002-06-26	0	0	$5,000	At least four house fires were started by lightning strikes in the Oak Ridge area.
HIGH PT	2002-07-01	0	0	$7,000	A lightning strike caused minor damage to a public library.
HAMILTON LAKES	2010-06-12	0	0	$1,500,000	Lightning struck a large fuel tank at the Colonial Pipeline gasoline tank farm resulting in a large fire destroying the tank and resulting in the closure of Interstate 40 for four hours. The tank contained 840,00 gallons of gasoline at the time of fire.
(GSO)GREENSBORO RGNL	2010-06-16	0	0	$100,000	Lightning struck the runway of the Piedmont Triad International Airport creating a hole two feet wide and 18 inches deep in the runway.
DEEP RIVER	2010-08-11	0	0	$15,000	A home on Windstream Court in High Point sustained roof damage due to a lightning strike. The damages were estimated.
BESSEMER	2010-08-11	0	0	$400	A lightning strike damaged an outbuilding at 3865 Arbor Drive in Greensboro. The damage was estimated at $300 and the content loss was $100.

Source: National Centers for Environmental Information

E.5.5.3 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 UNC Greensboro experience a direct tornado strike. The probability of future tornado occurrences affecting UNC Greensboro 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 UNC Greensboro 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 Guilford County 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), UNCG 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 are 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.

E.5.6 SEVERE WINTER WEATHER

E.5.6.1 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 UNC Greensboro 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.

E.5.6.2 Historical Occurrences

Winter weather has resulted in four disaster declarations Guilford County. This includes one severe snowfall and winter storm in 1993, the Blizzard of 1996, one subsequent 1996 winter storm, and a severe winter storm and flooding event in 2010. According to the National Centers for Environmental Information, there have been a total of 43 recorded winter storm events Guilford County since 1996 (**Table E.17**)[9]. These events resulted in $570,000 (2020 dollars) in damages.

TABLE E.17: WINTER STORM EVENTS IN GUILFORD COUNTY

Date	Deaths	Injuries	Property Damage	Description
1997-01-08	0	0	$0	n/a
1997-02-13	0	0	$0	n/a
1997-12-29	0	0	$0	n/a
2000-01-18	0	0	$0	n/a
2000-01-20	0	0	$0	n/a
2000-01-22	0	0	$0	n/a
2000-01-24	0	0	$0	n/a
2000-01-28	0	0	$0	n/a

[9] These ice and winter storm events are only inclusive of those reported by the National Centers for Environmental Information (NCEI). It is likely that additional winter storm conditions have affected Guilford County.

Date	Deaths	Injuries	Property Damage	Description
2001-02-12	0	0	$0	n/a
2002-01-03	0	0	$0	n/a
2002-01-06	0	0	$0	n/a
2002-12-04	0	0	$0	n/a
2003-02-16	0	0	$0	n/a
2003-02-27	0	0	$0	n/a
2003-12-13	0	0	$0	n/a
2004-01-26	0	0	$0	n/a
2004-02-15	0	0	$0	n/a
2004-02-26	0	0	$0	n/a
2005-01-30	0	0	$0	n/a
2005-12-15	0	0	$0	n/a
2007-01-18	0	0	$0	n/a
2007-01-21	0	0	$0	n/a
2007-12-07	1	0	$20,000	Light freezing rain during the early morning hours just prior to sunrise resulted in several automobile accidents from black ice on numerous bridges. A 40-year-old male was killed in a multi vehicle accident on Highway 421 just south of Greensboro. The accident was the result of black ice which formed on an overpass.
2008-01-17	0	0	$0	Between one to two inches of snow accumulated countywide mostly before daybreak.
2008-02-13	0	0	$0	Between one to three inches of snow fell across Guilford County between 6pm and midnight.
2009-01-22	0	0	$0	Between 1 to 2 inches of snow fell across the county resulting in the closing of local schools.
2009-02-03	0	0	$0	Around one inches of snow fell across the county around the time of evening rush hour.
2009-03-01	0	0	$0	Between five to six inches of snow fell countywide. Several automobile accidents were reported the mornings following the storm due to the re-freezing of the melting snow overnight.
2009-12-18	0	0	$0	Between 3 to 7 inches of snow fell across Guilford county and Greensboro and High point. Many primary roads including Highway 220, Highway 311 and western portions Interstate 40 became impassible during the evening. Law enforcement responded to hundreds of automobile accidents.
2009-12-30	0	0	$0	Light freezing rain was reported across the area resulting in a light coating of ice on elevated surfaces such as trees, bushes and power lines. Area roads remained clear.

Date	Deaths	Injuries	Property Damage	Description
2010-01-29	0	0	$0	Between 6 to 8 inches of snow fell across the county. Several vehicle accidents and spotty power outages were reported. Due to the cold temperatures icy road conditions persisted for several days resulting in the closure of schools and businesses.
2010-02-05	0	0	$50,000	Up to three inches of snow fell across portions of the county along with up to a quarter inch of freezing rain. A total of over fifty thousand people were without power in North Carolina. North Carolina Highway Patrol responded to over 725 calls involving vehicle accidents. Numerous trees fell due to the weight of the freezing rain.
2010-02-12	0	0	$0	Around one to two inches of snow fell across the county Friday night and early Saturday.
2010-03-02	0	0	$0	Around 3 to 4 inches of snow fell across the county. Only a few minor vehicle accidents and power outages were reported.
2010-12-04	0	0	$0	Two to three inches of snow fell across the county with the heaviest amounts reports along and north of Interstate 40.
2010-12-16	0	0	$0	A half inch of snow combined with a tenth of an inch of freezing rain to create hazardous driving conditions across the area.
2010-12-25	0	0	$0	Six to eight inches of snow fell countywide including in Greensboro and High Point. Many roads were impassible due to the heavy snow, however, other than a few minor accidents no other problems were reported due to the holiday.
2011-01-10	0	0	$0	Around one inch of snow fell across the area followed by a trace of freezing rain. This resulted in slippery road conditions and a few accidents.
2013-01-17	0	0	$0	Numerous reports of 3 inches of snow accumulation around the central part of the county.
2013-11-26	0	0	$0	Light freezing rain resulted in minor glazing on trees and other elevated surfaces in the area.
2014-01-21	0	0	$0	Snowfall amounts ranged from a dusting across southern portions of the county to near 1 inch across the north.
2014-01-28	0	0	$0	Snowfall averaged 1 to 2 inches across the county.
2014-02-12	0	0	$0	Snow fall averaged 6-8 inches across the county. In addition, ice accrual ranged between 1/10 to 1/4 inch.
2014-03-03	0	0	$0	Snowfall ranged from 1 inch across southern portions of county to as much as 2.0 inches across the north.
2014-03-06	0	0	$0	Snowfall of 3 to 7 inches fell across the county.
2014-03-17	0	0	$0	Ice accretion averaged around a tenth to two tenths of an inch across the county. Also, a few tenths of an inch of snow fell, with an isolated amount of an inch.

Date	Deaths	Injuries	Property Damage	Description
2015-01-13	0	0	$0	A thin glaze of ice was reported on trees and elevated surfaces. Icy bridges and overpasses created difficult travel conditions during the morning on the 14th, with several automobile accidents reported throughout the county.
2015-02-16	0	0	$0	Snowfall amounts 1 to 3 inches fell across the county. In addition, a trace of freezing rain accrual was reported.
2015-02-24	0	0	$0	Snowfall amounts of 1 to 2 inches fell across the county.
2015-02-25	0	0	$500,000	Snowfall/sleet amounts of 5 to 8 inches fell across the county. The heavy wet snow caused extensive power outages from falling trees and power lines.
2015-03-01	0	0	$0	The Piedmont Triad Airport ASOS reported 0.06 inches of freezing rain and similar amounts were reported across the county from other sources.
2016-01-22	0	0	$0	Snowfall/sleet amounts of 3 to 5 inches fell across the county.
2016-02-14	0	0	$0	Snowfall/sleet amounts of 2 to 3 inches fell across the county. In addition, a tenth to two tenths of freezing rain accrual was reported.
2017-01-06	0	0	$0	Snowfall amounts of 7 to 10 inches fell across the county.
2017-12-08	0	0	$0	Snowfall amounts of 3 to 4 inches fell across the county.
2018-01-17	0	0	$0	Six to ten inches of snow fell across the county.
2018-03-12	0	0	$0	Snowfall totals ranged from 1 inch to 5.5 inches across the county. The county average snowfall was approximately 3 inches.
2018-03-21	0	0	$0	One-half inch to one inch of snow fell across northern portions of the county.
2018-03-24	0	0	$0	One to one- and one-half inches of snow fell across northern portions of the county.
2018-12-09	0	0	$0	Snowfall amounts ranged between 10 to 14 inches across the county. One to two tenths of an inch of ice from freezing rain was also reported.
2019-01-12	0	0	$0	One-quarter to one-third of an inch of ice from freezing rain downed numerous trees across the county. At its peak, nearly 20,000 customers in the county were without power.
2019-12-13	0	0	$0	Freezing rain was reported across the county. Freezing rain amounts were less than a tenth of an inch.
2020-02-20	0	0	$0	Snowfall amounts ranged from 1 to 2 inches across the county.

Source: National Centers for Environmental Information

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.

E.5.6.3 Probability of Future Occurrences

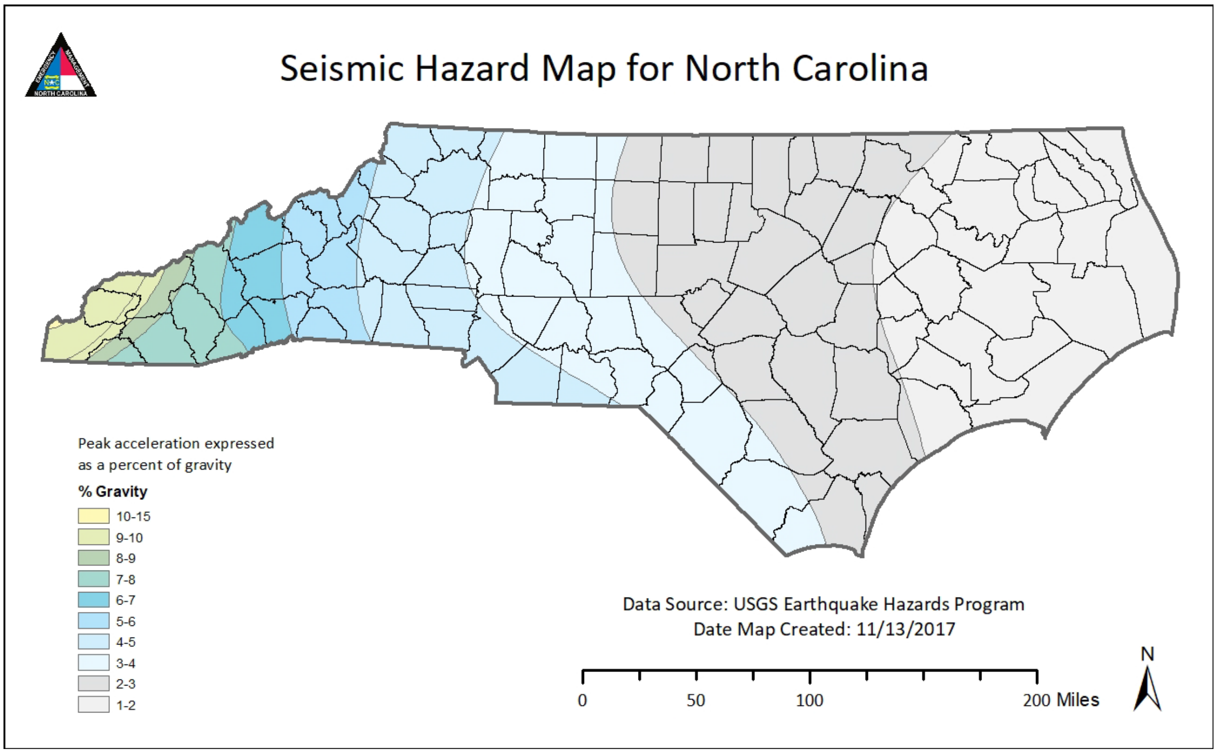
Winter storm events will remain a regular occurrence for UNC Greensboro in the central piedmont region. According to historical information the University often experiences several winter storms events each year. Therefore, the annual probability is highly likely (10 to 100 percent).

E.5.7 EARTHQUAKES

E.5.7.1 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 E.7** is a map showing geological and seismic information for North Carolina.

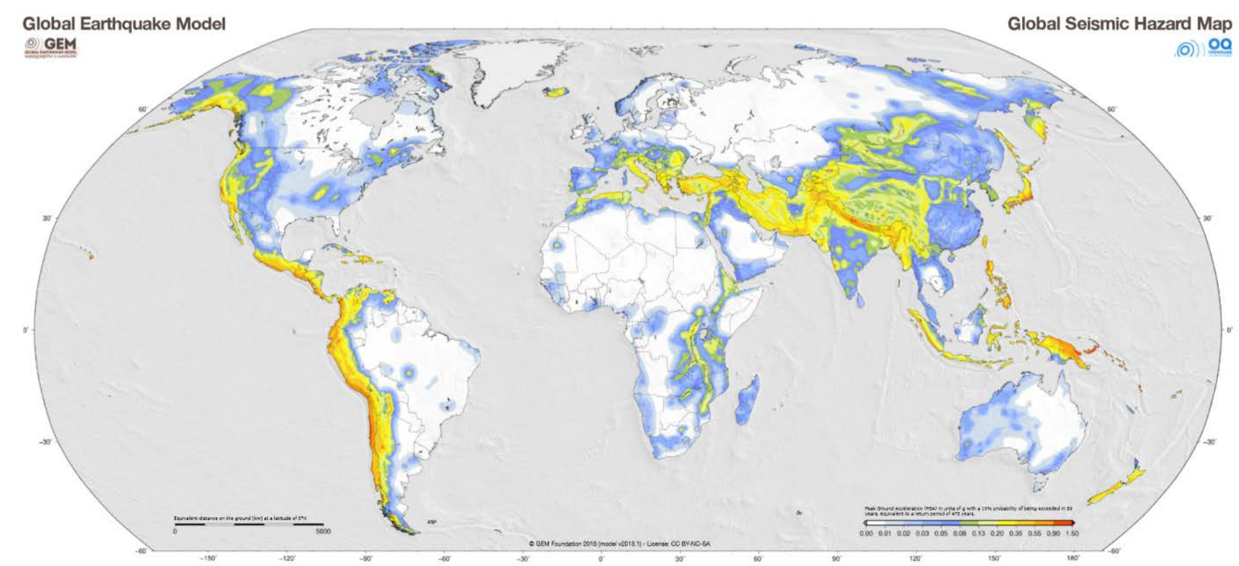
FIGURE E.7: GEOLOGICAL AND SEISMIC INFORMATION FOR NORTH CAROLINA



Source: North Carolina Geological Survey

Figure E.8 shows the intensity level associated with the world 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 campus as a whole exists within an area of moderate seismic risk.

FIGURE E.8: PEAK ACCELERATION WITH 10 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS



Source: Global Earthquake Model, 2018

E.5.7.2 Historical Occurrences

At least 6 earthquakes are known to have affected Guilford County since 1886. The strongest of these measured an IV on the Modified Mercalli Intensity (MMI) scale. **Table E.18** provides a summary of earthquake events reported by the National Geophysical Data Center between 1885 and 1985.

TABLE E.18: EARTHQUAKES IMPACTING GUILFORD COUNTY

Location	Date	Magnitude	MMI
Burlington	2/25/1978	2.2	IV
Greensboro	4/29/1852	Unavailable	III
Greensboro	12/23/1875	Unavailable	IV
Greensboro	2/21/1916	Unavailable	III
Greensboro	3/12/1960	Unavailable	IV
Greensboro	11/20/1969	4.3	IV

Source: US Earthquake Intensity Database, NOAA

A list of earthquakes that have caused damage throughout North Carolina is presented below in **Table E.19.**

TABLE E.19: EARTHQUAKES WHICH HAVE CAUSED DAMAGE IN NC

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

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).

E.5.7.3 Probability of Future Occurrences

The probability of significant, damaging earthquake events affecting the area surrounding the UNC Greensboro is possible. 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 campus. The annual probability level for the campus 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, and for Guilford County the likelihood was 3-4%.

E.5.8 GEOLOGICAL

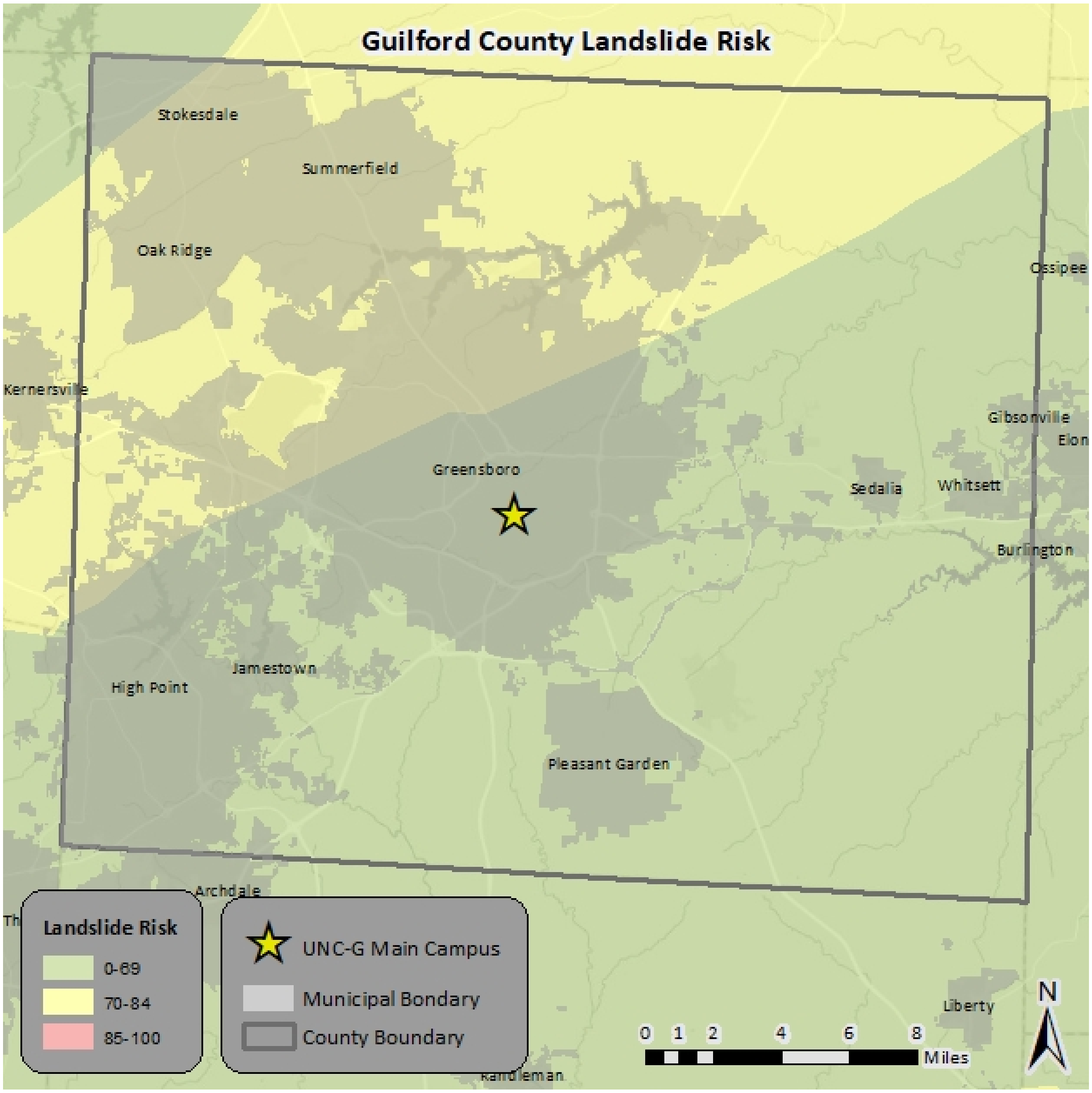
E.5.8.1 Location and Spatial Extent

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.

According to **Figure E.9** below, much of Guilford County, has a low risk to landslides.

FIGURE E.9: LANDSLIDE SUSCEPTIBILITY AND INCIDENCE MAP OF GUILFORD COUNTY

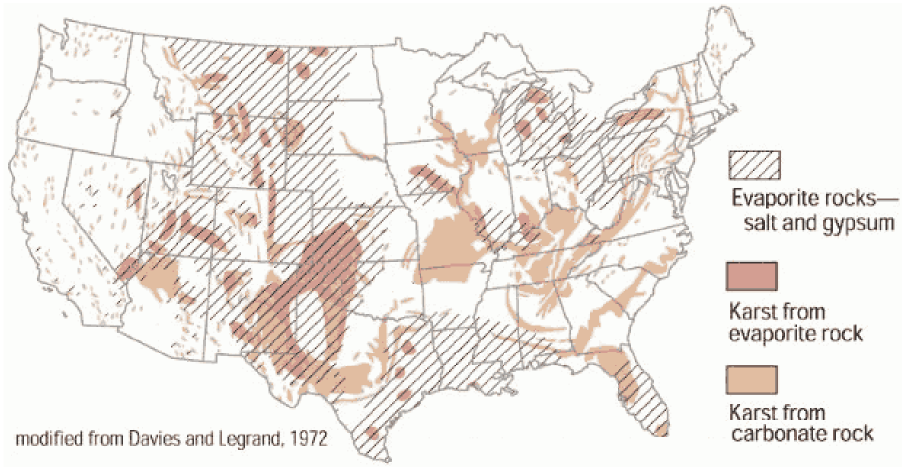


Source: United States Geological Survey

Sinkholes

Figure E.10 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 E.10: UNITED STATES GEOLOGICAL SURVEY OF KARST MODIFIED FROM DAVIES AND LEGRAND, 1972



Erosion

Erosion on the UNCG campus is typically caused by flash flooding events. Unlike coastal areas, where the soil is mainly composed of fine-grained particles such as sand, Guilford County soils have much greater organic matter content. Furthermore, vegetation also helps to prevent erosion in the area. Erosion occurs on the UNCG campus, particularly along the banks of rivers and streams, but it is not an extreme threat to any of the buildings on campus. No areas of concern were reported by the Campus Hazard Mitigation Planning Team.

E.5.8.2 Historical Occurrences

Landslides

UNCG, along with most of Guilford County as a whole, has even topography and is therefore at a low risk for landslide occurrences. There have been no reported landslides to impact UNCG.

Sinkholes

In North Carolina, most sinkholes occur in the southern coastal plain due to the high concentration of limestone. They are uncommon in Guilford County.

Erosion

Most historical occurrences of erosion are seen near the coast of North Carolina, but UNCG is still susceptible to the hazard. Several sources were vetted to identify areas of erosion at UNCG. This includes searching local newspapers, interviewing local officials, and reviewing previous hazard mitigation plans. Guilford County have previous mitigation actions that address erosion including bank stabilization and meeting erosion control requirements. Such actions will continue to be implemented as necessary throughout the region. Erosion was referenced in the previous North Carolina UNCG 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.

E.5.8.3 Probability of Future Occurrences

Landslides

Based on historical information and the USGS susceptibility index, the probability of future landslide events are unlikely (between 1 and 33.3 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 of the UNC Greensboro campus 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 in Guilford County. While many sinkholes have been relatively small, it is still unlikely (between 1 and 33.3 percent annual probability) that the campus will continue to be affected in the future.

Erosion

Erosion remains a natural, dynamic, and continuous process for UNCG, and it will continue to occur. The annual probability level assigned for erosion is unlikely (between 1 and 33.3 percent probability). 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*.

E.5.9 DAM FAILURE

E.5.9.1 Location and Spatial Extent

The North Carolina Division of Energy, Mineral and 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 E.20** explains these classifications.

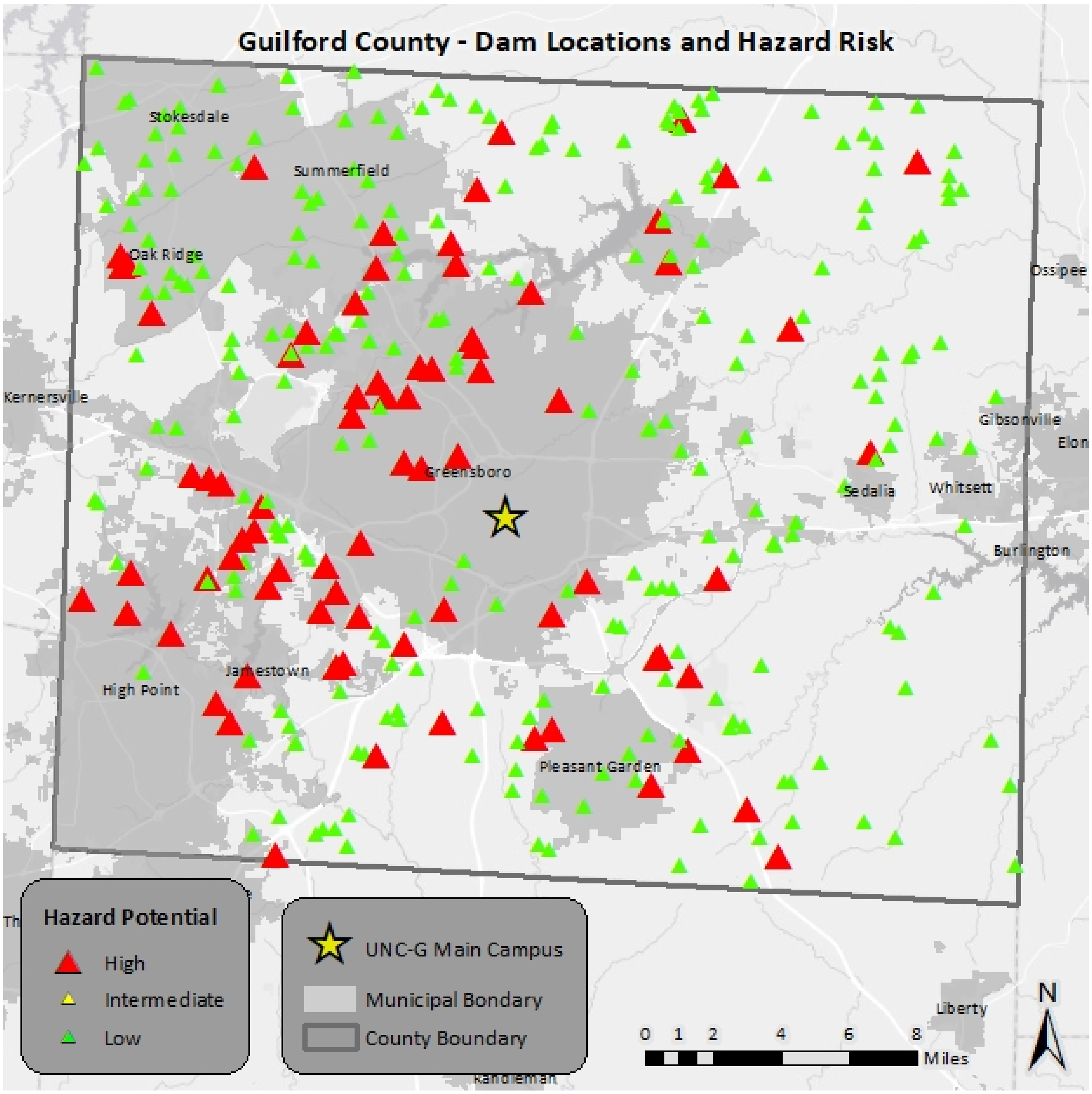
TABLE E.20: NORTH CAROLINA DAM HAZARD CLASSIFICATIONS

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 Management, there are 320 dams in Guilford County. **Figure E.11** shows the dam location and the corresponding hazard ranking for each. Of these dams, 76 are classified as high hazard potential. These high hazard dams are listed in **Table 5.21**. According to a consensus of the Campus Hazard Mitigation Planning Team, there is an extremely low possibility that any of these state-recognized dams would cause any damage whatsoever to UNCG should a dam breach or failure occur, despite the hazard classifications assigned to these dams by the state.

FIGURE E.11: GUILFORD COUNTY DAM LOCATION AND HAZARD RANKING



Source: North Carolina Division of Land Resources

TABLE E.21: GUILFORD COUNTY HIGH HAZARD DAMS

Dam Name	Hazard Potential	Surface Area (acres)	Max Capacity (Ac-ft)	State Regulated?
Guilford County				
Barker-Frazier Excv Inc Dam	High	4.4	45	Y
Blaylock Lake Dam	High	12.0	96	N
Odom Dam	High	3.0	36	N
Smith Dam	High	2.0	12	N
Hutton Dam	High	4.2	37	N
Church of God Of Prophecy Dam	High	2.0	14	Y
Hobbs Lake Dam	High	7.4	69	Y
Ridgewood Farm Dam	High	6.0	37	Y
Hillside Lake Dam	High	10.0	80	N
Ski Lake Dam	High	4.5	45	Y
Hillsdale Lake Dam	High	20.0	200	Y
Lake Higgins Dam	High	226.0	5115	Y
Lake Brandt Dam	High	817.0	18391	Y
Lake Jeanette Dam	High	272.0	8042	N
Richardson Lake Dam	High	16.0	137	N
Cedar Hollow Dam	High	14.5	384	Y
Brooks Lake Dam	High	32.0	346	Y
Lake Townsend Dam	High	1635.0	38285	Y
Lake Herman Dam	High	12.0	120	N
Buckhorn Lake Dam	High	7.0	56	N
Lynwood Lake Dam	High	52.0	857	Y
Aydelette Lake Dam	High	15.0	143	N
Rounda Dam	High	14.0	231	N
Benjamin Dam	High	6.0	80	Y
Lake Hamilton Dam	High	10.7	110	Y
Buffalo Lake Dam	High	76.0	868	N
Jefferson Standard Country Club Dam	High	20.4	231	Y
Friendly Lake Dam	High	8.0	58	Y
Koger Properties Dam	High	6.0	50	Y
Fairfield Lake Dam	High	23.0	276	Y
Adams Lake Dam	High	12.0	96	N
Dogwood Lake Dam	High	8.3	125	Y
Uwharrie Lake Dam	High	15.0	174	Y
Oak Hollow Lake Dam	High	690.0	24500	Y
City Lake Dam	High	287.0	11694	Y
Linthicum Lake Dam	High	6.0	33	N
Wood Lake Dam	High	12.0	90	Y

Dam Name	Hazard Potential	Surface Area (acres)	Max Capacity (Ac-ft)	State Regulated?
Forest Oaks Lake Dam	High	18.0	222	N
Teague Lake Dam	High	8.0	80	Y
Sparger Lake Dam	High	1.5	9	Y
Lower Colonial Dam	High	8.0	64	N
Pilot Life Dam	High	8.0	99	N
Piedmont Centre Dam	High	5.0	50	N
Jamesford Meadows Dam	High	2.8	29	Y
Deep River Pointe-Lower Dam	High	4.5	31	Y
Owens Dam	High	7.2	105	N
Welborn Dam	High	4.2	34	N
Roth Dam	High	8.0	64	N
Gibson Dam	High	3.0	19	N
Guilford Technical Institute Dam	High	2.5	41	N
Lakeview Farm Dam	High	4.4	37	N
Pine Lake Dam	High	1.5	9	N
Pringle Dam	High	3.0	20	N
Northline Corporation Dam	High	7.9	94	Y
Price Dam	High	4.0	32	N
Lake Windemere Dam	High	3.0	31	N
Moose Lodge Dam	High	3.5	38	N
Mallard Dam	High	3.0	27	N
Cathedral of His Glory Dam	High	2.5	19	N
Green Dam	High	4.7	38	Y
Lakota Farm Dam	High	6.4	75	N
Lynco Dam	High	7.0	89	Y
Foster Sikes Dam	High	7.7	89	N
Hagan Stone Park Dam	High	10.0	128	N
John Painter Dam	High	8.0	56	N
Knight Dam	High	2.0	21	Y
Old Deep River Golf Course Dam	High	3.0	20	N
Brookway Dam	High	1.0	6	N
Piedmont Lake Dam	High	9.0	95	Y
Davis Lake Dam	High	23.0	310	Y
Jefferson Square Det. Pond Dam	High	0.5	1	Y
Innkeeper Detention Pond	High	0.2	1	Y
Donald Cox Dam	High	2.0	13	N
Cardinal Lake Dam	High	2.5	19	N
AMP Detention Dam	High	4.0	27	Y
Bridford Apartments Dam	High	2.0	24	Y

Source: North Carolina Division of Land Resources

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

E.5.9.2 Historical Occurrences

According to information from the North Carolina Division of Energy, Mineral and Land Resources, there has only been one dam breached in Guilford County. There are no reports of death, injury, or property damage with any of this event. Further, there are no known levees in Guilford County.

E.5.9.3 Probability of Future Occurrence

Given the current dam inventory and historic data, a dam breech is unlikely (between 1 and 33.3 percent annual probability) in the future. However, with regular monitoring, these events can be prevented as has been demonstrated in the past. Inundation by failure of the Phillips Lake Dam would cause catastrophic damage, including loss of life and injuries, especially to those areas located along the Catawba River. In addition to local devastation, the region as a whole would be impacted.

Inventories of statewide dam inundation data is an area that NCEM-RM is currently working hard to improve. At this time, there is geospatial data in final quality control review for 19 dams in North Carolina and that number is expected to increase significantly over the next several years. Additionally,

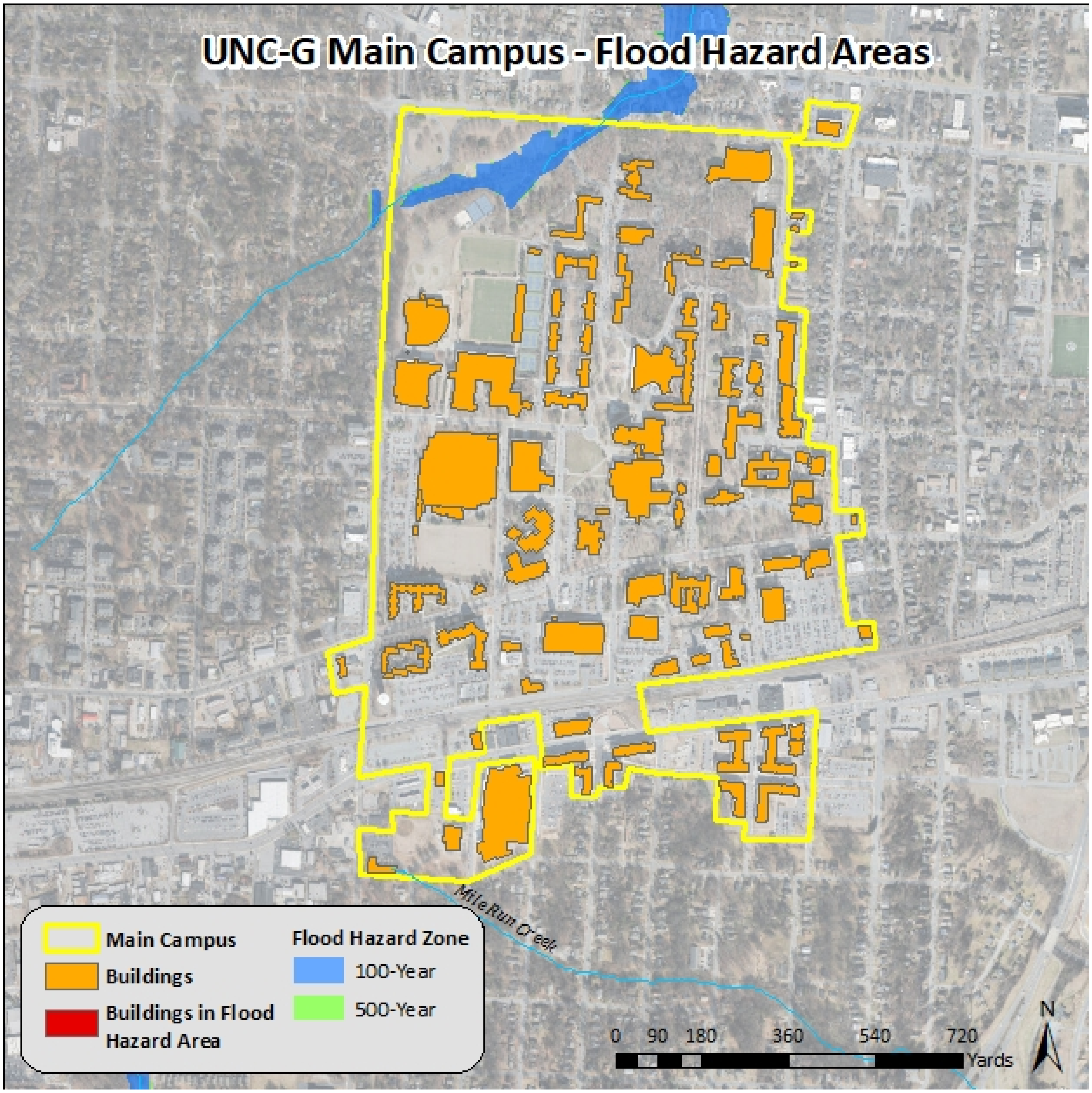
NCEM is currently working with the USACE to acquire inundation data for 9 dams under the Corps' management. As this data becomes available, detailed assessments can be run to better determine vulnerability to dam failures. The 2025 update of this plan may include a much more robust analysis of dam failure vulnerability at the County level.

E.5.10 FLOODING

E.5.10.1 Location and Spatial Extent

There are areas on the UNCG campus that are susceptible to flooding from Mill Run Creek and other areas of localized stormwater flooding. Special flood hazard areas on the UNCG campus were mapped using Geographic Information System (GIS) and FEMA Digital Flood Insurance Rate Maps (DFIRM). This includes the 1-percent annual chance floodplain (100-year), and the 0.2-percent annual chance floodplain (500-year). **Figure E.12** illustrates the location and extent of currently mapped special flood hazard areas for the campus based on best available FEMA DFIRM data from October of 2018. 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 E.12: SPECIAL FLOOD HAZARD AREAS ON THE UNC GREENSBORO



Source: Federal Emergency Management Agency

Of the 80 buildings on the main campus, none were found to lie in a special flood hazard area.

E.5.10.2 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 100 events throughout Guilford County since 1996[10]. A summary of major flooding events is presented in **Table E.22** A summary of flood occurrences in Guilford County are presented in **Table E.23**. These events accounted for over $18.1 million (2020 dollars) in property damage throughout the county.

TABLE E.22: MAJOR FLOOD OCCURRENCES

Area	Date	Type	Property Damage	Crop Damage	Description
High Point	3-Sep-96	Flash Flood	$20,000	$0	A quick five inches of rain in the Triad produced serious street and highway flooding. Several cars were flooded.
Greensboro	17-Aug-03	Flash Flood	$12,000	$0	Numerous roads were flooded around the Piedmont Triad Airport, including New Gordon Road, and Bryant Road. An office was damaged by flooding.
(GSO) Greensboro RGNL	27-Aug-08	Flash Flood	$30,000	$0	Major flooding occurred in portions of Greensboro. Wendover Avenue was closed near Lathan Park and near Bridford Road. The Ashley Creek Apartments along Buffalo Creek experienced flooding and evacuations were necessary. Numerous other roads in the city limits were also closed due to flooding. The remnants of Hurricane Fay which made landfall along the Louisiana coast moved northeast across central North Carolina producing several weak tornadoes along with significant flash flooding.
Greensboro May Arpt	27-Aug-08	Flash Flood	$150,000	$0	Law enforcement reported major flooding over eastern Guilford county. Blakeshire Road was washed out. Numerous other roads were closed due to flooding including Highway 61 near Cone Club Road, Ingle Road, Bethel Church Road and Brightwood Church Road.
Greensboro	3-Jun-09	Flash Flood	$2,000,000	$0	Numerous streets were closed in downtown Greensboro with as many as 50 to 100 water rescues performed, mainly from stalled out vehicles. Multiple buildings were flooded, with at least 10 to 15 on the UNC-Greensboro Campus alone. In addition, as many as two dozen businesses and government buildings were also flooded. One fatality occurred when a woman lost control of a moped and went into a creek. A police officer rescued the woman, only to have her jump back into the creek in an attempt to recover her moped.
Hamilton Lakes	9-Jul-12	Flash Flood	$100,000	$0	Heavy rainfall between 2.5 to 3.0 inches resulted in multiple road closures with 20 to 30 cars flooded on Interstate 40 between High Point Road and Wendover Road. Flood waters also overtook some apartments on Wendover Avenue. Monetary damages were estimated.

[10] These events are only inclusive of those reported by NCEI. It is likely that additional occurrences have occurred and have gone unreported.

Area	Date	Type	Property Damage	Crop Damage	Description
Guilford	10-Jul-13	Flash Flood	$50,000	$0	Flooding was reported in the West Wendover area, Big Tree Way, and along Interstate 40. Crews had to rescue cars stalled in high water. Flood waters displaced residents at Westborough Apartment Complex, Colonial Apartments, and Ashley Creek Apartments. Monetary damages were estimated.
Broadview	21-Jul-13	Flash Flood	$20,000	$0	Flood waters from North Buffalo Creek closed several roads in the area. Latham Park was also closed due to high flood waters from nearby North Buffalo Creek. Flooding was reported near the intersection of North Church Street and East Cone Blvd. There was a water rescue on Green Valley road near Westover Terrace. A car flooded and stuck under Benjamin Parkway at Green Valley. Bryan Blvd was closed at Holden Road with reports of several feet of water on the road.
High Point	29-Sep-15	Flood	$500,000	$0	Numerous roads were closed due to flooding, which includes Elm, Lindsay, Gatewood, Ferndale, Chestnut, Green, Orlando and Ray. Emergency responders performed several water rescues. Water also entered into the basement of several homes. Monetary value of property damage was estimated.
Sedgefield	19-Jun-17	Flash Flood	$5,000	$0	Heavy rainfall resulted in flash flooding in the Greensboro area. Several roads were closed due to flash flooding, including Yanceyville Street at East Cornwallis Drive, South Holden Road at Center Street, East Cone Boulevard between Church Street and Yanceyville Street and on Shelby Drive at Ashebrook Drive. A water rescue was needed when car became stranded in flood waters on McKnight Mill Road in North Greensboro.
Guilquarry	2-Aug-18	Flash Flood	$10,000	$0	A private roadway near Stokesdale was washed out due to flash flooding.
Deep River	2-Aug-18	Flash Flood	$50,000	$0	Flash flooding resulting in the closure of several roads in the city of High Point and surrounding areas. Road closures included Chester Ridge Drive, Skeet Club Road, Piedmont Parkway, and North Main Street.
High Point Midway Arpt	17-Sep-18	Flood	$14,630,000	$5,000,000	Torrential rainfall of 6 to 8 inches caused widespread flooding across the county, which caused moderate flooding along North Buffalo and South Buffalo Creeks, as well as other creeks and streams throughout the county. Flooding damaged approximately 119 structures throughout the county, destroying 7 and resulting in over $14.63 million in property damage. Numerous roads were closed due to flooding. Numerous homes and businesses were flooded as well. While final losses on crops are not

Area	Date	Type	Property Damage	Crop Damage	Description
					yet tallied, estimates around $5 million or more are possible.
Guilquarry	11-Oct-18	Flash Flood	$500,000	$0	Flash flooding from heavy rainfall of 4 to 6 inches closed several roads across the county. The roads include Wendover Avenue near Market Street and Gate City Boulevard near Elm Street. Additionally, North Buffalo Creek and Horsepen Creek both came out of their banks, flooding Rankin Mill Road and US 220, respectively. Also, Horse Pen Creek Road from Jessup Grove Road to Drawbridge Parkway was closed after a section of road washed out.
Pinecroft	7-Jul-19	Flash Flood	$10,000	$0	Heavy rain from training thunderstorms resulted in flash flooding in downtown Greensboro. Several vehicles became trapped in flood waters and multiple water rescues were performed. Flooded roads included Gate City Boulevard, West Wendover Avenue, and Maplewood Lane near Pinecroft Road. Additionally, Stream gauges along South Buffalo Creek went into flood, indicating the creek overflowing its banks.
Guilford	1-Aug-19	Flash Flood	$10,000	$0	Heavy rain resulted in flash flooding in southwest areas of Greensboro. Several vehicles went under water and a couple of water rescues were needed at West Wendover Avenue and Big Tree Way. Several vehicles were also under water at Guilford College Road and Interstate 73 North. Additionally, South Buffalo Creek near Pomona and Merritt Street rose above flood stage around 9:25 PM and remained in flood until approximately 11:10 PM.
Greensboro	19-Aug-19	Flash Flood	$10,000	$0	Heavy rainfall over the cities of Greensboro and High Point resulted in flash flooding across both cities. Multiple water rescues were performed in High Point near the intersection of North Elm Street and Lindsay Street. Several water rescues were also performed across the city of Greensboro, with the worst flooding along Gate City Boulevard.

Source: National Centers for Environmental Information

TABLE E.23: SUMMARY OF FLOOD OCCURRENCES

Location	Number of Occurrences	Deaths/Injuries	Property Damage (2020)
Archdale	0	0/0	$0
Burlington	0	0/0	$0
Gibsonville	0	0/0	$0
Greensboro	27	0/0	$2,022,000
High Point	10	0/0	$520,000
Jamestown	1	0/0	$0
Kernersville	0	0/0	$0
Oak Ridge	1	0/0	$0
Pleasant Garden	2	0/0	$0
Sedalia	0	0/0	$0
Stokesdale	0	0/0	$0
Summerfield	6	0/0	$0
Whitsett	0	0/0	$0
Unincorporated Areas	53	0/0	$15,565,000
Guilford County Total	**100**	**0/0**	**$18,107,000**

Source: National Environmental Information Center

E.5.10.3 Probability of Future Occurrences

Flood events will remain a threat to UNC Greensboro, and the probability of future occurrences will remain highly 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). It can be inferred from the floodplain location maps, previous occurrences, and repetitive loss properties that risk varies throughout the UNC Greensboro campus.

E.5.11 WILDFIRES

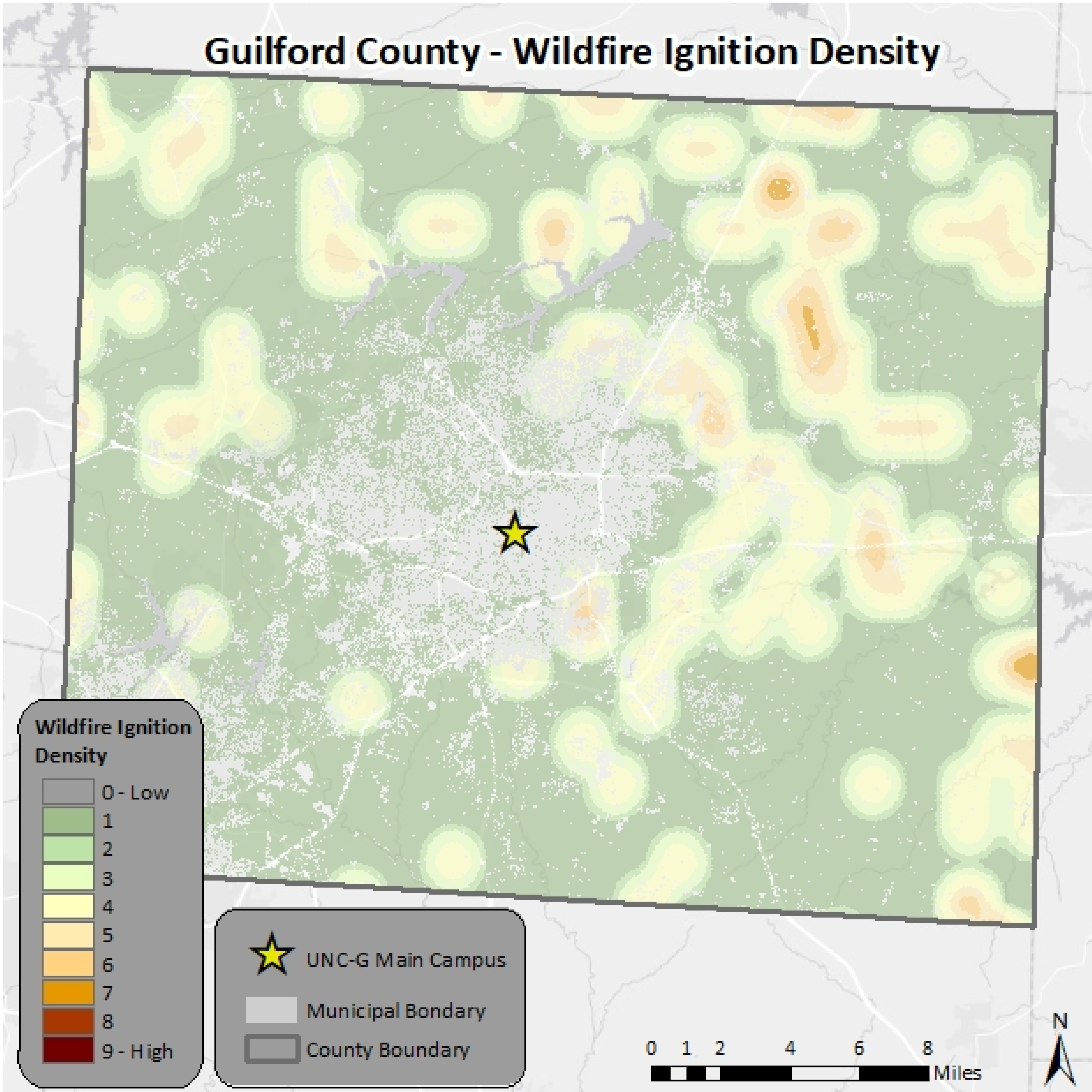
E.5.11.1 Location and Spatial Extent

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

E.5.11.2 Historical Occurrences

Figure E.13 shows the Wildfire Ignition Density for Guilford County 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.

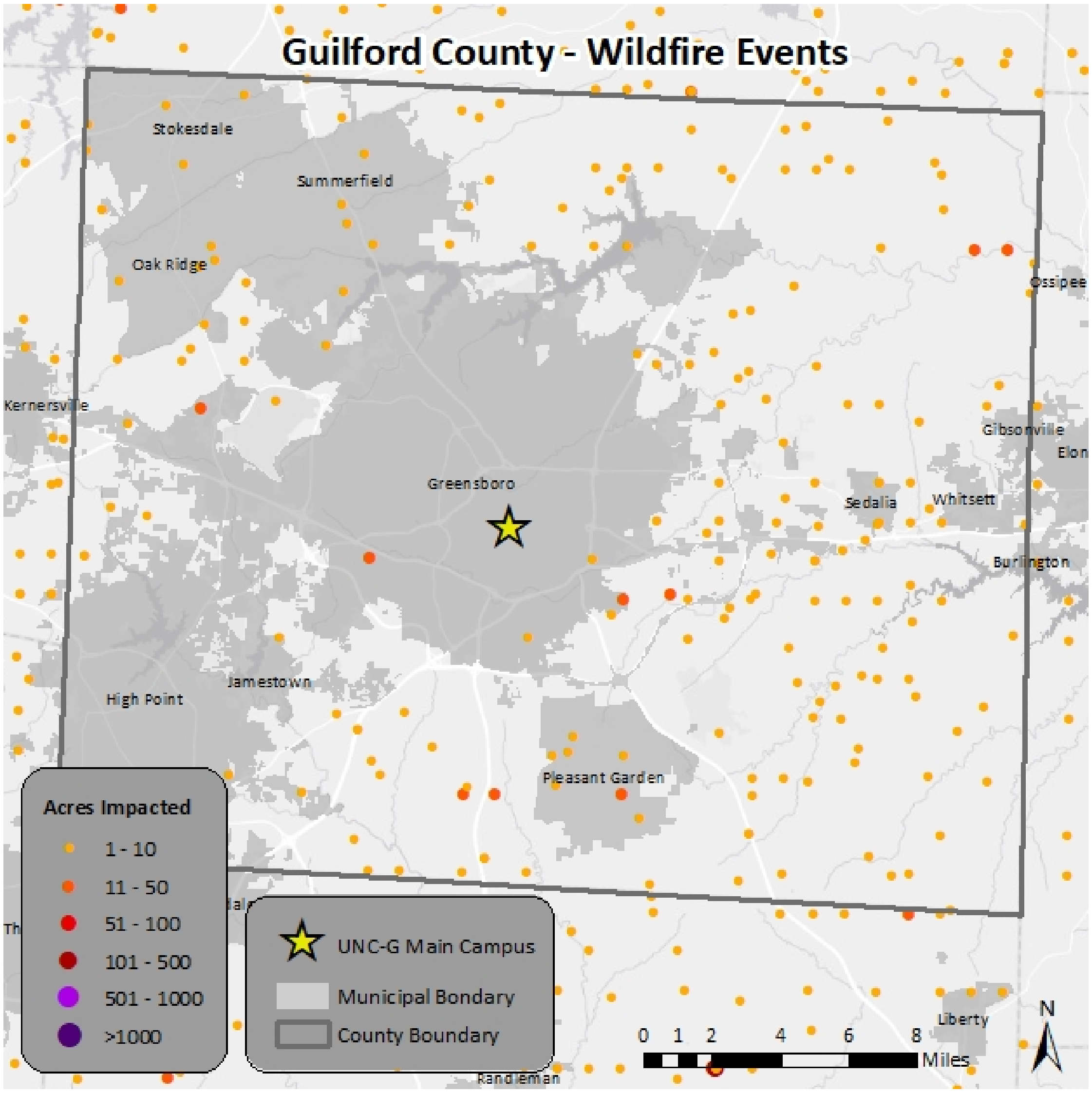
FIGURE E.13: WILDFIRE IGNITION DENSITY IN GUILFORD COUNTY



Source: Southern Wildfire Risk Assessment

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 158 events that impacted an area greater than 1 acre have occurred throughout Guilford County since (January 27, 2001)[11]. **Figure E.14** displays wildfire events in Guilford County.

FIGURE E.14: WILDFIRE EVENTS IN GUILFORD COUNTY



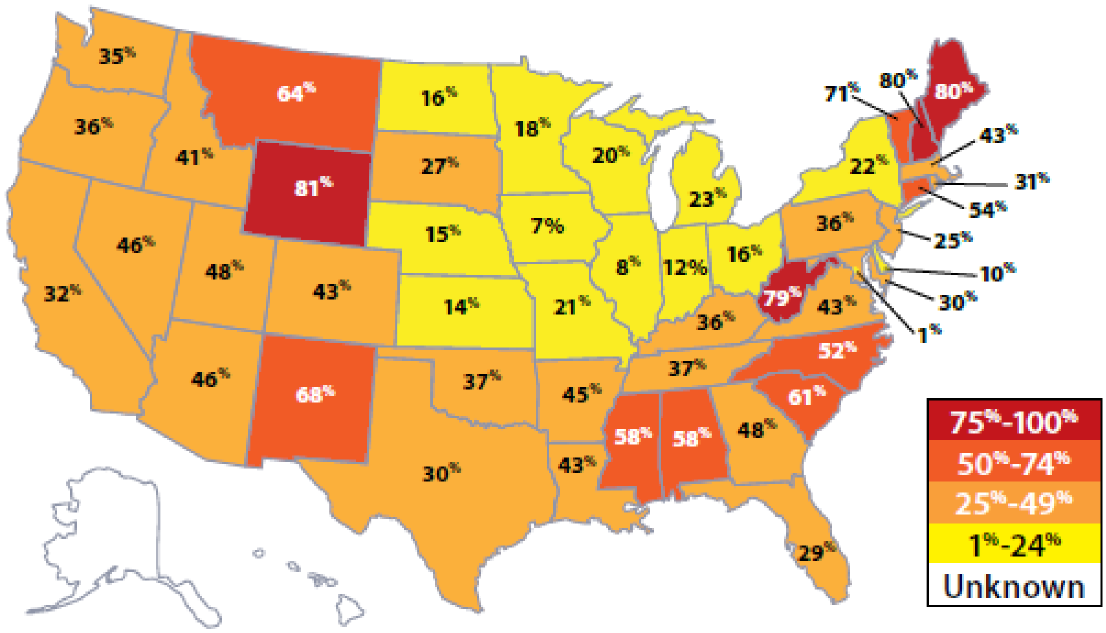
Source: NASFI

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**

[11] These events are only exclusive of those reported by NASFI. It is likely that additional occurrences have occurred and have gone unreported.

E.15 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.

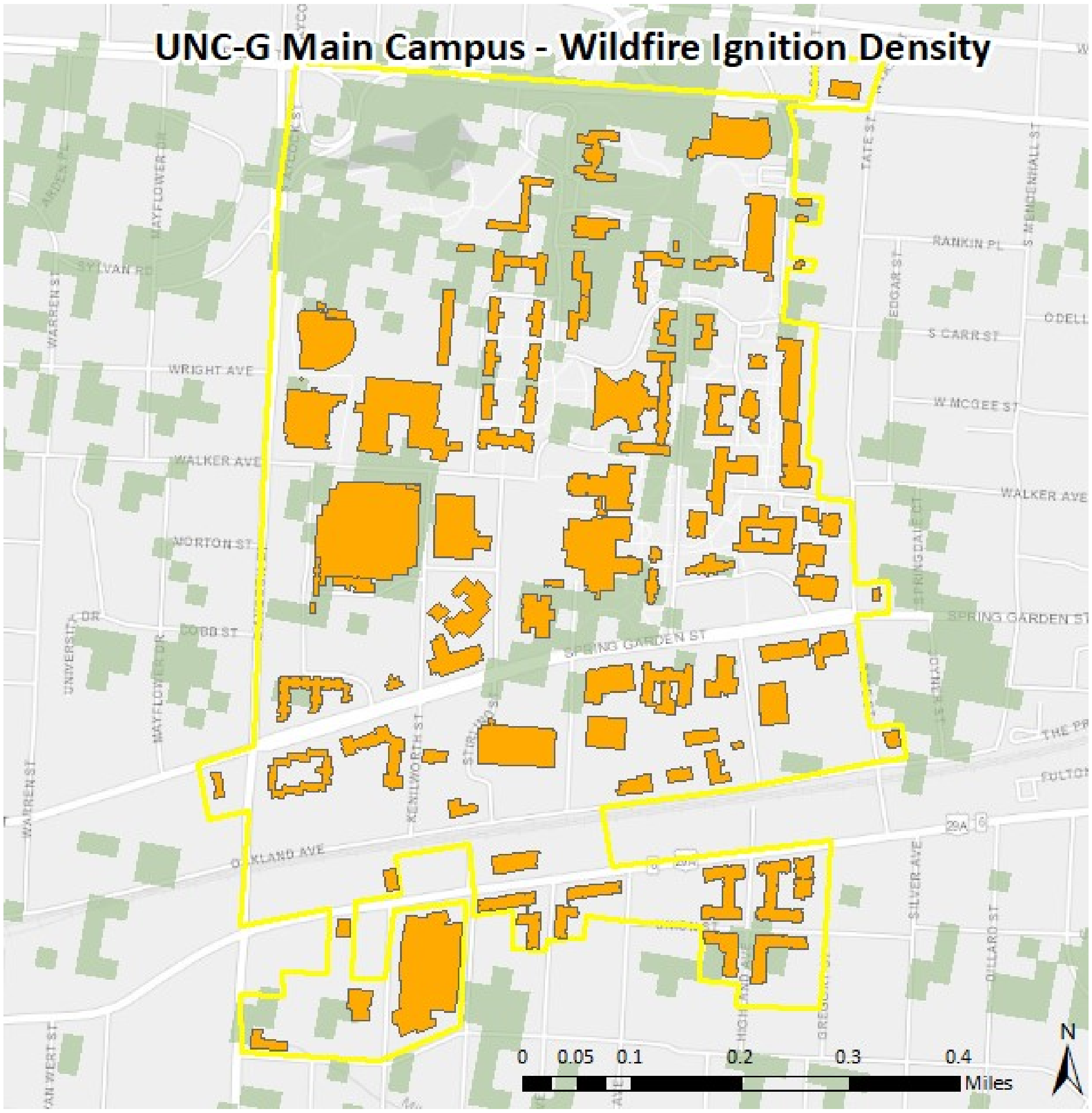
FIGURE E.15: % OF HOMES IN THE WILDLAND URBAN INTERFACE



Source: US Department of Agriculture

Below, **Figure E.16** displays the Ignition Density for the UNC Greensboro.

FIGURE E.16: UNCG CAMPUS WILDFIRE IGNITION DENSITY



Source: Southern Wildfire Risk Assessment

Based on data from the North Carolina Division of Forest Resources from 2003 to 2018, Guilford County 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.

E.5.11.3 Probability of Future Occurrences

Wildfire events will be an ongoing occurrence in Guilford County. The likelihood of wildfires increases during drought cycles and abnormally dry conditions. Fires are likely to stay small in size but could increase due local climate and ground conditions. Dry, windy conditions with an accumulation of forest floor fuel (potentially due to ice storms or lack of fire) could create conditions for a large fire that spreads quickly. It should also be noted that some areas do vary somewhat in risk. For example, highly developed areas are less susceptible unless they are located near the urban-wildland boundary. The risk will also vary due to assets. Areas in the urban-wildland interface will have much more property at risk, resulting in increased vulnerability and need to mitigate compared to rural, mainly forested areas. The probability assigned to the UNCG for future wildfire events are possible (1 to 10 percent annual probability).

E.5.12 INFECTIOUS DISEASE

E.5.12.1 Location and Spatial Extent

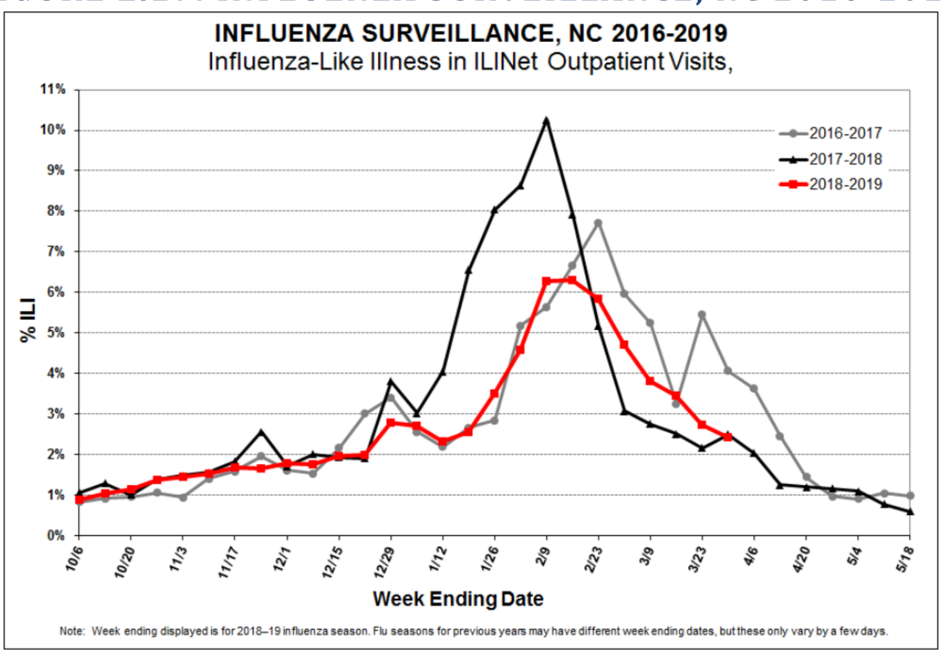
Extent is difficult to measure for an infectious disease event as the extent is largely dependent on the type of disease and on the effect that it has on the population. Extent can be somewhat defined by the number of people impacted, which depending on the type of disease could number in the tens of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

E.5.12.2 Historical Occurrences

Infectious Disease

Influenza is historically the most common infectious disease that has occurred in Guilford County. Cases of the flu tend to occur in the late fall to early winter months. In recent years, cases of the influenza and influenza-like illnesses have been reported in hospitals. As seen in **Figure E.17** below, 172 people throughout North Carolina died from the flu between 2018 and 2019.

FIGURE E.17: 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

Starting in 2020, the COVID-19 infectious disease pandemic began to impact North Carolina and Guilford County. The NC Department of Health and Human Services has been actively monitoring and tracking cases since the first case arrived in the State. A Presidential disaster declaration was declared for North Carolina on March 24, 2020 for the COVID-19 pandemic. **Table C.22** provides a summary of confirmed cases of COVID–19 in Guilford County as of the date of the final version of this plan in 2021. The COVID-19 pandemic is still evolving even though vaccines have been created that are slowing the spread. The pandemic unfolded as this plan was being developed, so the information below presents only a small sample of the pandemic's impacts on Guilford County. On April 27, 2020, the UNC System made the decision to postpone in-person classes for the remainder of the school year. As a result, UNCG and all other universities in North Carolina, shifted to online courses. Due to Executive Order 135, which extended the existing statewide stay-at-home order through May 8, 2020; college campuses were asked to vacate any on-campus university housing.

TABLE E.24: SUMMARY OF CONFIRMED COVID-19 CASES IN GUILFORD COUNTY

Location	Number of Cases	Number of Deaths*
Guilford County	**47,358**	**701**

Source: North Carolina Department of Health and Human Services as of 5/18/20

** Deaths reflect deaths in persons with laboratory-confirmed COVID-19 reported by local health departments to the 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[12].

E.5.12.3 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 possible (between 1 and 10 percent annual probability) that UNCG will experience an outbreak of infectious diseases in the future.

[12] https://www.ncdhhs.gov/news/press-releases/nc-prepared-zika-virus-risk-local-virus-carrying-mosquitoes-low

Technological Hazards

E.5.13 HAZARDOUS SUBSTANCES

E.5.13.1 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 collection information from industrial facilities on the releases and transfers of certain toxic agents. This information is then reported in the Toxic Release Inventory (TRI). TRI sites indicate where such activity is occurring. Guilford County has record of 5,547 Facility Registry Services (HAZMAT) Sites in the County.

E.5.13.2 Historical Occurrences

The U.S. Department of Transportation Pipeline and Hazard 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.

The Pipeline and Hazardous Materials Safety Administration (PHMSA) is an agency of the United States Department of Transportation that was established in 2004. The PHMSA maintains a database of hazardous materials incidents for communities across the United States. Summary results of their data for events that have occurred in Guilford County can be found in **Table E.25.**

TABLE E.25: SUMMARY OF HAZMAT INCIDENTS IN GUILFORD COUNTY

Location	Incidents Reported	Injuries	Fatalities	Type	Costs
Archdale	0	0	0	N/A	$0
Burlington	3	0	0	Highway	$253,711
Gibsonville	0	0	0	N/A	$0

Greensboro	41	0	1	Highway/Rail	$2,056,977
High Point	3	0	0	Highway	$0
Jamestown	3	0	0	Highway/Rail	$328,600
Kernersville	5	1	0	Highway	$159,163
Oak Ridge	0	0	0	n/a	$0
Pleasant Garden	0	0	0	N/A	$0
Sedalia	0	0	0	N/A	$0
Stokesdale	0	0	0	N/A	$0
Summerfield	0	0	0	N/A	$0
Whitsett	0	0	0	N/A	$0
Unincorporated Areas	0	0	0	n/a	$0
Guilford County Total	**55**	**1**	**1**		**$2,798,451**

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

E.5.13.3 Probability of Future Occurrence

Given the location of toxic release inventory sites in Guilford County, it is likely (10 to 100 percent annual probability) that a hazardous material incident may occur. University officials are mindful of this possibility and take precautions to prevent such an event from occurring.

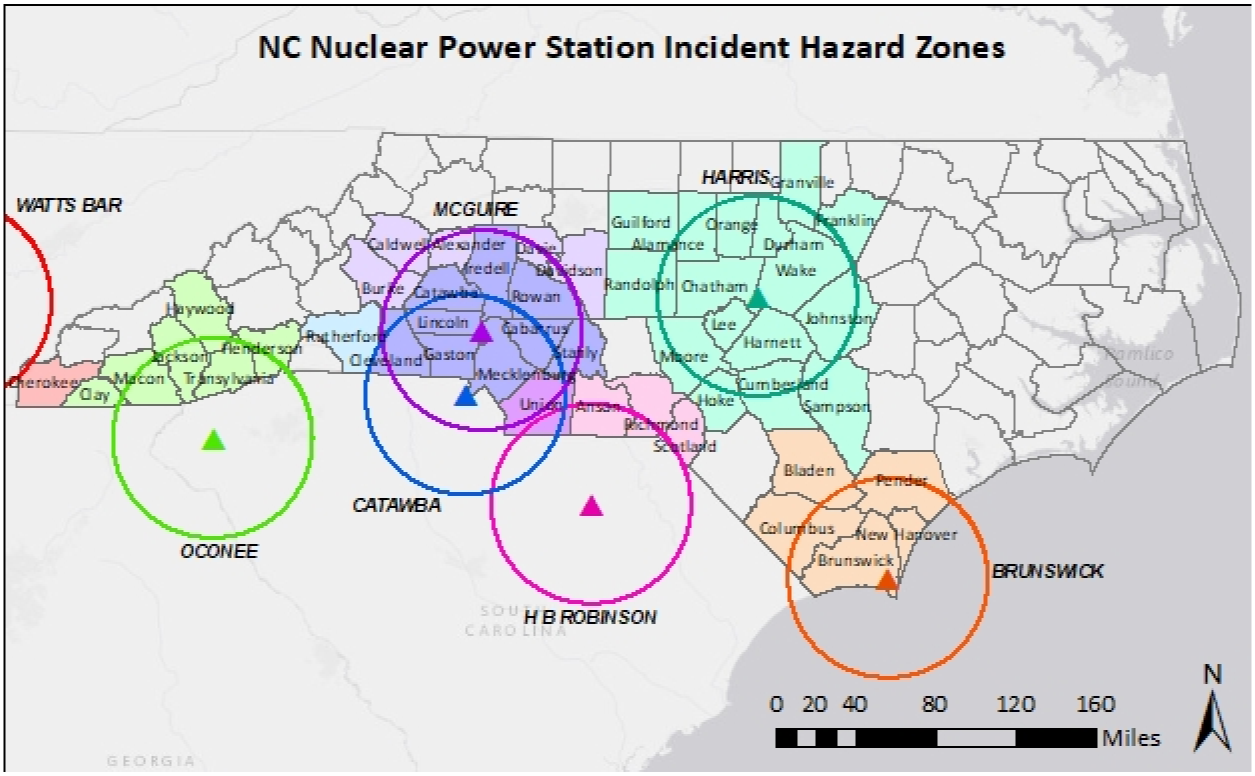
E.5.14 RADIOLOGICAL EMERGENCY – FIXED NUCLEAR FACILITIES

E.5.14.1 Location and Spatial Extent

Guilford County and UNCG are both at risk to a nuclear accident. However, areas in the Southeast of Guilford County are the only areas that fall within a 50-mile radius of a fixed nuclear facility. 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 miles 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.

The southeastern section of Guilford County only falls within the 50-mile radius of Sharon Harris Nuclear station, as seen in **Figure E.18** below.

FIGURE E.18: NORTH CAROLINA NUCLEAR POWER STATIONS AND INCIDENT HAZARD ZONES



Source: International Atomic Energy Agency

E.5.14.2 Historical Occurrences

Although there have been no major nuclear events at Sharron Harris Nuclear Plant, 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.

E.5.15.3 Probability of Future Occurrences

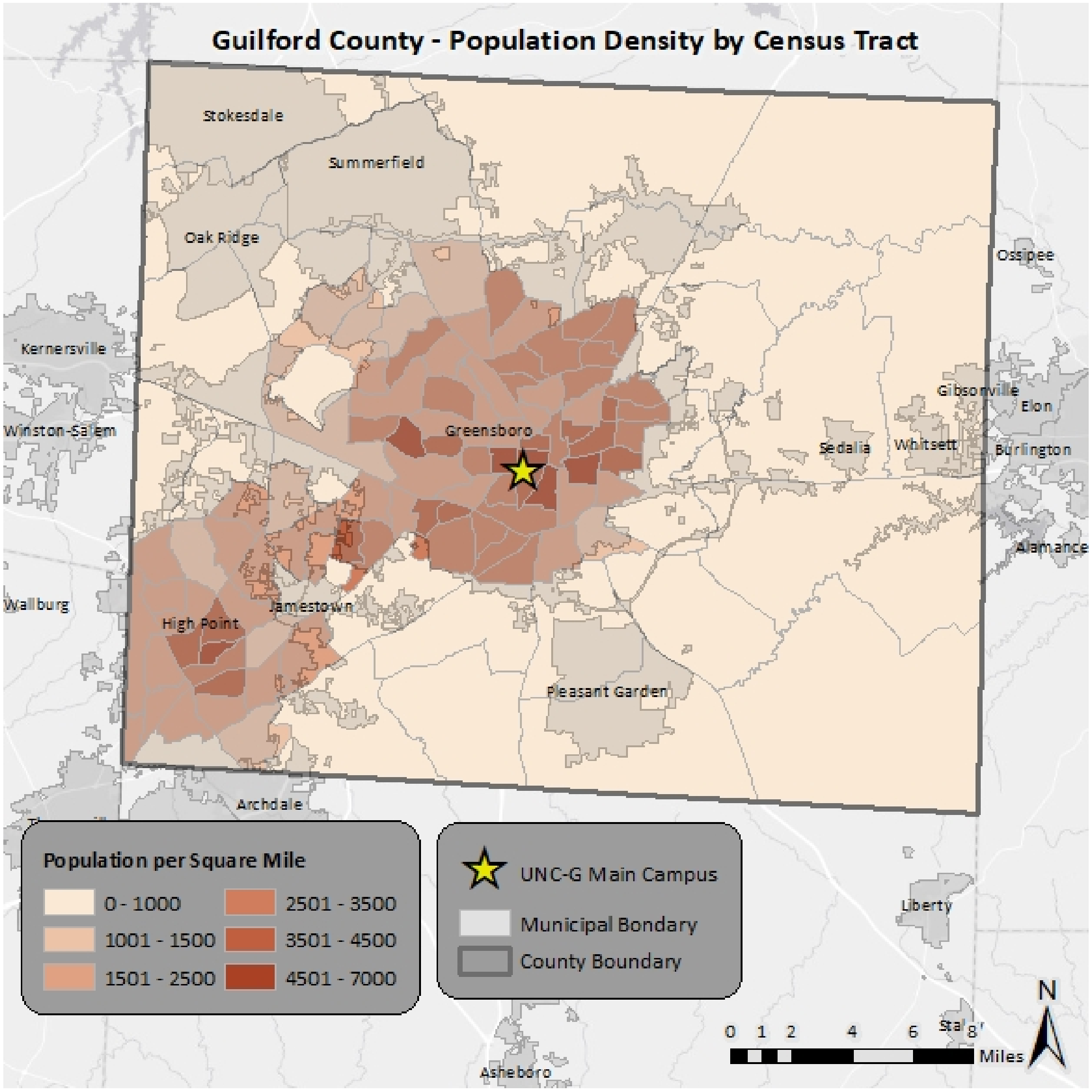
A nuclear event is a very rare occurrence in the United States due to the intense regulation of the industry. There have been incidents in the past, but it is considered unlikely (less than 1 percent annual probability).

E.5.15 VIOLENT/MAJOR CRIME

E.5.15.1 Location and Spatial Extent

All parts of North Carolina are vulnerable to crime and potentially to a terrorist attack. However, violent crime and terrorism tends to target more densely populated areas and a university campus is a prime example of such a location. University campuses also seem to be a higher target for active shooter events. Additionally, more populated areas are generally more susceptible to crime and terrorist attack. The map in **Figure E.19** displays the population density in Guilford County using census tract levels.

FIGURE E.19: POPULATION DENSITY



Source: US Census Bureau

The most recent population counts of UNCG, Guilford County and surrounding municipalities can be seen in **Table E.26** below.

TABLE E.26: 2018 POPULATION ESTIMATES FOR GUILFORD COUNTY

Location	2018 Population Estimate
Archdale	11,415
Burlington	49,963
Gibsonville	6,410
Greensboro	269,666
High Point	104,371
Jamestown	3,382
Kernersville	23,123
Oak Ridge	6,185
Pleasant Garden	4,907
Sedalia	678
Stokesdale	5,458
Summerfield	11,278
Whitsett	628
UNC Greensboro	19,653
Unincorporated Areas	39,710
Guilford County Total	**537,174**

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

E.5.15.2 Historical Occurrences

No extreme cases of terror attacks have previously affected Guilford County or the UNC Greensboro. However, as the population in the area continues to increase, so does the chance of an attack. UNCG Emergency Management records of historic events do indicate 5 "Law enforcement Events" recorded between 2016 and 2020.

E.5.15.3 Probability of Future Occurrence

Neither Guilford County nor UNC Greensboro have experienced a major terrorist attacks, but the area's population is continuing to rise. The probability of future occurrences of a terrorist attack, while unlikely (less than 1 percent annual probability) is a real possibility that the area must be prepared for.

E.5.16 TECHNOLOGY SYSTEM DISRUPTION

E.5.16.1 Location and Spatial Extent

Technology system disruption is a hazard that is growing in frequency of occurrence. 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. UNC Greensboro is susceptible to cyber-attacks.

E.5.16.2 Historical Occurrences

In North Carolina, 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. **Table E.27** displays the North Carolina Cybercrimes and Victim Counts in 2018. At UNCG, the Information Technology Services (ITS) department is responsible for monitoring and responding to cyber incidents. UNCG Emergency Management records of historic events indicate 1 Cyber Incident between 2016 and 2020.

Table E.27: North Carolina Cybercrimes and Victim Counts in 2018

Crime Type by Victim Count

Crime Type	Victim Count	Crime Type	Victim Count
Advanced Fee	436	Identity Theft	330
BEC/EAC	430	Investment	47
Charity	11	Lottery/Sweepstakes/Inheritance	213
Civil Matter	15	Malware/Scareware/Virus	49
Confidence Fraud/Romance	432	Misrepresentation	148
Corporate Data Breach	39	No Lead Value	246
Credit Card Fraud	306	Non-payment/Non-Delivery	1,647
Crimes Against Children	28	Other	172
Denial of Service/TDos	28	Overpayment	406
Employment	391	Personal Data Breach	1,125
Extortion	1,219	Phishing/Vishing/Smishing/Pharming	947
Gambling	4	Ransomware	29
Government Impersonation	255	Re-shipping	31
Hacktivist	2	Real Estate/Rental	286
Harassment/Threats of Violence	330	Spoofing	430
Health Care Related	9	Tech Support	361
IPR/Copyright and Counterfeit	30	Terrorism	2
Descriptors*			
Social Media	902	Virtual Currency	790

Source: FBI Internet Crime Compliant Center, 2018

E.5.16.3 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 at UNC Greensboro, and it is considered possible (between 1 and 10 percent annual probability) to experience one in the near future.

E.5.17 ELECTROMAGNETIC PULSE

E.5.17.1 Location and Spatial Extent

An EMP can happen in any location, and they are relatively unpredictable. Due to advancing technologies, densely populated areas may be more prone to damages from an EMP. Therefore, Greensboro and the UNC Greensboro campus may be more susceptible.

E.5.17.2 Historical Occurrences

There have been no reports of EMP occurrences at UNC Greensboro.

E.5.17.3 Probability of Future Occurrences

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

E.5.18 UTILITY INTERRUPTION/FAILURE

E.5.18.1 Location and Spatial Extent

Utility interruption/failure can occur where utility lines run (electric, water, sewer, computer network, etc.) and can impact the entire campus. Because of the compact nature of university campuses, utility failures can occur frequently and have major impacts.

E.5.18.2 Historical Occurrences

UNCG Emergency Management records of historic events indicate 12 utility failure events between 2016 and 2020.

E.5.18.3 Probability of Future Occurrences

The probability of a utility failure is likely (between 10-100% annually).

E.5.19 CIVIL DISTURBANCE/UNREST

E.5.19.1 Background

Public unrest has been evident in society from the earliest recordings of civilization. Most of these disturbances have been related to political or social issues. Insurrection has framed much of history, dictating the governance and progression of society. In recent years, most of the publicized disturbances have been protests and riots. Rioting does not occur very often in the United States; however, marches and protests are common and could subsequently lead to riots.

E.5.19.2 Location and Spatial Extent

Civil disturbance or unrest can occur in any location on campus, but is more likely to take place in or near prominent locations such as government buildings or significant landmarks.

E.5.19.3 Historical Occurrences

At UNCG, there have not been any major civil disturbances in recent years. While there are occasional marches and protests that take place within the County and occasionally on campus, they have not had significant threat of violence associated with them.

One of the more recent events occurred in the March of 2016 at an event called Gym Jam when five were arrested and three were injured when a large fight occurred.

Other historical civil unrest occurrences that have taken place in Guilford County (but not on the UNCG campus) include the November 3, 1979, event since named the Greensboro Massacre saw members of the Ku Klux Klan and American Nazis clash with members of the Communist Party marching for African-American industrial workers. The event climaxed with Klansmen opening gunfire on marchers, five of whom died.

A disturbance near North Carolina Agricultural and Technical State University in Greensboro led to the shooting death of a college student on May 22, 1969. African American student protestors clashed with city police and members of the National Guard for three days (May 21-23), leading to several civilian and nine officer injuries in addition to the fatality. Dozens of students were arrested for disturbing the peace on public school property.

Downtown Greensboro is well-publicized for its part in the non-violent, sit-in protests during the civil rights movement. In 1960, a group of four freshmen from North Carolina Agricultural and Technical College were denied service for being African Americans at a lunch counter in the business F.W. Woolworth. In response, they sat at the counter for several days, with others later joining in on the protest. A large boycott of the business followed, resulting in substantial losses for the company before it relented and enacted changes in policy chain-wide. Although some of the events described above are not considered hazards to the community per se, they are noted as they serve as examples of past points of conflicting ideology among citizens which can sometimes lead to interactions between groups that cause harm or hurt to those involved.

E.5.19.4 Probability of Future Occurrences

Despite some history of civil disturbance in Guilford County, there have been few recent events that caused major violence, injury, or fatalities, so the probability of future occurrences is possible.

E.5.19.5 Consequence Analysis

People (The Public and Public Confidence) - The United States and Guilford County are relatively stable politically and socially. However, there are United States citizens who hold extremist opinions and ideals. There is always the likelihood of some incident sparking some form of violence or disobedience. Most incidences of civil disturbance or insurrection have specific targets, unlike terrorism where maximum effect (including casualties) is desired. Therefore, collateral damage is not as likely but still possible. The public confidence in government and nongovernmental organizations response is paramount during these incidents. There will be high emotions already present within the community, so an effective, organized, and professional response is crucial to instill confidence in community members. Working with the media is also an important component, as the messages disseminated can influence public perception. The incident response, the media, and also societal expectations will all factor into the positive or negative outcome in the minds of the public.

Responders - During riots and events that become violent, first responders are put into a situation of extreme danger. This is especially true of those employed by local, state, or federal governments as they may actually be targeted in such events. Law enforcement personnel are trained and equipped to deal with such situations and would be utilized to provide for public safety during these events. Other operations may be put on hold in areas of unrest until the situation improves.

Continuity of Operations - Continuity of operations could be disrupted by a civil disturbance, especially if the aim of the unrest is aimed at government buildings or officials. Plans to maintain continuity of operations are in place, but operations would likely be disrupted to some degree by a civil disturbance.

Built Environment (Property, Facilities, and Infrastructure) - Building Stock If disturbances occur in residential areas, residents may be unable to access their homes and neighborhoods without putting their safety in jeopardy. Destruction of property is also possible in such a scenario. In commercial areas, civil unrest can lead to the destruction of property or theft of goods and equipment. Workers may not be able to access their workplaces or may not be able to work at all if the business is shut down during the disturbance. Industrial facilities are similarly vulnerable to the destruction of property, theft of goods or equipment, or sabotage of the equipment and systems housed in the facility(ies). Critical Facilities and Personnel During incidences of civil disturbance, hospitals may expect higher volume of patients. While hospitals are unlikely to be targeted during civil unrest, there could be some impacts if the violence is nearby. These impacts include the possibility of limited access to the hospital for workers, patients, and emergency/patient transportation crews. Incidents of violence in emergency departments and other sections of hospital are also more likely to occur. A civil disturbance event will likely increase call volume for emergency services, and increase the potential for the targeting of responders, or cause access issues relating to emergency scenes and the transportation of patients to hospitals.

Transportation Systems Transportation systems may be blocked or otherwise damaged during a civil disturbance event, including damage to traffic lights, signs, etc. However, generally there would not be major impacts to the infrastructure itself.

Economy - The economic impact of civil disturbances is dependent on the extent of media coverage of the event and people's feelings of safety in the area(s) affected. Tourism can be negatively affected, causing potential visitors to go somewhere else or not travel at all. Businesses or homeowners may choose to shut down and real estate values could potentially fall as well if there are frequent incidents. These effects are dependent on the severity, the scope, and the nature of the disturbance(s). Civil disturbances can lead to work stoppages, which results in loss of productivity. Targeting of financial institutions could lead to significant economic hardship through the impairment of financial transactions. City centers could be the nexus of civil disturbance activity. This activity could limit access to businesses or services in the area, impairing commerce.

Environment - Impacts are unlikely as natural resources and the environment are not generally targeted and collateral impacts are not typical, unless other hazards are caused by violent acts.

E.5.20 BUILDING FIRE

E.5.20.1 Background

Building fires may be accidental or intentional (arson). According to the National Fie Incident Reporting System, potential ignition sources include the following:

- Heat from fuel-fired, fuel-powered object (e.g., heat, spark, ember, or flame from equipment)
- Heat from electrical equipment arcing, overloaded (e.g., short circuit arc, fluorescent light ballast)
- Heat from smoking material (e.g., cigarette, cigar, pipe)
- Heat from open flame (e.g., lighter, candle)
- Heat from cooking source (e.g., confined cooking fire, stoves, ovens, deep fat fryers, open grills)
- Heat from hot object (e.g. electric lamp, spark from friction)
- Heat from explosive, fireworks (e.g., fireworks, incendiary device)
- Heat from natural source (e.g., lightning, sun's heat, static discharge)
- Heat spreading from another hostile fire (exposure) (e.g., radiated heat, direct flame)

The National Fire Protection Association states that there were an estimated 3,840 structure fires in dormitory properties from 2005-2009. These fires resulted in 3 deaths, 38 injuries and $20.9 million in property damage. 81% of those fires were caused by cooking equipment.

E.5.20.2 Location and Spatial Extent

All of the buildings on the UNCG campus are vulnerable to building fires.

E.5.20.2 Historical Occurrences

UNCG has recorded 29 building fires from January 2017 to January 2020.

Below is a summary of a couple of fires that have occurred.

In March of 2013, a large fire occurred at a UNCG apartment complex that was under constructions.

In April of 2017 the UNCG Auditorium suffered a fire which damaged the stage curtains, rigging and lighting.

E.5.20.3 Probability of Future Occurrences

Due to the number of building fire events recorded by UNCG in such a short timeframe, it can be expected that future occurrences of future building fires is likely (between 10 and 100% chance of occurrence annually).

E.5.20.2 Consequence Analysis

People There are a number of potential losses from a building fire at UNCG. Potential losses include human life, structures, and natural resources. Health hazards from smoke caused by fires within or outside the university boundaries can include breathing difficulties and worsening of chronic breathing and/or cardiovascular disease. Smoke and air pollution pose a risk for children, the elderly, and those with respiratory and cardiovascular problems. First responders are also at risk for exposure to dangers from the initial incident and after-effects such as smoke inhalation and/or heat stroke. Fires can create some issues with public confidence because of the very visible impacts that the fire has on the community.

Responders

Responders are often at great risk when addressing fires, especially firefighters who are responsible for putting out the blaze. All response personnel are potentially at risk when dealing with fires and often changing winds and a number of other factors can cause a fire to spread rapidly.

Like the general public, first responders are also at risk for exposure to dangers from the initial incident and after-effects such as smoke inhalation and/or heat stroke. However, their risk is often more prominent as they are often in the middle of an incident through their responsibilities as a responder.

Continuity of Operations

Since fires can moves quickly and can affect infrastructure that is important to maintaining continuity of operations, there is some level of concern for maintaining continuity. However, operations at UNCG, will probably not be impacted in a major way from a building fire.

Built Environment (Property, Facilities, and Infrastructure)

Building fires have the potential to substantially burn the built environment. Damage and destruction university and any surrounding State, county, private, and municipal structures and facilities are major losses that are attributed to fires. Damage to capital goods and equipment as well as evacuation expenses and other losses are directly related to fire and smoke damage. Additional potential losses include building and landscape maintenance expenses, firefighting equipment purchases, and fire-related business closures. Additional post-fire losses include cleanup, rehabilitation and repair expenses, equipment and capital goods replacement, drinking water pollution, smoke damage, deflated real estate values, and an increase in fire insurance premiums.

Economy
There could be some economic impacts of a fire at UNCG. If campus buildings are burned, the cost of rebuilding could be fairly substantial.

E.5.21 TRAFFIC/TRANSPORTATION ACCIDENTS

E.5.21.1 Background

While motor vehicle accidents occur on a near daily basis, large-scale incidents that have major impact are uncommon. This section will focus on large-scale incidents, which will include incidents involving airplanes on and off airport properties in Guilford County and incidents involving trains or major highways as when these do occur, they can have significant impacts on the community. The area has experienced several incidents in the past, but occurrence is relatively infrequent and significant impacts are rare. The most common impacts involve how the incident will impact daily life, such as travel and commerce. In Guilford County, the most prominent site for air travel is Piedmont Triad International Airport (PTIA) located in Greensboro. There are smaller airports within the county such as Southeast Greensboro Airport which have much smaller operations that are of very low significance to national air travel. Incidents have and will occur both on and off of airport properties as will be discussed in the "Historical Data" section. Guilford County is also a major thoroughfare for rail commerce and travel. A major rail line passes through the downtown areas of both Greensboro and High Point. Norfolk Southern and Amtrak are the two major carriers of cargo and passengers. There are also several major highways and interstate highways that run through Guilford County including Interstate-40, Interstate-73, Interstate-74, Interstate-85, and Interstate-840.

E.5.21.2 Location and Spatial Extent

Transportation incidents are most likely to occur along major transportation corridors such as highways, interstates, or railways. However, transportation incidents can occur throughout the county, especially given the number of planes that take flight in and out of regional and local airports and the many roads that are found throughout the county.

E.5.21.3 Historical Occurrences

There have been 1,056 traffic accidents recorded by UNCG Police from 2017 to 2020. The following incidents are just a sample of some of the incidents that have occurred at UNCG.

October 2015 – A UNCG student was taken to the hospital after being hit by a car at an intersection near UNCG.

November 2018 – A UNCG Student was killed in a traffic accident that involved an overturned car. The driver was arrested.

February 2020 – A UNCG Police Officer accidentally hit a student crossing the street. Rain may have played a factor. The student was treated for non-life-threatening injuries.

E.5.21.4 Probability of Future Occurrences

Transportation incidents are a highly likely event given that automobile accidents occur nearly every single day to some degree. However, these smaller-scale transportation incidents would have a relatively low impact overall on the community. Transportation incidents are fairly common, and the probability of a major future occurrence is likely.

E.5.21.5 Consequence Analysis

People (The Public and Public Confidence) - In the event of a transportation incident such a car accident, plane crash, or train derailment, there is a strong possibility of injury or death. The first concern in any incident is toward life safety, and emergency services will respond to not only assist those directly involved, but to monitor for fire or hazardous materials that could impact others. A car accident or train derailment could impact the normal operations of the transportation system, as other cars or trains attempting to pass through the area of the incident may be stopped or redirected. A plane crash on the site of an airport could drastically alter operations, also causing stoppages or redirection. An offsite plane crash may not impact other flights, but could impact businesses, homes, and other parts of everyday life depending on where the incident takes place.

Public confidence in the response to a transportation incident is dependent on the expectations of the public and past experience with such incidents. If the incident is major and there are many casualties, public confidence could be reduced, but in most smaller scale cases, there will be little impact to public confidence.

Responders - During any transportation-related incident, first responders will be responsible for public safety and returning the area of the scene back to normal as best as possible. Some of the concerns that may be present during and after an incident include the injured, fatalities, and the protection of others from hazards that result from the incident. Hazardous materials (fuel or cargo), entrapped passengers, fires, and explosions are some examples of these hazards, and are possible in any type of transportation incident. Response agencies are trained to identify, monitor, and react to any of these possibilities to provide an effective public safety response.

Continuity of Operations - Since these types of events occur on a relatively regular basis and their impact is generally fairly localized, there would probably be little disruption to continuity of operations from a transportation incident. However, if it is a major incident, staff resources may be strained and there could be some effect on continuing normal operations.

Built Environment (Property, Facilities, and Infrastructure) - Building Stock A transportation incident having an impact on any given residence is highly unlikely. If it were to occur, there could be structural damage to the residence and the potential for fire and severe localized damage to the particular structure impacted. If the incident involves hazardous materials release the impact on homes could be more widespread.

Critical Facilities and Personnel - Similarly, impacts to any given critical facility are unlikely. However, a transportation incident could increase the volume of patients at a hospital and strain the ability of responders. Facilities may be located in close proximity to rail lines or roadways, and a major incident near one of those facilities could have an impact on the community overall.

Transportation Systems Transportation infrastructure will be directly affected by incidents. Short term or potentially long-term closures are possible depending on the magnitude of the incident. For example, while Piedmont Triad International Airport is not one of the major national travel hubs, any disruptions to its operations will have some impact on air travel and commerce.

Economy - The economic impact of a transportation incident would be relatively minor. Plane crashes may discourage some from traveling while a train derailment may have a temporary impact on commerce. However, operations are expected to return to normal in a short period of time following the incident. There are some rail lines that pass through the downtown Greensboro area, which makes it possible for impacts from a derailment incident to a more widespread economy, but these would likely remain fairly localized. For example, a rail line runs very close to the Greensboro Coliseum and impacts are possible. These impacts could vary from access issues to the arena to a complete closure due to hazardous materials or other significant safety concerns.

Environment - The impacts of a transportation incident vary on the types of materials contained. Most transportation vehicles use some type of fuel that may be spilled during an incident and these fuels are hazardous to plant and wildlife populations and may also be harmful if spilled into a water source. Other contained chemicals and materials that are being transported by freight vehicles can be hazardous to these populations as well, depending on the characteristics of the substance(s). These are described above in the Hazardous Materials Incident section.

E.5.22 RESOURCE SHORTAGE

E.5.22.1 Location and Spatial Extent

Water or fuel shortages would impact the entire university so the location of this hazard is considered to be university-wide.

E.5.22.2 Historical Occurrences

In July of 2002, there was a major water shortage throughout North Carolina. This shortage was exacerbated by exceptional drought conditions over an extended period of time. The majority of the years between 1998 and 2002 were marked as under some level of drought. The shortage led to a significant water emergency for Guilford County, in particular in the City of Greensboro. At its worst point, the city had only a 67-day water supply and emergency conservation measures were put in place.

In September of 2008, the impacts of Hurricanes Gustav and Ike caused shortages of fuel in Guilford County and many other parts of the Southeast. Oil refineries in the Gulf of Mexico and the pipelines that deliver the product to various distribution points experienced significant disruptions or damages. Three years prior in August of 2005, Hurricane Katrina caused major shortages of fuel after it damaged or shut down many of the refineries and pipelines in the same region. In both shortages, there were long lines of vehicles at gas stations as the public attempted to fill up gas tanks before the supply ran out. Some stations were completely out of diesel and regular unleaded gasoline.

The fuel situation in the area was also critical during the OPEC fuel crisis in 1973 and 1974. Some gas stations in Greensboro implemented limits on refueling, including one station recorded as asking customers to purchase a maximum of 10 gallons. This illustrates how the geopolitical climate with respect to oil in the Middle East and other major oil reserves can have a significant impact on the price and supply of fuel.

E.5.22.3 Probability of Future Occurrences

Fuel and water shortages have occurred a number of times in Guilford County over the past several decades. Water shortages were more common in recent years, but fuel shortages have certainly impacted the county as well. As a result of these events potentially also impacting UNCG, the probability of future occurrences is possible.

E.5.22.4 Consequence Analysis

People (The Public and Public Confidence)

During events such as drought that cause water shortages or emergencies, the public is given limitations on using water for non-essential purposes such as watering lawns or washing vehicles. Water shortages beyond this are possible but less likely. Greater restrictions could be implemented and enforced in extreme water emergencies. Due to these impacts to the public, first response agencies may require additional resources to deal with heightened public safety or medical emergency concerns.

Fuel shortages are not as critical to life safety but could impact decisions made about travel and other life activities. When fuel supply issues become apparent, the public often resorts to panic buying, and lines become long at gas stations. Before the shortage even takes place, gas stations may be overtaxed, as fuel is dispensed faster than it can be replenished. In extreme shortages, limitations could be placed on consumers and in some cases businesses, governments, and other groups. Rationing at gas stations may be implemented and non-essential business or governmental activities may be put on hold or eliminated completely.

Water and other resource shortages can have an influence on the public and its outlook on how the government and any related nongovernmental organizations respond to the shortage. If rationing and restrictions are put in place, it will impact the public and its confidence in the entities responsible for dealing with these limitations. Collaboration with the media could have some influence on what is reported and could reduce negative perception.

Responders

Water shortages are more likely to present life safety issues than fuel shortages. In the event of a water shortage, more health-related emergencies such as dehydration can be expected, particularly if mechanisms are not in place to effectively obtain water from other areas. The concern is heightened during warm weather conditions, especially with extreme temperatures. Water shortages may also hamper firefighting.

Continuity of Operations

The nature of a resource shortage generally means that there is some recognition that the shortage maybe forthcoming in advance of major issues. The county generally has plans in place to ensure that Continuity of operations can be maintained during a resource shortage. Still, a long-term resource shortage could have an impact on operations as it begins to affect staff in the same ways as the general public is affected.

Built Environment (Property, Facilities, and Infrastructure)

Building Stock

In the midst of a water shortage, the prime concerns for residential areas would deal with hydration, preparation of food, and personal hygiene. In a fuel shortage, generators that run on fuel may not be operational. In both water and fuel shortage scenarios, there may be limitations put on property maintenance. Water intensive processes may be disrupted during water shortages for commercial and industrial operations. Accommodations such as restrooms for employees may not be operational. During fuel supply shortages, generators may not be able to be used, and property maintenance may be limited. Also, business operations that require transportation could be impacted significantly.

Critical Facilities and Personnel

During water or fuel shortages, there could be significant impacts on medical facilities and operations. Water intensive processes within the facility may be disrupted. Some medical procedures may need to be postponed or altered. In the event of a fuel shortage, interfacility transportation of patients may be impacted and backup generators may not be operational if needed. The major concern for emergency services during water shortages deals with firefighting. At the emergency services facilities, accommodations such as restrooms or showers and gear washing machines may not have the water needed for use. Fuel shortage events would spur concerns about emergency vehicles' consumption of fuel, as well as equipment and generators that run off of fuel.

The primary concern at the I-40 Fuel Farm during water supply emergencies is fire protection on site. Some water-intensive processes or basic accommodations for employees may be affected as well. The Fuel Farm's operations could be significantly impacted by the shortage of fuel. Productivity and profit would be of concern, but security issues may be an additional concern. There may be attempts of theft at the site when the fuel supply becomes critically low.

Transportation Systems

There would be few expected impacts on the transportation system during a water shortage. However, these systems could see significant impacts during a fuel shortage. Many travelers' vehicles may breakdown due to running out of fuel, which could block roadways for others. Maintenance and response mechanisms could be limited or unavailable depending on whether fuel is available as well. There could also be significant impacts on airport operations. Maintenance measures or accommodations on the airplanes that require water may not be able to be carried out. Accommodations such as restrooms for patrons and employees at the airport may not be operational, which could force the facility to shut down operations until the crisis is resolved. A fuel crisis can be equally as problematic as, without fuel, the airplanes cannot fly and again operations could be shut down.

Economy

Shortages dealing with critical resources such as water and fuel can have detrimental impacts on the economy. Governmental entities, businesses and the public may be forced to make significant and drastic decisions in order to deal with the complexities of shortages. Water supply disruptions could impact tourism and commerce if water is needed in key processes. Businesses such as hotels and restaurants may have to consider having water brought in or closing. The transport and delivery of goods and supplies can be severely impacted by fuel shortages, causing significant disruptions in economic activity. The overall impact is dependent on the severity and the duration of the shortage. It is also dependent on the availability of the resource from other sources and the ability to effectively get these resources to the intended end user. Workers may not be able to commute to work, bringing about productivity concerns and significant costs.

E.5.23 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.

E.5.23.1 Hazard Extent

Table E.28 describes the extent of each natural hazard identified for UNC Greensboro. The extent of a hazard is defined as its severity or magnitude, as it relates to the planning area.

TABLE E.28 EXTENT OF UNC GREENSBORO 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. According to the North Carolina Drought Monitor Classifications, the most severe drought condition is Exceptional. Guilford County has received this ranking (three times) over the nineteen-year reporting period.
Extreme Temperatures	The extent of extreme temperatures can be defined by the maximum and lowest temperature reached. The highest temperature recorded in Guilford County is 106 degrees Fahrenheit (reported on July 26, 1926) and the lowest was -8 degrees Fahrenheit (reported on 1/21/1985).
Hurricane and Coastal Hazards	Hurricane extent is defined by the Saffir-Simpson Scale which classifies hurricanes into Category 1 through Category 5. The greatest classification of hurricane to traverse directly through Guilford County was an unnamed Tropical Storm in 1893 which carried tropical force winds of 65 knots upon arrival.
Tornadoes/Thunderstorms	Tornadoes: Tornado hazard extent is measured by tornado occurrences in the US provided by FEMA as well as the Fujita/Enhanced Fujita Scale. The greatest magnitude reported in Guilford County was an F2 (reported in June 16, 1954). Thunderstorms: Thunderstorm extent is defined by the number of thunder events and wind speeds reported. According to a 64-year history from the National Centers for Environmental Information, the strongest recorded wind event in Guilford County was reported on July 15, 1976 at 84 knots (approximately 96 mph). It should be noted that future events may exceed these historical occurrences.

	Lightning: According to the Vaisala flash density map, UNC Greensboro 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. Hailstorms: Hail extent can be defined by the size of the hail stone. The largest hail stone reported in Guilford County was 2.75 inches (reported on April 2, 1983). It should be noted that future events may exceed this.
Severe Winter Weather	The extent of winter storms can be measured by the amount of snowfall received (in inches). The greatest 24-hour snowfall was reported in Guilford County was 20 inches reported on March 2, 1927.
Earthquakes	Earthquake extent can be measured by the Richter Scale and the Modified Mercalli Intensity (MMI) scale and the distance of the epicenter UNC Greensboro. According to data provided by the National Geophysical Data Center, the greatest MMI to impact Guilford County was IV (strong) with a correlating Richter Scale measurement of approximately 4.3 (reported on November 20, 1969). The epicenter of this earthquake was located between 236 and 284 km away.
Geological	Landslide: As noted above in the landslide profile, the landslide data provided by the North Carolina Geological survey is incomplete. This provides a challenge when trying to determine an accurate extent for the landslide hazard. However, when using the USGS landslide susceptibility index, extent can be measured with incidence, which is low throughout most of Guilford County. There is also at least moderate susceptibility throughout a majority of the region. Sinkhole: The central piedmont part of North Carolina and UNC Greensboro have a moderate susceptibility to sinkholes. On 6/18/2021, UNC Greensboro experienced a large sinkhole at 701 Kenliworth Street. Erosion: The extent of erosion can be defined by the measurable rate of erosion that occurs. There are no erosion rate records available for Guilford County or UNC Greensboro.
Dam Failure	Dam failure extent is defined using the North Carolina Division of Land Resources criteria. Of the 320 dams in Guilford County, 76 are classified as high-hazard.

<table>
<tr><td>Flooding</td><td>Flood extent can be measured by the amount of land and property in the floodplain as well as flood height and velocity. Flood depth and velocity are recorded via United States Geological Survey stream gages throughout the region. While a gauge does not exist on UNC Greensboro’s campus, there is one at or near many areas. The greatest peak discharge recorded for the area was reported on September 22, 1979. Water reached a discharge of 9,140 cubic feet per second and the stream gage height was recorded at 20.12 feet. Additional peak discharge readings and gage heights are in the table below.

<table>
<tr><th>Location/Jurisdiction</th><th>Date</th><th>Peak Discharge (cfs)</th><th>Gage Height (ft)</th></tr>
<tr><td>Guilford County</td><td></td><td></td><td></td></tr>
<tr><td>North Buffalo Creek Near Greensboro, NC</td><td>February 28, 1929</td><td>9,140</td><td>20.12</td></tr>
</table>
</td></tr>
<tr><th colspan="2">Other Hazards</th></tr>
<tr><td>Wildfires</td><td>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 Guilford County.

• The greatest number of fires to occur in any year was 22 in 2007.
• The greatest number of acres in a single year occurred in 2007 when 101 acres were burned.
• The largest acres burned in a single incidence occurred on June 26, 2007 when 40 acres were burned.
Although this data lists the extent that has occurred, larger more frequent wildfires are possible throughout Guilford County.</td></tr>
<tr><td>Infectious Disease</td><td>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 UNC Greensboro is susceptible to infectious diseases such as the flu, which kills hundreds of people annually.

As of May 18, 2020, the number of COVID-19 cases in Guilford County was 47,358 and the number of deaths related to COVID-19 was 701. On April 27, 2020, the UNC System made the decision to postpone in-person classes for the remainder of the school year. As a result, UNCG and all other universities in North Carolina, shifted on online classes. There is no tangible way of determining dollar losses due to the pandemic in Guilford County.</td></tr>
<tr><th colspan="2">Technological Hazards</th></tr>
<tr><td>Hazardous Materials Incident</td><td>According to USDOT PHMSA, the largest hazardous materials incident reported in Guilford County is 100 LGA released on the highway on March 27, 1976. It should be noted that larger events are possible.</td></tr>
</table>

Radiological Emergency – Fixed Nuclear Facilities	Although there is no history of a nuclear accident at the Sharron Harris Nuclear Stations, other events across the globe and in the United States in particular indicate that 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 Sharron Harris is possible.
Violent Crime/Major Crime	Although no major violent crime or severe terrorism attacks have been reported at UNC Greensboro, the entire campus is still at risk to a future event. Densely populated areas, such as university campuses, are considered more susceptible. Terror events have the potential to affect the human population, buildings and infrastructure, and the economy in the region.
Technology System Disruption	UNCG has experienced cyber related incidents in the past; however, to date, each incident has been resolved quickly. Technology usage, however, is increasing. A cyber-attack could potentially devastate the campus and could have lasting negative impacts.
Electromagnetic Pulse	Electromagnetic Pulse (EMP) occurrences have not taken place at UNC Greensboro, 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.
Utility Interruption/Failure	There are many impacts that would occur as a result of an energy/power/utility failure. Among other impacts, traffic lights could be down, students living on campus and those in classrooms might lose heat or air conditioning, medical equipment may be non-operational, and well pumps could be shut down limiting access to clean water. These failures could potentially be widespread, leaving tens of thousands of homes and businesses without power or utilities.
Civil Disturbance/Unrest	Often one of the greatest impacts from civil disturbances is collateral damage to people and property. During civil disturbances, property can be destroyed or stolen and citizens can be injured due to violence that erupts. First responders may also be targeted and many times are more likely to be injured as a result of civil unrest than the typical citizen.
Building Fire	There have been 29 building fires recorded on the UNCG campus from 2017 – 2020. The largest of these fires destroyed an entire apartment complex that was under construction.
Traffic/Transportation Accidents	A transportation incident might cause death or injury to those involved in the accident as well as to bystanders near the site of the incident. The main effects of a transportation incident might be fire or explosions and a shutdown of transportation corridors. Although these events are relatively common and emergency officials deal with them fairly often, the impacts to individuals might be severe with disruption to daily life at a minimum.
Resources Shortage	A resource failure would likely have widespread impacts that cause a strain on the local economy and on everyone on campus. In the past, the county has experienced events wherein there was less than 70 days of water supply available which is very low. Similarly, the county has experienced rationing of fuel supplies. Both of these types of events could occur again and impact UNCG and the extent could be similar or somewhat worse.

E.5.23.2 Priority Risk Index

In order to draw some meaningful planning conclusions on hazard risk for UNC Greensboro, the results of the hazard profiling process were used to generate hazard classifications according to a "Priority Risk Index" (PRI). The purpose of the PRI is to categorize and prioritize all potential hazards for UNC Greensboro 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 UNC Greensboro to consider as part of their proposed mitigation strategy.

The prioritization and categorization of identified hazards for UNC Greensboro 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 UNC Greensboro Campus Hazard Mitigation Planning Team in gaining consensus on the determination of those hazards that pose the most significant threat to the campus 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 at UNC Greensboro 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[13], as summarized in **Table E.29**. 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:

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

According to the weighting scheme and point system applied, the highest possible value for any hazard is 4.0. When the scheme is applied for UNC Greensboro, 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 UNC Greensboro Campus Hazard Mitigation Planning Team.

[13] The Campus 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.

TABLE E.29: PRIORITY RISK INDEX FOR THE UNC GREENSBORO

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. Little to no impact on the environment, and own operations.	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. Limited impact on the environment and own operations.	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. Impacts felt on environment and own operations impacted.	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. Significant impacts on environment and own operations including potential need for implementing Continuity of Operation Plans.	4	

PRI Category	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
Spatial Extent	Negligible	Less than 1% of area affected	1	20%
	Small	Between 1 and 10% of area affected	2	
	Moderate	Between 10 and 50% of area affected	3	
	Large	Between 50 and 100% of area affected	4	
Warning Time	More than 24 hours	Self-explanatory	1	10%
	12 to 24 hours	Self-explanatory	2	
	6 to 12 hours	Self-explanatory	3	
	Less than 6 hours	Self-explanatory	4	
Duration	Less than 6 hours	Self-explanatory	1	10%
	Less than 24 hours	Self-explanatory	2	
	Less than one week	Self-explanatory	3	
	More than one week	Self-explanatory	4	

E.5.23.3 Priority Risk Index Results

Table E.30 summarizes the degree of risk assigned to each category for all initially identified hazards based on the application of the PRI. Assigned risk levels were based on the detailed hazard profiles developed for this section, as well as input from the Campus Hazard Mitigation Planning Team. The results were then used in calculating PRI values and making final determinations for the risk assessment.

TABLE E.30: SUMMARY OF PRI RESULTS FOR THE UNC GREENSBORO

Hazard	Sub hazard(s) Assessed	Category/Degree of Risk					
		Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score*
Natural Hazards							
Drought		Likely	Minor	Large	More than 24 hours	More than one week	2.6
Extreme Temperature		Likely	Minor	Large	More than 24 hours	Less than one week	2.5
Hurricane and Coastal Hazards		Likely	Critical	Large	More than 24 hours	Less than 24 hours	3.0
Tornadoes/ Thunderstorms	Hailstorm, Lightning	Highly Likely	Critical	Moderate	6 to 12 hours	Less than 6 hours	3.4
Severe Winter Weather		Likely	Limited	Large	More than 24 hours	Less than one week	2.8
Earthquakes		Possible	Minor	Moderate	Less than 6 hours	Less than 6 hours	2.4

Hazard	Sub hazard(s) Assessed	Category/Degree of Risk					
		Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score*
Geological	Landslide, Sinkholes, Erosion	Possible	Limited	Small	Less than 6 hours	Less than 6 hours	2.5
Dam Failure		Unlikely	Minor	Small	Less than 6 hours	Less than 24 hours	2
Flooding		Likely	Limited	Small	6 to 12 hours	Less than one week	2.8
Other Hazards							
Wildfires		Unlikely	Minor	Small	Less than 6 hours	Less than 24 hours	2
Infectious Disease		Possible	Critical	Moderate	6 to 12 hours	More than 1 week	3.1
Technological Hazards							
Hazardous Materials/Substances		Likely	Limited	Small	Less than 6 hours	Less than 24 hours	2.9
Utility Interruption/Failure		Likely	Limited	Moderate	Less than 6 hours	Less than 24 hours	3.1
Building Fire		Possible	Limited	Small	Less than 6 hours	Less than 6 hours	2.5
Traffic/Transportation Accidents		Likely	Minor	Small	Less than 6 hours	Less than 6 hours	2.5
Resource Shortage		Possible	Critical	Small	More than 24 hours	More than one week	2.5
Civil Disturbance/Unrest		Possible	Limited	Small	Less than 6 hours	Less than 24 hours	2.6
Violent/Major Crime	Active assailant, Terrorism	Unlikely	Critical	Moderate	Less than 6 hours	Less than 24 hours	2.8
Radiological Emergency	Fixed Nuclear Facilities	Unlikely	Minor	Moderate	6 to 12 hours	Less than 1 week	2.1
Technology System Disruption	Cyber attack/breach, Communication System Disruption	Possible	Critical	Moderate	Less than 6 hours	Less than 1 week	3.2
Electromagnetic Pulse		Unlikely	Minor	Large	12 to 24 hours	Less than 6 hours	1.9

**PRI scores and degree of risk were submitted by the UNC Greensboro.*

E.5.24 FINAL DETERMINATIONS

The conclusions drawn from the hazard profiling process for UNC Greensboro, including the PRI results and input from the Campus 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 people, property, the environment and own operations from these hazards. It should be noted that although some hazards are classified below as posing low risk, their occurrence of varying or unprecedented magnitudes is still possible in some cases and their assigned classification will continue to be evaluated during future plan updates.

Table E.31 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 UNC Greensboro Campus Hazard Mitigation Planning Team.

TABLE E.31: 2021 CONCLUSIONS ON HAZARD RISK FOR UNCG

HIGH RISK	Tornadoes/Thunderstorms Technology System Disruption Utility Interruption/Failure Infectious Disease Hurricanes and Coastal Hazards
MODERATE RISK	Hazardous Materials/Substances Violent/Major Crime Severe Winter Weather Flooding Civil Disturbance/Unrest Drought Building Fire Traffic/Transportation Accidents Geological Extreme Temperature Resource Shortage Earthquake
LOW RISK	Radiological Emergency Wildfires Dam Failure Electromagnetic Pulse

E.6 Capability Assessment

The purpose of conducting a capability assessment for an institution of higher education is to determine the ability of the institution to implement a comprehensive mitigation strategy and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs, or projects[14]. 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 the university's regulatory framework, level of administrative and technical support, access to fiscal resources, and current political climate.

A capability assessment is generally based upon two primary components: 1) an inventory of the university's relevant plans, programs and policies already in place and 2) an analysis of the university's capacity to carry them out. Careful examination of campus capabilities will detect any existing gaps, shortfalls, or weaknesses with ongoing 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 university, which should continue to be supported and enhanced through future mitigation efforts.

The capability assessment completed for UNCG 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.

Capability Assessment Findings and Conclusion

Collectively, UNCG's administrative, technical and fiscal capabilities are high. Some of the highlights of UNCG's capabilities include the following:

- They were instrumental in the update of this plan and essentially led the update effort from the UNC System perspective.
- Designated a StormReady Campus by the National Weather Service.
- The university has established a university-wide Emergency Management Policy that will help facilitate mitigation strategies.
- UNCG has an established hazard mitigation program, which includes a process to monitor overall progress of mitigation activities and documents completed initiatives and their resulting reduction or limitation of the hazard impact on the university.

UNCG's high capability will help ensure that the Mitigation Strategy is effectively carried out and that hazard risk reduction for the campus is an attainable goal. The conclusions of the Risk Assessment and

[14] While the Final Rule for implementing the Disaster Mitigation Act of 2000 does not require a local capability assessment to be completed for hazard mitigation plans, it is a critical step in developing a mitigation strategy that meets the needs of the university while taking into account their own unique abilities. The Rule does state that a 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)).

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 Campus Hazard Mitigation Planning Committee considered not only their level of hazard risk, but also their existing capability to minimize or eliminate that risk.

E.7 Mitigation Action Plan

The Mitigation Action Plan is designed to achieve the mitigation goals and objectives established in Section 4: Mitigation Strategy of the main plan and will be maintained on a regular basis according to the plan maintenance procedures established in Section 5: Plan Maintenance of the main plan.

Each proposed mitigation action has been identified as an effective measure (policy or project) to reduce hazard risk to the people, property, environment and UNCG's own operation. 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's 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. 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.

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 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.
- Relative Cost
- Identification of University Department Responsible for each action
- Implementation Schedule—Date by which the action should be completed. More information is provided when possible.
- Implementation Status (2021)—Indication of completion, progress, deferment, or no change since the previous plan. If the action is new, that will be noted here.

All of the mitigation actions in this section have been assigned to various different university agencies to ensure their implementation.

For the update of this plan, the UNCG University Hazard Mitigation Planning Team participated in three activities related to the mitigation strategy for the university. Those activities included the following:

1. Review and reapproval of previous mitigation goals for the UNC Western Campuses. All eight of the campuses in the Western region decided to align the goals and objectives of this plan with the goals and objectives found in the UNC Eastern Campuses plan to provide consistency across the UNC System.
2. Review and update of existing mitigation actions. The Campus Hazard Mitigation Planning Team reviewed each existing action to determine if it was still relevant, if the prioritization of

the action remained the same and to provide an update on the status of implementation for the actions.

3. Identification of any new mitigation actions as determined necessary. The Campus Hazard Mitigation Team identified several new actions for inclusion in the plan. New mitigation actions for this update are marked as such in the Mitigation Action Plan.

The Mitigation Action Plan for UNCG is found on the following pages.

Campus-Wide Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Priority	Lead Agency/Department	Relative Cost and Potential Funding Source	Target Completion Date	2021 Implementation Status
Prevention							
CW-P-1	Critical Facilities Mitigation - Identify the campus's most at-risk vital/critical facilities, and evaluate the potential mitigation techniques for protecting each facility to the maximum extent possible.	All Hazards	Moderate	Emergency Management	No Additional Costs, Existing Operating Budgets	2022	New action for the 2021 plan update
CW-P-2	Building Emergency Action Planning - Create building emergency actions plans for each campus building and educate building occupants on the plan(s).	All Hazards	Moderate	Environmental Health and Safety, Emergency Management	No Additional Costs, Existing Operating Budgets	2021-2022	New action for the 2021 plan update
CW-P-3	Water Conservation Plan - Develop a plan to conserve water during a drought or at a time when water resources are in limited supply.	Drought, Resource Shortage	Low	Campus Enterprises	No Additional Costs, Existing Operating Budgets	2024	New action for the 2021 plan update
CW-P-4	Tree Inspection and Maintenance Program - Regularly inspect trees and the natural environment on campus and perform any needed maintenance to protect life, property, and the environment.	Tornadoes/ Thunderstorms, Hurricanes and Coastal Hazards, Severe Winter Weather	High	Facilities Operations	No Additional Costs, Existing Operating Budgets	Ongoing	New action for the 2021 plan update
CW-P-5	Drainage Inspection and Maintenance Program - Regularly inspect the	Flooding	High	Facilities Operations	No Additional Costs,	Ongoing	New action for the 2021 plan update

Action #	Description	Hazard(s) Addressed	Priority	Lead Agency/Department	Relative Cost and Potential Funding Source	Target Completion Date	2021 Implementation Status
	stormwater infrastructure on and around campus and perform any needed maintenance to reduce the possibility of flooding.				Existing Operating Budgets		
CW-P-6	2-Factor Authentication - Require 2-factor authentication (2FA) for all faculty and staff.	Technology System Disruption (Cyber)	High	Information Technology Services	$40,000, Existing Operating Budgets	2021	New action for the 2021 plan update
CW-P-7	Cybersecurity Incident Response Plan - Develop and test a campus-wide cybersecurity incident response plan.	Technology System Disruption (Cyber)	High	Information Technology Services	No Additional Costs, Existing Operating Budgets	Ongoing	New action for the 2021 plan update
CW-P-8	Pedestrian Safety Upgrades - Update pedestrian pathways and crosswalks in a manner which reduces the chance that a pedestrian will be struck by a vehicle. There have been multiple incidents each year in which a pedestrian in a crosswalk was struck by a vehicle and required medical treatment.	Traffic Accidents	High	Police Department	Unknown, University Funding Request	2021-2025	New action for the 2021 plan update
CW-P-9	Plan Review for Mitigation Actions - Develop a process to evaluate potential mitigation projects during the planning process for	All Hazards	Moderate	Emergency Management	No Additional Costs, Existing Operating Budgets	2021-2025	New action for the 2021 plan update

Action #	Description	Hazard(s) Addressed	Priority	Lead Agency/Department	Relative Cost and Potential Funding Source	Target Completion Date	2021 Implementation Status
	new construction and major modification projects.						
Property Protection							
CW-PP-1	Increase Property Insurance Coverage - Property Insurance being increased to Special Form "All Risk" on all property per UNC System mandate at renewal on March 1, 2021.	Tornadoes/Thunderstorms, Flooding, Lightning, Building Fire	High	Risk Management	Premium Deductible $1,102,738 $5,000 $1,063,990 $10,000 $1,025,242 $25,000 $1,001,993 $50,000 $978,744 $100,000, Existing Operating Budgets	2021	New action for the 2021 plan update
CW-PP-2	Repetitive Loss Tracking - Create a process to track repetitive losses to identify locations and buildings in need of mitigation actions.	All Hazards	High	Emergency Management and Facilities Operations	No Additional Costs, Existing Operating Budgets	2021	New action for the 2021 plan update
CW-PP-3	Emergency/Backup Power for Critical Facilities and Critical Research Equipment - Evaluate and compile a list of locations that serve as critical facilities and/or have	All Hazards	Moderate	Facilities Operations	Unknown, University Funding Request	2021-2025	New action for the 2021 plan update

Action #	Description	Hazard(s) Addressed	Priority	Lead Agency/Department	Relative Cost and Potential Funding Source	Target Completion Date	2021 Implementation Status
	critical research equipment that need emergency/backup power to maintain critical operations or research in the event of power outage. As funding becomes available, projects identified from this evaluation should be performed.						
Emergency Services							
CW-ES-1	Emergency Notification System Audio Enhancements - Establish a long-term solution to tie in the emergency notification system with building mass notification systems and exterior broadcast speakers.	All Hazards	Moderate	Emergency Management	$350,000, University Funding Request	2023	New action for the 2021 plan update
CW-ES-2	Emergency Notification System Visual Enhancements - Establish a long-term solution to tie in the emergency notification system with existing digital displays and expand digital displays campus-wide.	All Hazards	Moderate	Emergency Management	$25,000, University Funding Request	2021-2025	New action for the 2021 plan update
CW-ES-3	Expand Fire Drill Program - Establish and enact a plan to conduct fire drills in non-	Building Fire	High	Environmental Health and Safety	No Additional Costs,	2021	New action for the 2021 plan update

Action #	Description	Hazard(s) Addressed	Priority	Lead Agency/Department	Relative Cost and Potential Funding Source	Target Completion Date	2021 Implementation Status
	residential buildings on campus.				Existing Operating Budgets		
CW-ES-4	Expand On-Campus GIS Capabilities - Expand the use of GIS data for purposes of conducting more detailed hazard risk assessments.	All Hazards	Low	Emergency Management and Facilities Operations	$5,000, Existing Operating Budget	2021-2025	New action for the 2021 plan update
CW-ES-5	Monitor Grants and Other Funding Opportunities - Monitor grants and other funding opportunities for funding to establish a local reserve fund for repairing and/or incorporating hazard mitigation measures for public facilities and infrastructure damaged by hazards.	All Hazards	High	Emergency management	No Additional Costs, Existing Operating Budget	Ongoing	New action for the 2021 plan update
CW-ES-6	Severe Weather Shelter Area Identification - Identify and mark severe weather sheltering areas in all buildings on campus and educate building occupants on the location of these areas.	Tornadoes/Thunderstorms, Hurricanes and Coastal Hazards	Moderate	Emergency Management	$2,000, Existing Operating Budget	2021-2022	New action for the 2021 plan update
CW-ES-7	Civil Unrest Training and Equipment - Offer additional training to law enforcement officers	Civil Unrest	Moderate	Police Department	$10,000, Existing Operating Budget	2021	New action for the 2021 plan update

Action #	Description	Hazard(s) Addressed	Priority	Lead Agency/Department	Relative Cost and Potential Funding Source	Target Completion Date	2021 Implementation Status
	regarding civil unrest and provide necessary equipment to officers.						
CW-ES-8	Increase Emergency Shelter Resources - Acquire resources to support on campus shelter operations so that the University can be less reliant on county resources.	All Hazards	High	Emergency Management	$25,000, University Funding Request	2021	New action for the 2021 plan update
CW-ES-9	Debris Removal Contract - Establish a debris removal contract that is FEMA compliant to expedite the removal of debris from campus following a storm.	Severe Winter Weather, Tornadoes/Thunderstorms, Hurricane and Coastal Hazards	Moderate	Facilities Operations and Emergency Management	No Additional Costs, Existing Operating Budgets	2022	New action for the 2021 plan update
CW-ES-10	Inventory and Evaluate the University's Emergency Response Activities - Identify the resources needed to accomplish specific response activities. Reviews shall include the needs of personnel, equipment, and required resources to address hazards.	All Hazards	Moderate	Emergency Management	No Additional Costs, Existing Operating Budgets	2021	New action for the 2021 plan update
CW-ES-11	Update Emergency Operations Center - Update the technology in the Emergency Operations Center to provide better	All Hazards	Moderate	Emergency Management	$200,000, University Funding Request	2021-2022	New action for the 2021 plan update

Action #	Description	Hazard(s) Addressed	Priority	Lead Agency/Department	Relative Cost and Potential Funding Source	Target Completion Date	2021 Implementation Status
	real-time data and information to decision makers.						
CW-ES-12	Large Mobile/Towable Generator - Purchase a large capacity (200kw+) generator to be a deployable asset on campus and within the UNC System to power critical operations they do not have a dedicated backup power supply. During the 2014 Ice Storm, and in Hurricanes Matthew and Florence, local generator rentals were unavailable due to the demand prioritization for the equipment.	Utility Interruption, Tornadoes/Thunderstorms, Hurricanes and Coastal Hazards, Severe Winter Weather	Low	Emergency Management	$150,000, Grant	2023	New action for the 2021 plan update
CW-ES-13	Bi-Directional Amplifier (BDA) Installation and Maintenance - Continue to evaluate in building public safety radio coverage and install BDAs in buildings with low reception, and maintain existing BDAs. Public safety officers on a weekly basis experience loss of radio signal inside of campus buildings.	Technology System Disruption (Cyber)	Moderate	Emergency Management	$250,000, University Funding Request	2021-2025	New action for the 2021 plan update

Action #	Description	Hazard(s) Addressed	Priority	Lead Agency/Department	Relative Cost and Potential Funding Source	Target Completion Date	2021 Implementation Status
CW-ES-14	Pedestrian Safety Upgrades - Update pedestrian pathways and crosswalks in a manner which reduces the chance that a pedestrian will be struck by a vehicle. There have been multiple incidents each year in which a pedestrian in a crosswalk was struck by a vehicle and required medical treatment.	Traffic Accidents	High	Police Department	Unknown, University Funding Request	2021-2025	New action for the 2021 plan update
Public Education and Awareness							
CW-PEA-1	Increased Cybersecurity Awareness - Expand the existing cybersecurity awareness training to include additional topics for awareness.	Technology System Disruption (Cyber)	Moderate	Information Technology Services	No Additional Costs, Existing Operating Budgets	Ongoing	New action for the 2021 plan update
CW-PEA-2	Tiered Weather Notifications to Campus - Develop and implement a plan to send weather related information, advisories, watches, and warnings (that do not meet the criteria for an emergency notification) to the campus community using targeted mediums like the SpartanAlert	All Hazards	Moderate	Emergency Management	No Additional Costs, Existing Operating Budgets	2021	New action for the 2021 plan update

Action #	Description	Hazard(s) Addressed	Priority	Lead Agency/Department	Relative Cost and Potential Funding Source	Target Completion Date	2021 Implementation Status
	webpage and digital displays.						
CW-PEA-3	Run, Hide, Fight Program - Continue the Run, Hide, Fight Program and campus and consider making this a mandatory training program for all students, faculty, and staff.	Violent Crime (Terrorism)	Moderate	Police Department	No Additional Costs, Existing Operating Budgets	Ongoing	New action for the 2021 plan update
CW-PEA-4	StormReady University - Re-Certify as a StormReady University through the National Weather Service	All Natural Hazards	Low	Emergency Management	$1,000, Existing Operating Budgets	Emergency Management	New action for the 2021 plan update
CW-PEA-5	Enhance Emergency Preparedness Education Program - Enhance and maintain an all-hazards public education program to educate prepare student, faculty, and staff for all hazards identified.	All Hazards	Moderate	Emergency Management	$2,500, Existing Operating Budgets	Emergency Management	New action for the 2021 plan update
CW-PEA-6	Snow Clearance Mapping - Develop a mapping program to track snow removal from sidewalks, building entrances, roadways, and parking lots to provide real-time information to decision makers and the campus community. UNCG	Severe Winter Weather	Low	Facilities Operations	$10,000	Facilities Operations	New action for the 2021 plan update

Action #	Description	Hazard(s) Addressed	Priority	Lead Agency/Department	Relative Cost and Potential Funding Source	Target Completion Date	2021 Implementation Status
	experiences severe winter weather annually. In 2019 UNCG received record snowfall of 10"+.						
CW-PEA-7	Update SpartanAlert Webpage - Update the SpartanAlert Webpage to be inclusive of information and resources for stakeholders prior to or during an emergency.	All Hazards	Moderate	Emergency Management	No Additional Costs, Existing Operating Budgets	Emergency Management	New action for the 2021 plan update

Dining Hall Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Project/Action Update	Relative Cost	Target Completion Date	2021 Action Implementation Status
Property Protection						
DH-PP-1	All areas of insufficient concrete cover should be inspected and properly repaired to provide cover for reinforcing steel and prevent further deterioration and compromising of structural integrity.	High Wind/ Tornado, Winter Weather	This item was addressed during the 2011-2014 renovation and addition.	\$5,000-\$25,000	07/2014	Remove / Do not carry over to 2020 plan update.
DH-PP-2	Retrofit the paling and patio drainage/flashing as needed to remediate damage and prevent further deterioration.	High Wind/ Tornado, Winter Weather	This item was addressed during the 2011-2014 renovation and addition.	\$25,000-\$100,000	07/2014	Remove / Do not carry over to 2020 plan update.
DH-PP-3	Provide back-up generator power sufficient to maintain a food supply and business continuity in the event of an extended power loss.	High Wind/ Tornado, Winter Weather	This item was addressed during the 2011-2014 renovation and addition.	>\$100,000	07/2014	Remove / Do not carry over to 2020 plan update.
Structural Projects						
DH-SP-1	Foundation piers and/or shear walls should be retrofitted to enhance seismic performance.	High Wind/ Tornado, Winter Weather	This item was addressed during the 2011-2014 renovation and addition.	>\$100,000	07/2014	Remove / Do not carry over to 2020 plan update.

Eberhart Hall Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Project/Action Update	Relative Cost	Target Completion Date	2021 Action Implementation Status
Property Protection						
EH-PP-1	The drainage system should be routinely serviced to prevent system failure. Facilities Maintenance should provide emergency pumping equipment that can be used in the event of a system failure.	High Wind/ Tornado, Winter Weather	Grounds routinely removes debris to keep it out of the drainage systems as much as possible.	<$5,000	Accomplished through on-going routine maintenance	This is included in routine maintenance now. Do not carry over to 2020 plan update.
EH-PP-2	Trees that are located adjacent to the facility should be regularly pruned to prevent damage from falling limbs. Dead or dying trees should be completely removed.	High Wind/ Tornado, Winter Weather	Trees are trimmed as needed and removed when necessary.	<$5,000	Accomplished through on-going routine maintenance	This is included in routine maintenance now. Do not carry over to 2020 plan update.
EH-PP-3	Any building operations requiring electrical power to maintain business continuity, such as experiments or freezers, should be relocated or have a plan in place for power outages.	High Wind/ Tornado, Winter Weather	Facilities Design & Construction Project ID 2019-719 executed a design study (only) for a second generator. Status of implementation is unknown.	$25,000-$100,000	Unknown at this time	Remove. We will lump this need into a comprehensive need for emergency power for critical research equipment and other continuity of operations needs.
Structural Projects						
EH-SP-1	Create a proper access on the east side of the building for emergency vehicles.	High Wind/ Tornado, Winter Weather	Access is available.	$5,000-$25,000	None	Remove / Do not carry over to 2020 plan update.

Coleman Health and Human Performance Building Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Project/Action Update	Relative Cost	Target Completion Date	2021 Action Implementation Status
Property Protection						
CHHP-PP-1	Trees that are located adjacent to the facility should be regularly pruned to prevent damage as a result of falling limbs. Dead or dying trees should be completely removed.	High Wind/ Tornado, Winter Weather	Trees are trimmed as needed and removed when necessary.	<$5,000	Accomplished through on-going routine maintenance	This is included in routine maintenance now. Do not carry over to 2020 plan update.
CHHP-PP-2	The drainage system at the south side should be routinely serviced to prevent system failure. Facilities Maintenance should provide pumping equipment that can be used in the event of a system failure.	High Wind/ Tornado, Winter Weather	Grounds routinely removes debris to keep it out of the drainage systems as much as possible.	$5,000-$25,000	Accomplished through on-going routine maintenance	This is included in routine maintenance now. Do not carry over to 2020 plan update.
CHHP-PP-3	The drainage culvert passing below the structure should be periodically inspected to ensure it is not a hazard to the structure above. The culvert should be regularly cleaned and care should be taken to not direct more water through the culvert than its design intent.	High Wind/ Tornado, Winter Weather	No problems have been observed. Gravity automatically directs water through the culvert.	$5,000-$25,000	Accomplished through on-going routine maintenance	Remove / Do not carry over to 2020 plan update.
CHHP-PP-4	If Coleman skylights do not contain safety glass, replace existing lights with fiberglass or safety glass.	High Wind/ Tornado, Winter Weather	Skylights in the Rosenthal wing were removed during a renovation.	$5,000-$25,000	2017	Remove / Do not carry over to 2020 plan update.
Emergency Services						

Action #	Description	Hazard(s) Addressed	Project/Action Update	Relative Cost	Target Completion Date	2021 Action Implementation Status
CHHP-ES-1	Proper emergency measures should be installed on the east side of the building, such as fire hydrants, etc., in lieu of emergency vehicle access.	High Wind/ Tornado, Winter Weather	No known deficiencies exist for proper response by the Greensboro Fire Department. FDCs are labeled properly for east and west sections of the building and hydrants are located within range.	$5,000-$25,000	None	Remove / Do not carry over to 2020 plan update.

Jackson Library Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Project/Action Update	Relative Cost	Target Completion Date	2021 Action Implementation Status
Property Protection						
JL-PP-1	The library should provide adequate backup power to maintain environmental control in the rare books collection. Portable equipment could be purchased to provide temporary cooling in the event of an extended outage.	High Wind/ Tornado, Winter Weather	Temporary coolers run on a portable generator can be provided for Rare Books Collection if needed.	$25,000-$100,000	2015	Remove / Do not carry over to 2020 plan update.
JL-PP-2	Environmental controls or new windows should be installed in the rare books collection to prevent a condensing environment.	High Wind/ Tornado, Winter Weather	Environmental controls are fine. Windows are believed to be single pane glass and should be upgraded during renovation.	$25,000-$100,000	Unknown	Remove / Do not carry over to 2020 plan update.
Structural Projects						

Action #	Description	Hazard(s) Addressed	Project/Action Update	Relative Cost	Target Completion Date	2021 Action Implementation Status
JL-SP-1	The water infiltration through the fifth-floor façade should be corrected.	High Wind/ Tornado, Winter Weather	Water infiltration issues have been resolved.	$25,000-$100,000	2015	Remove / Do not carry over to 2020 plan update.
JL-SP-2	Provide adequate bracing of bookshelves to prevent them from toppling onto occupants	High Wind/ Tornado, Winter Weather	Bracing was added to the stacks in the tower in 2002/2003.	$5,000-$25,000		Remove / Do not carry over to 2020 plan update.

McNutt Building Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Project/Action Update	Relative Cost	Target Completion Date	2021 Action Implementation Status
Property Protection						
MB-PP-1	Mini-split heat pumps and all vital mechanical equipment should be anchored to their foundation in compliance with building code.	High Wind/ Tornado, Winter Weather	HVAC Shop personnel to complete.	<$5,000	12/31/2020	Remove / Do not carry over to 2020 plan update. Will be completed by the end of December 2020.
MB-PP-2	Consider instituting a policy which would remove sensitive electronics from below the skylight prior to the arrival of hurricanes.	High Wind/ Tornado	Plan has been completed.	<$5,000	2019	Remove / Do not carry over to 2020 plan update.
MB-PP-3	Consider installation of alternate fire suppression system in areas with sensitive electronics.	High Wind/ Tornado, Winter Weather	Fire suppression system was installed to meet code during renovation of facility.	>$100,000	2008	Remove / Do not carry over to 2020 plan update.
Structural Projects						

Action #	Description	Hazard(s) Addressed	Project/Action Update	Relative Cost	Target Completion Date	2021 Action Implementation Status
	Verify with engineer of record that generator anchorage complies with seismic requirements of building code.	Earthquake		<$5,000	None	Remove / we will reevaluate this action and lump various anchorage actions into one comprehensive action.
	Provide several bollards around generator enclosure to prevent accidental vehicle impacts where generator enclosure extends beyond existing fence line.	High Wind/ Tornado, Winter Weather	Upper portion of generator that extends beyond existing fence line is difficult to hit with a delivery vehicle.	$5,000-$25,000	None	Remove / Do not carry over to 2020 plan update.

Mossman Building Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Project/Action Update	Relative Cost	Target Completion Date	2021 Action Implementation Status
Property Protection						
MSB-PP-1	The drainage system at the facility's rear should be routinely serviced to prevent failure. A backup pumping system should be maintained by the campus in the event that the drainage system fails.	High Wind/ Tornado, Winter Weather	Stormwater drainage system is on a PM program.	<$5,000	Accomplished through on-going routine maintenance	Remove / Do not carry over to 2020 plan update.
MSB-PP-2	Trees that are located adjacent to the facility should be regularly pruned to prevent damage to the facility during ice and high wind events. Dead or dying trees should be completely removed.	High Wind/ Tornado, Winter Weather	Trees are trimmed as needed and removed when necessary.	<$5,000	Accomplished through on-going routine maintenance	Remove / Do not carry over to 2020 plan update.

Action #	Description	Hazard(s) Addressed	Project/Action Update	Relative Cost	Target Completion Date	2021 Action Implementation Status
Prevention						
MSB-P-1	Facility personnel indicated that accounting and payroll have plans to relocate in the event of a power outage. The Chancellor's executive command center should make plans to relocate or sufficient backup power should be provided to permit facility operation during power outages.	High Wind/ Tornado, Winter Weather	The Emergency Operations Center in the UNCG Police Building is available if needed. Existing almost new generator currently provides power for Life Safety only.	$25,000-$100,000	2016	Remove / Do not carry over to 2020 plan update.

Police Department Building Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Project/Action Update	Relative Cost	Target Completion Date	2021 Action Implementation Status
Property Protection						
PD-PP-1	Reinforce the windows in the dispatch/surveillance area to prevent breach by wind borne debris.	High Wind/ Tornado	The Police Department moved into a newly constructed building. Doing so addressed this concern.	<$5,000	01/2015	Remove / Do not carry over to 2020 plan update.
PD-PP-2	Trees that are located adjacent to the facility should be regularly pruned to prevent damage from falling limbs. Dead or dying trees should be completely removed.	High Wind/ Tornado, Winter Weather	The Police Department moved into a newly constructed building. Doing so addressed this concern.	<$5,000	01/2015	Remove / Do not carry over to 2020 plan update.

Action #	Description	Hazard(s) Addressed	Project/Action Update	Relative Cost	Target Completion Date	2021 Action Implementation Status
PD-PP-3	Trees surrounding the emergency generator should be pruned back or removed to prevent damage as a result of falling limbs.	High Wind/ Tornado, Winter Weather	The Police Department moved into a newly constructed building. Doing so addressed this concern.	<$5,000	01/2015	Remove / Do not carry over to 2020 plan update.
PD-PP-4	Trees surrounding overhead power lines should be pruned to reduce the chance of damage during a wind or ice event.	High Wind/ Tornado, Winter Weather	The Police Department moved into a newly constructed building. Doing so addressed this concern.	<$5,000	01/2015	Remove / Do not carry over to 2020 plan update.
Emergency Services						
PD-ES-1	Acquire a new generator or other forms of redundant power supply to ensure that critical facilities and infrastructure remain operational during storm events and in any cases where normal power supply is not available.	All Hazards	The Police Department moved into a newly constructed building. Doing so addressed this concern.	>$100,000	01/2015	Remove / Do not carry over to 2020 plan update.

Steam Plant Building Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Project/Action Update	Relative Cost	Target Completion Date	2021 Action Implementation Status
Property Protection						
SP-PP-1	The structure should be periodically inspected to identify the onset of any masonry, concrete, or steel deterioration which could further increase the structure's susceptibility to extreme loads.	(High Wind/ Tornado, Winter Weather)	Inspection is included in PM program.	$5,000-$25,000	Accomplished through on-going routine maintenance	This is included in routine maintenance now. Do not carry over to 2020 plan update.
SP-PP-2	The roof should be periodically inspected to identify loose tiles. Prior to known high wind events (hurricanes), the area around the steam plant should be barricaded to protect pedestrians and vehicles.	(High Wind/ Tornado)	Inspection is included in PM program.	<$5,000	Accomplished through on-going routine maintenance	This is included in routine maintenance now. Do not carry over to 2020 plan update.
Structural Projects						
SP-SP-1	Verify with licensed engineer that generator anchorage complies with lateral and overturning strength requirements of the building code.	(High Wind/ Tornado, Winter Weather)	Not done. Not sure this is needed.	<$5,000	None	Remove / Do not carry over to 2020 plan update.
SP-SP-2	Provide minimum vehicle barriers to prevent accidental damage to natural gas connection.	(High Wind/ Tornado, Winter Weather)	Not done. The natural gas piping is located in an area with almost no vehicular traffic.	<$5,000	None	Remove / Do not carry over to 2020 plan update.

Action #	Description	Hazard(s) Addressed	Project/Action Update	Relative Cost	Target Completion Date	2021 Action Implementation Status
SP-SP-3	Provide alternate means for supplying makeup water to the steam system.	(High Wind/ Tornado, Winter Weather)	There is a plan in place to address this issue real-time. Temporary piping can be installed if there is a problem with the City makeup water pipe.	$25,000-$100,000	2019	Remove / Do not carry over to 2020 plan update.

Student Health Center Building Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Project/Action Update	Relative Cost	Target Completion Date	2021 Action Implementation Status
Property Protection						
SHC-PP-1	Trees that are located adjacent to the facility should be regularly pruned to prevent damage from falling limbs. Dead or dying trees should be completely removed.	High Wind/ Tornado, Winter Weather	Trees are trimmed as needed and removed when necessary.	<$5,000	Accomplished through on-going routine maintenance	This is included in routine maintenance now. Do not carry over to 2020 plan update.
SHC-PP-2	The drainage system at the facility's rear should be routinely serviced to prevent system failure. Facilities maintenance should maintain emergency pumping equipment that can be used in the event of a system failure.	High Wind/ Tornado, Winter Weather	Stormwater drainage system is on a PM program.	<$5,000	Accomplished through on-going routine maintenance	This is included in routine maintenance now. Do not carry over to 2020 plan update.
Emergency Services						
SHC-ES-1	The facility should have an emergency generator to permit vital business continuity functions in the event of a campus emergency.	High Wind/ Tornado, Winter Weather	A generator was installed at Gove Health to provide backup power to the critical operations.	$25,000-$100,000	04/2020	Remove / Do not carry over to 2020 plan update.

Sullivan Science Building Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Project/Action Update	Relative Cost	Target Completion Date	2021 Action Implementation Status
Property Protection						
SSB-PP-1	The glass of the greenhouse should be reinforced with shatter-proof film. The floor should be sealed and protected to prevent leakage to the floors below.	High Wind/ Tornado, Winter Weather	Glass reinforcement probably could be added to FDC Project ID 2019-725 for corrections to greenhouse environmental control systems if funding is provided. The epoxy floor was replaced in 6/2016.	$25,000-$100,000	Ceiling reinforcement - Unknown Floor - 6/2016	Remove / Do not carry over to 2020 plan update.
SSB-PP-2	The cause of water intrusion at the greenhouse/building connection should be identified and repaired to prevent further water damage.	High Wind/ Tornado, Winter Weather	No update. No recent history of this issue.	$25,000-$100,000	None	Remove / Do not carry over to 2020 plan update.
Structural Projects						
SSB-SP-1	Replace water-based sprinklers in Room 001 with fire suppression system compatible with electronic equipment.	High Wind/ Tornado, Winter Weather	Not done. Not currently Recommended	$25,000-$100,000	None	Remove / Do not carry over to 2020 plan update.
Emergency Services						
SSB-ES-1	Backup power should be provided to the server room's HVAC so that during a power outage the servers can continue functioning.	High Wind/ Tornado, Winter Weather	Not done. Possible to take care of in Sullivan emergency power study?	$25,000-$100,000	Unknown	Remove. We will lump this need into a comprehensive need for emergency power for critical equipment and other continuity of operation's needs.

Weil Winfield, Quad Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Priority	Lead Agency/Department	Relative Cost and Potential Funding Source	Target Completion Date	2021 Action Implementation Status
Emergency Services							
WWQ-ES-1	Residence Hall Emergency/Backup Power - Complete the installation of emergency/backup generator power at all residence halls to provide at a minimum power to life safety and access control systems in the buildings.	Utility Interruption, Tornadoes/ Thunderstorms, Hurricanes and Coastal Hazards, Severe Winter Weather	Moderate	Housing and Residence Life	Unknown, University Funding Request	2021-2025	New action for the 2021 update.

Gate City Boulevard Corridor

Action #	Description	Hazard(s) Addressed	Priority	Lead Agency/Department	Relative Cost and Potential Funding Source	Target Completion Date	2021 Action Implementation Status
Structural Projects							
GCB-SP-1	Commercial Power Redundancy for Gate City Blvd Corridor - Buildings on the south side of Gate City Blvd often experience power outages when the rest of campus remains energized. Work with the appropriate stakeholders to identify if an alternate source of commercial power can be established.	Utility Interruption, Tornadoes/ Thunderstorms, Hurricanes and Coastal Hazards, Severe Winter Weather	Moderate	Facilities Operations	Unknown, Stakeholder Partnership	2022	New action for the 2021 update.

Pedestrian Tunnel

Action #	Description	Hazard(s) Addressed	Priority	Lead Agency/Department	Relative Cost and Potential Funding Source	Target Completion Date	2021 Action Implementation Status
Structural Projects							
PT-SP-1	Tunnel Drainage - Evaluate the drainage capacity of the tunnel drains and expand capacity if needed.	Flooding	Low	Facilities Operations	Unknown, University Funding Request	2024	New action for the 2021 update.

Annex F University of North Carolina School of the Arts

This section provides planning process, campus profile, hazard risk, vulnerability, capability, and mitigation action information specific to University of North Carolina School of the Arts (UNCSA). This section contains the following subsections:

- F.1 Planning Process Details
- F.2 Campus Profile
- F.3 Asset Inventory
- F.4 Hazard Identification
- F.5 Hazard Profiles, Analysis, and Vulnerability
- F.6 Capability Assessment
- F.7 Mitigation Strategy

F.1 Planning Process Details

The update of the campus hazard mitigation plan was conducted by a Campus Hazard Mitigation Planning Team comprised of university staff and faculty. The committee followed a planning process prescribed by FEMA and participated in a series of meetings to update the plan. Details about the meetings held by the committee are provided below.

TABLE F.1: UNC SCHOOL OF THE ARTS CAMPUS HAZARD MITIGATION PLANNING COMMITTEE

LAST NAME	FIRST NAME	TITLE	ATTENDED FIRST MEETING	ATTENDED SECOND MEETING
Beery	Toni	Facilities Management – EHS		X
Beres	Karen	Vice Provost & Dean of Academic Affairs	X	
Bowman	Chris	Director of Mechanical Maintenance		X
Brinkley	Frank	Chief of Police	X	X
Carley	Deb	Student Affairs		X
Davis*	Clarisse	Emergency Manager	X	X
Davis	Gary	Public Safety Supervisor		X

LAST NAME	FIRST NAME	TITLE	ATTENDED FIRST MEETING	ATTENDED SECOND MEETING
Ferrell	Martin	Dean HS Academics	X	X
Fuiell	Sherrie	Operations Captain UNCSA PD	X	
Gleghorn	Gregory	Director of Information Security		X
Grice	Jeremy	Director Client Services IT	X	X
Johnson	Jared	Technology – Client Services Technician		X
Jones	Jordan	Grounds Manager		X
Mahoney	Angela	Director of HR	X	
Martin	Steve	AVC Facilities	X	X
Russell	Amber	Administrative Support Specialist		X
Wilson	Wade	School of Design and Production		X

* Primary Point of Contact

November 15, 2019 – Kickoff Meeting

ESP Associates' Project Manager, Nathan Slaughter, 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 Campus Hazard Mitigation Planning Team and began by having attendees introduce themselves. The 8 attendees included faculty and staff from various departments at the University. 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 was managing the planning effort and had assigned ESP Associates, Inc. to manage the update.

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 on campus (buildings, infrastructure 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 a discussion about various mitigation techniques. He briefly explained the six different categories of mitigation techniques: emergency services, prevention, natural resource protection, structural projects, public education and awareness, and property protection. The attendees were then asked what types of mitigation projects would be needed the most at UNCSA if FEMA funding was available. This helped demonstrate how priorities in mitigation actions should be considered for the plan.

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

- Coordinate between the eight participating campuses to update the existing plan,
- Update the plan to demonstrate progress and reflect current conditions,
- Complete the update in a timely manner because the existing plan expired in October of 2017,
- Increase public awareness and education,
- Maintain grant eligibility for participating campuses, and
- Maintain compliance with State and Federal requirements.

Mr. Slaughter reviewed the list of participating campuses with the group. He also explained the project tasks to be accomplished. These included the planning process, risk assessment, capability assessment, mitigation strategy, mitigation action plan, and plain maintenance procedures.

He explained that the project as being managed by a Campus Hazard Mitigation Steering Committee that had one representative from each of the eight campuses. For UNCSA, that representative was Clarisse Davis, Emergency Manager. He explained that the group currently in the room would be known as the Campus Hazard Mitigation Planning Team.

Mr. Slaughter explained that this update would expand the scope of the plan to not only address natural hazards, as was previously done for the existing plan, but that it would also address manmade/technological hazards as well. This was done to ensure alignment with the State of North Carolina's Hazard Mitigation Plan.

Mr. Slaughter explained that the plan would address campus vulnerability, where feasible, to identify specific types and numbers of campus assets that are at risk to the identified hazards. He said that an attempt would be made to address other types of vulnerability as well to include social, economic and environmental vulnerabilities.

He then discussed the capability assessment and how the plan would include a discussion on the University's capability to address their hazard vulnerability through mitigation. Next, he discussed the mitigation strategy and explained how that section of the plan would be reviewed and updated as required by FEMA.

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

Mr. Slaughter then reviewed the roles and responsibilities of ESP Associates, Inc, the campus leads and stakeholders. The presentation concluded with a discussion of the next steps to be taken in the project development. He explained that a Hazard Mitigation Public Survey was being developed and that it would be distributed soon. The next campus HMPT meeting was discussed and would be held sometime in the Spring or Summer of 2020. The purpose of the second meeting would be to discuss the findings of the risk and capability assessments and to begin updating existing mitigation actions and identify new goals.

January 26, 2021 – Mitigation Strategy Meeting – Zoom Meeting

Following a hiatus in the planning process caused by the onset, response and initial recovery from the COVID 19 pandemic, the UNCSA Campus Hazard Mitigation Planning Team held an online Mitigation Strategy Meeting on January 26, 2021.

Mr. Slaughter began the meeting with brief introductions and an overview of the agenda for the day. He provided a brief refresher on the definition of mitigation and a recap of the Disaster Mitigation Act of 2000, the key objectives of the project and the project schedule (which remained somewhat delayed because of the COVID-19 pandemic, but still on track for completion of the final plan).

He then began providing more detailed information about the hazards that impact the University. He started by recapping the number of hazard events experienced since the previous plan and discussed the presidential disaster declarations that have been experienced since the previous update. These included declarations for Tropical Storm Michael and the COVID-19 pandemic. He provided summary stats and slides for the following hazards: drought, hail, hurricanes and tropical storms, lightning, severe thunderstorms, tornadoes, flood, wildfire, winter storms and freeze, dam failure, earthquake, landslides, excessive heat, hazardous materials incident, public health hazards/infectious disease, cyber nuclear power plants, electromagnetic pulse and terrorism.

Mr. Slaughter provided an overview of the Priority Risk Index. The PRI is a quantitative scoring of hazards which is used to focus in on the hazards of greatest concern for the University. Using the PRI, the following hazards were considered the be highest risk for the University: severe winter weather, tornadoes/severe thunderstorms, flooding and hurricanes and coastal hazards.

The following feedback on the hazard identification slides was provided by the planning committee during the presentation:

- Flooding on campus does occur as a result of stormwater runoff. Portions of the main drive into campus (on the Northwestern side of campus) are sometimes submerged. Additionally, there have been instances of water getting into buildings in some areas.
- Changes to hazard rankings
    - Cyber is a high/moderate hazard of concern
    - Wildfire is a low hazard of concern as is drought.
    - Flood move from high to moderate.
    - Hurricane moderate.
- Social vulnerability concerns on campus are mainly a result of having high schoolers on campus. This is a challenge that no other universities in the UNC system face.

Following the hazard identification and PRI review, Mr. Slaughter reviewed the listing of key assets from the prior plan and discussed the need to update that ranking. He also mentioned that social vulnerability would be included in the plan to some extent and he presented slides on social vulnerability for Forsyth County.

There was also a brief discussion about the capability assessment that would be included in the plan for the University. He mentioned how that assessment would be conducted and what it would try to capture (administrative, technical, fiscal, and political capabilities of the University).

The remainder of the meeting was spent discussing the Mitigation Strategy. Mr. Slaughter gave an overview of the process for updating the Mitigation Strategy and presented the existing mitigation goals for the UNC Western Campuses regional plan. He asked the UNCSA Campus Hazard Mitigation Planning Team to review the goals to determine whether or not they still reflect current vulnerabilities and current mitigation priorities. The committee members agreed that the goals were no longer relevant and new goals and associated objectives were developed, voted upon and accepted. It should be noted that these goals and objectives also align with those found in the UNC Eastern Campuses Hazard Mitigation Plan.

Mr. Slaughter then indicated that Campus Hazard Mitigation Planning Team would need to provide a status update for their existing mitigation actions (completed, deleted, or deferred) and a brief discussion of how that determination was made. Mr. Slaughter also discussed the Mitigation Action Worksheets to be completed for any new mitigation actions. Mr. Slaughter then presented sample mitigation actions for the committee members to consider to include in their plan update.

Mr. Slaughter mentioned the need to conduct public outreach measures to meet FEMA requirements and indicated that a public survey would be sent out soon and an online public meeting for the entire UNC Western Campuses region would be conducted before the plan was finalized.

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

February 4, 2021 - Internal Staff Critical Building Ranking and Mitigation Strategy Discussion

Members of the UNCSA Campus Hazard Mitigation Planning Team held a meeting to talk through the mitigation actions and to discuss the rankings of the critical buildings on campus. The meeting was facilitated by Clarisse Davis, the UNCSA primary point of contact and, project consultant, Nathan Slaughter provided facilitation assistance for the discussion. The end result of the meeting was updated mitigation actions, new mitigation actions and an updated ranking of critical buildings on campus.

Involving the Public

Because this plan update was developed during the COVID-19 pandemic, the planning teams had to get creative in order to solicit feedback from the public about the plan and their thoughts on hazard mitigation. A public survey instrument was developed to provide an opportunity for the public to provide comment on their concerns about hazard impacts on the campuses and their thoughts on how mitigation could help reduce vulnerability. The public survey was distributed by each campus through different means to outreach to faculty, staff and students.

For UNCSA, 33 public survey responses were received and the results from those surveys were shared with the Campus Hazard Mitigation Planning Team. Feedback from the surveys was reviewed and considered for inclusion in this plan, as applicable, where determined to be relevant. A summary of the responses can be found in **Appendix B** and detailed survey responses can be obtained through North Carolina Emergency Management, Hazard Mitigation Planning staff.

F.2 Campus Profile

This section of the plan provides a general overview of the UNC School of the Arts Campus and surrounding area.

F.2.1 Geography and the Environment

UNCSA is located in Winston-Salem, North Carolina. Winston-Salem is the largest city in Forsyth County with an estimated 2019 population of 255,969. Winston-Salem is sometimes called the "Camel City" due to the city's historic involvement in the tobacco industry related to the locally based R.J. Reynolds Tobacco Company. Winston has seen a surge in growth and revitalization in the downtown area with hotels, restaurants, and apartment buildings under construction. Winston-Salem is in the northwest piedmont area of North Carolina roughly 65 miles from the center of the state. The city has a rough total area of 134 square miles with a little over a square mile being water. The city lies within the Yadkin-Pee Dee river basin, mainly draining via Salem Creek. Community renovations involve plans to purchase property and build new apartment units, with a 4,000 square foot community space. An orientation map of the University of North Carolina School of the Arts can be seen in **Figure F.1** and a map of the main-campus can be seen in **Figure F.2**.

FIGURE F.1: UNC SCHOOL OF THE ARTS LOCATOR MAP

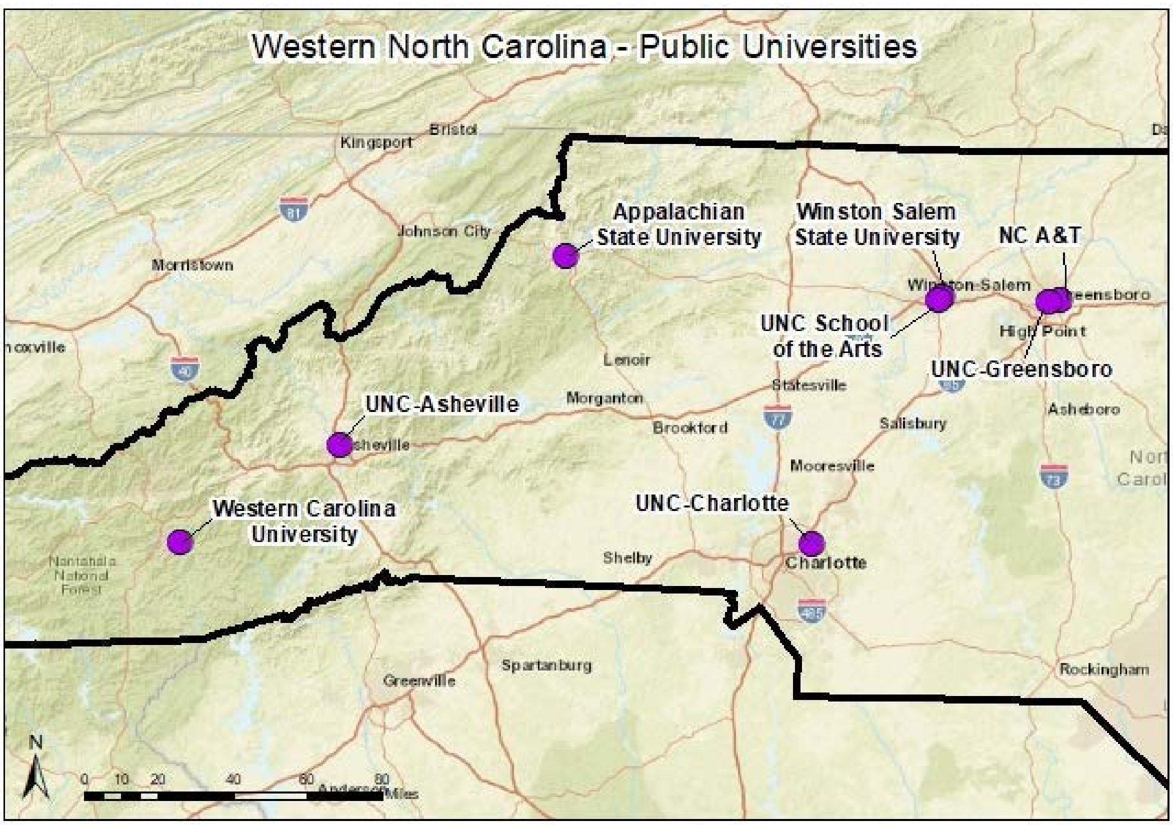
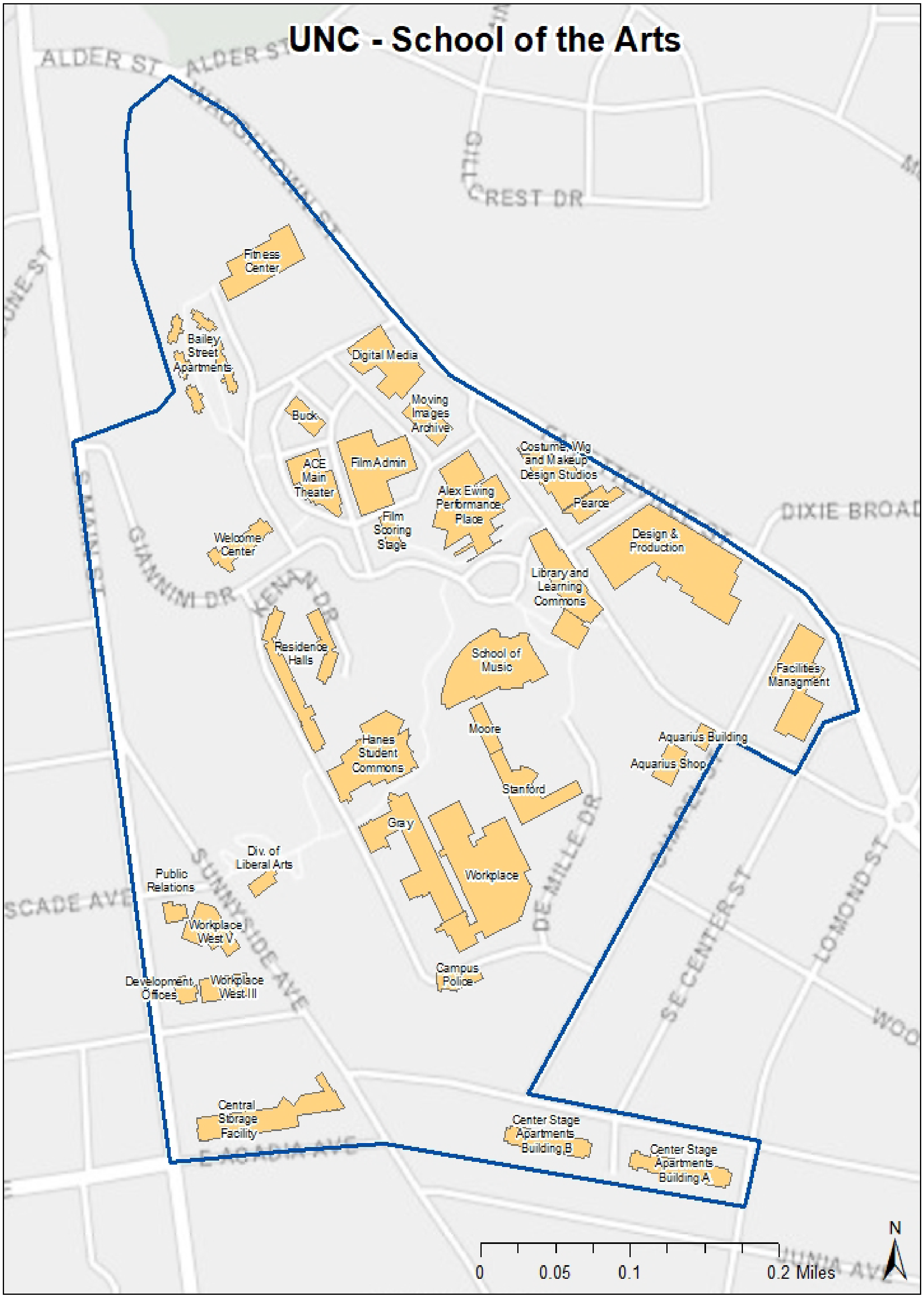


FIGURE F.2 UNCSA MAIN CAMPUS MAP



UNCSA has a climate similar to the other UNC system schools closer to the middle of the state. During the summer months, the average high temperature in Winston-Salem is 89°F. Summers are hot and humid similar to other piedmont areas in parts of the Carolinas. Winters are generally characterized as cool and moderately cold. The average low temperature in winter is 28°F. The annual average of rainfall in Winston-Salem is around 40 inches. However, more than half of days out of the year are sunny. The monthly averages for Winston-Salem are presented in **Table F.2**.

TABLE F.2 MONTHLY AVERAGES FOR WINSTON-SALEM, NORTH CAROLINA

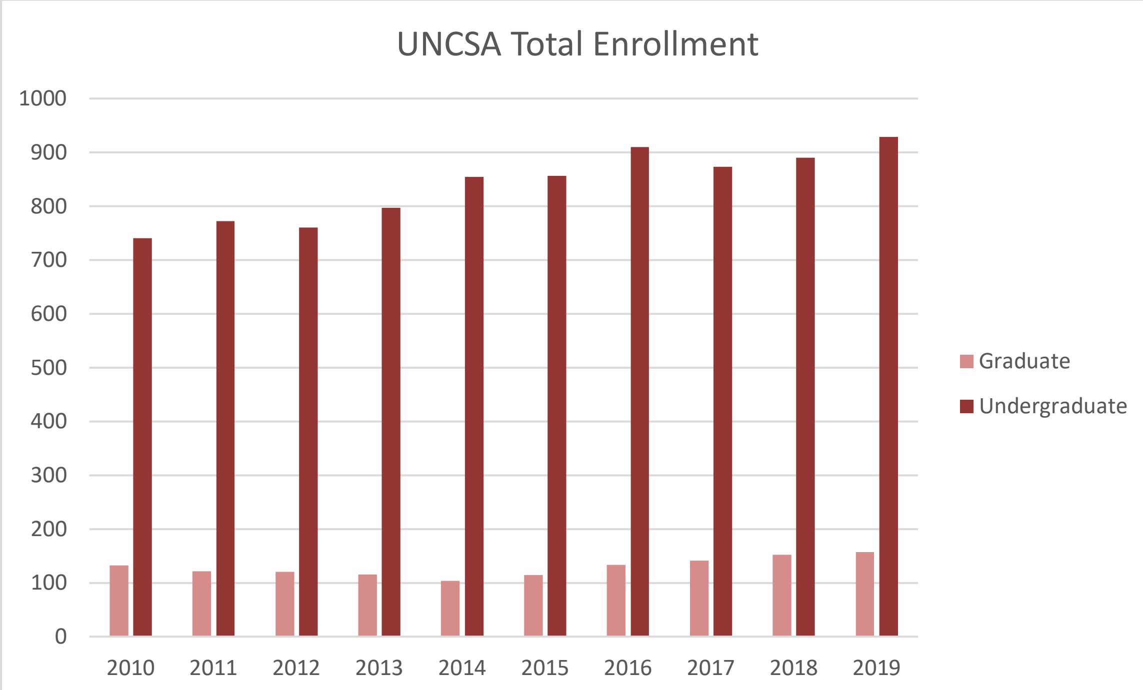
Month	Average High	Average Low	Average Precipitation
January	49°F	30°F	3.61 in
February	53°F	33°F	3.19 in
March	61°F	40°F	4.04 in
April	71°F	48°F	3.70 in
May	78°F	56°F	3.87 in
June	85°F	65°F	4.20 in
July	89°F	69°F	5.00 in
August	86°F	68°F	4.87 in
September	80°F	61°F	4.19 in
October	71°F	50°F	3.41 in
November	62°F	40°F	3.35 in
December	62°F	33°F	3.47 in

Source: National Weather Service

F.2.2 Population and Demographics

UNC School of the Arts has grown steadily over the years, and has been an established since 1963. As of Fall 2019, UNC School of the Arts has a total enrollment of 1,086 students. This includes 929 undergraduate students and 157 graduate students. Since 2007 UNC School of the Arts has grown nearly 20%. The majority of students attending this university are White representing slightly over 70% of the student population, with the second most prevalent ethnicity being African American representing nearly 10%. Native Hawaiian's make up the least represented group for this school consisting of less than .1% of the total student population. The enrollment trends over the past ten years can be seen in **Figure F.3.**

FIGURE F.3: ENROLLMENT TOTALS



For a breakdown of enrollment demographics please see **Table F.3** below.

TABLE F.3 ENROLLMENT DEMOGRAPHICS (2019)

Race/Ethnicity	Enrollment (Fall 2019)	Percentage
White	749	68.96%
Hispanic or Latino	91	8.37%
Black or African American	90	8.28%
Two or More Races	58	5.34%
Asian	29	2.67%
Nonresident Alien	40	3.68%
American Indian or Alaska Native	8	0.73%
Native Hawaiian or Other Pacific Islander	1	0.09%
Unknown	20	1.84%

Source: UNC System – Interactive Data Dashboards

F.3 Asset Inventory

An inventory of assets was compiled to identify the total count and value of property exposure on the UNC School of the Arts campus. This asset inventory serves as the basis for evaluating exposure and vulnerability by hazard. Assets for analysis include buildings, critical facilities, and critical infrastructure.

F.3.1 Building Inventory

This section provides total building exposure for the campus, which was estimated by summarizing building footprints provided by North Carolina Emergency Management and property values derived from 2020 insurance assessment data. According to that data, there are 51 buildings associated with UNCSA totaling a value of $423,044,791 (building and contents).

F.3.2 Critical Buildings

Of significant concern with respect to any disaster event is the location of critical facilities and infrastructure in the planning area. Critical facilities are those essential services and lifelines that, if damaged during and emergency event, would disrupt campus continuity of operations or result in severe consequences to public health, safety, and welfare.

Critical buildings are a subset of the total building exposure and were identified by UNCSA's HMPC representatives. The UNCSA HMPC updated the list of critical facilities from the previous DRU plan and ranked each facility on a set of standardized criteria designed to evaluate all critical buildings in the UNC System DRU plans. Factors considered for this ranking included:

- the building's use for emergency response,
- the building's use for essential campus operations
- the building's use as an emergency shelter or for essential sheltering services,
- the presence of a generator or generator hook-ups,
- the building's use for provision of energy, chilled water or HVAC for sensitive or essential systems,
- the storage of hazardous materials,
- the building's use for sensitive research functions,
- the building's cultural or historical significance, and
- building-specific hazard vulnerabilities

Figure F.4 below shows the scoring sheet that the ASU Campus Mitigation Planning Team used to rate critical buildings on campus. All of the campuses in the UNC system used to same scoring methodology for consistency.

FIGURE F.4: CRITICAL BUILDING SCORING WORKSHEET

Critical Building Scoring Worksheet

Campus:
Facility Name:

		Score
1	Does the facility serve as the campus Emergency Operations Center (EOC)? Yes, Primary EOC = 6 pts Yes, Secondary EOC = 3 pts No = 0 pts	0
2	Does the facility house functions essential to campus operations? Main Telecommunication Center = 3 pts Computer Network Hub = 3 pts Adminstrative Operations = 1 pts Maintenance = 1 pt Public Safety = 1 pt	0
3	Is the facility equiped with a generator or hook-ups? Generator = 3 pts Hook-ups = 1 pt Neither = 0 pts	0
4	Does the facility serve as a pre or post disaster shelter? Both pre and post disaster shelter = 6 pts Either pre or post disaster shelter = 3 pts Neither = 0 pts	0
5	Does the facility provide services essential to sheltering? Resident Housing = 1 pt Assesmbly Space = 1 pt Food Preperation Facility = 1 pt Shower Facilities = 1 pt	0
6	Does the facility provide chilled water distribution or contain HVAC systems necessary to sensitive or essential systems? Yes = 3 pts No = 0 pts	0
7	Are there hazardous materials on-site? (greater than 25 gallons) Yes = 3 pts No = 0 pts	0
8	Does the facility house research functions that have a low level of tolerance for disruption? Yes = 2 pts No = 0 pts	0
9	Does the facility serve as storage for rare or unique collections (art, artifacts, letters, etc) or is it a historically or culturally significant building? Yes = 2 pts No = 0 pts	0
10	Does the facility have hazard specific vulnerabilities (basement susceptible to flood, etc.) Yes = 3 pts No = 0 pts	0
Notes/ Comments		

Total Score:	0
Total Possible Score:	42

The identified critical facilities for UNCSA, as scored by the UNCSA Campus Hazard Mitigation Planning Team are listed below:

- Sanford and Moore Residence Halls (13)
- Police and Public Safety (12)
- Administration Annex (12)
- Hanes Student Commons (11)
- New Residence Hall - Scheduled to be open 2022 (10)
- Center Stage Apartment (9)
- Semans Academic and Administration Building (8)
- Facilities Management (7)
- Library (7)
- Fitness Center (5)
- Workplace Central Plant (4)

F.4 Hazard Identification

This section describes how the Campus Hazard Mitigation Planning Team identified the hazards to be included this plan.

F.4.1 Hazard Identification

Upon a review of the full range of natural hazards suggested under FEMA planning guidance, the Campus Hazard Mitigation Planning Team identified a number of hazards that are to be addressed in its Hazard Mitigation Plan. These hazards were identified through a process that utilized input from the Campus Hazard Mitigation Planning Team, research of past disaster declarations in the surrounding county, and review of the previous UNCSA Pre-Disaster Mitigation Plan. To maintain consistency, the Multi-Campus Hazard Mitigation Steering Committee and the Campus Hazard Mitigation Planning Teams voted to assess the same hazards that were identified in the most recent update of the North Carolina State Hazard Mitigation Plan. Therefore, since the development of the previous plan, the hazard identified and included in the plan have changed. A list of all previous hazards covered in the previous UNCSA Pre-Disaster Mitigation Plans are viewable in **Table F.4**, 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.

TABLE F.4: 2021 UNC SCHOOL OF THE ARTS HAZARDS UPDATE

2010 University of North Carolina School of the Arts Identified Hazards		2021 University of North Carolina School of the Arts Identified Hazards		Description of hazards covered in 2021 Plan and Explanations
Atmospheric Hazards	Drought	**Natural Hazards**	Drought	Agricultural Drought, Hydrological Drought
	Driving Rain			
	Other High Wind events			
			Excessive Heat	
	Hurricane		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

2010 University of North Carolina School of the Arts Identified Hazards		2021 University of North Carolina School of the Arts Identified Hazards		Description of hazards covered in 2021 Plan and Explanations
	Tornado		Tornadoes/Thunderstorms	Hailstorm, Torrential Rain associated with Severe Thunderstorms, Thunderstorm Wind, Lightning, Waterspout, High Wind
	Electrical Storm			
	Severe Winter Weather, including ice or snow events		Severe Winter Weather	Freezing Rain, Snowstorms, Blizzards, Wind Chill, Extreme Cold
Hydrologic Hazards			Dam Failures	
	Flood		Flooding	
Geologic Hazards	Earthquake		Earthquakes	
	Landslide, Rockslide, and other Geologic		Geological	Landslides, Sinkholes, Erosion
Other Hazards	Wildfire or Building Fire	**Other Hazards**	Wildfires	
	Animal borne and other Infectious Diseases		Infectious Disease	
	Accidental Explosion	**Technological Hazards**		
			Hazardous Substances	Hazardous Materials, Hazardous Chemicals, Oil Spill
			Terrorism	Chemical, Biological, Radiological, Nuclear, Explosive
			Cyber	
			Electromagnetic Pulse	

F.4.2 Disaster Declarations

Disaster declarations provide insight into the hazards that may impact UNCSA. **Table F.5** shows every declared presidential disaster to impact Forsyth County since 1989. There have been ten total disaster declarations in Forsyth County since 1989.

TABLE F.5: FORSYTH COUNTY DISASTER DECLARATIONS

Year	Disaster Number	Description
1989	844	HURRICANE HUGO
1989	827	TORNADOES
1996	1087	BLIZZARD OF '96
1996	1103	WINTER STORM
1999	1292	HURRICANE FLOYD
2002	1448	SEVERE ICE STORM
2003	1457	ICE STORM
2004	1553	HURRICANE IVAN
2019	4412	TROPICAL STORM MICHAEL
2020	4487	COVID-19 PANDEMIC

F.4.3 Summary of Hazard Impacts Since Previous Plan

Since the approval of the previous UNC School of the Arts Pre-Hazard Mitigation Plan (June 30th, 2010), there have been 218 hazard events recorded for the planning area in the National Centers for Environmental Storm Event Database. It is important to take note of those hazard events and consider them in the *Hazard Identification* section to help ensure that the appropriate hazards are being considered in the risk assessment sections in the Mitigation Strategy. **Table F.6** documents the hazard events recorded.

TABLE F.6: SUMMARY OF HAZARD EVENTS SINCE PREVIOUS PLAN

Hazard Type*	Number of Reported Events in Forsyth County
Cold/Wind Chill	0
Flash Flood	21
Flood	0
Hail	25
Heavy Snow	0
High Wind	0
Lightning	0
Strong Wind	8
Thunderstorm Wind	132
Tornado	0
Tropical Storm	2
Winter Storm	14
Winter Weather	16
TOTAL NUMBER OF REPORTED EVENTS	218

* The hazard type names that NCEI uses are different than the names of hazards used in this plan; however, one can still get an understanding of the types of hazards that impact the region as the hazard types are similar in name.

F.4.4 Hazard Evaluation

Table F.7 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 furthered 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 further evaluations and updates of the risk assessment if deemed necessary by the Multi-Campus Hazard Mitigation Steering Committee and the Campus Hazard Mitigation Planning Team during the plan update process.

TABLE F.7: 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?
NATURAL HAZARDS			
Avalanche	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of the NC State Hazard Mitigation Plan • Review of the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan • Review of US Forest Service National Avalanche Center website	• The United States avalanche hazard is limited to mountainous western states including Alaska as well as some areas of low risk in New England. • Avalanche hazard was removed from the North Carolina State Hazard Mitigation Plan after determining the mountain elevation in Western North Carolina did have enough snow not to produce this hazard. • Avalanche is not included in the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan.
Drought	**YES**	• Review of the NC State Hazard Mitigation Plan • Review of the North Carolina Drought Monitor website • Review of the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan	• There are reports of drought conditions in seventeen out of the last nineteen years in Forsyth County, according to the North Carolina Drought Monitor. • Droughts are discussed in NC State Hazard Mitigation Plan as a lesser hazard. • Two of the ten presidential disaster declarations for Forsyth County were caused by drought • The NC State Hazard Mitigation Plan lists drought as a hazard.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Hailstorm	**YES (Assessed under Tornadoes/Thunderstorms)**	• Review of NC State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NOAA NCEI Storm Events Database • Review of the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan	• Hailstorm events are discussed in the state plan under the Severe Thunderstorm hazard. • NCEI reports 100 hailstorm events (0.75-inch size hail to 2.75 inches) for Forsyth County between 1970 and 2019. There was no property of crop damages reported by NCEI for these events.
Excessive Heat	**YES**	• Review of NOAA NCEI Storm Events Database • Review of the North Carolina State Hazard Mitigation Plan • Review of the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan	• The NC State Hazard Mitigation Plan does include Excessive Heat as a hazard. • Extreme Heat was not addressed in the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan.
Hurricane and Coastal Hazards	**YES**	• Review of NC State Hazard Mitigation Plan • Analysis of NOAA historical tropical cyclone tracks and National Hurricane Center Website • Review of NOAA NCEI Storm Events Database	• Hurricane and coastal hazard events are discussed in the state plan and are listed as a top hazard. • NOAA historical records indicate 14 hurricane/coastal hazards have come within 25 miles of Forsyth County since 1850. • Four out of ten disaster declarations in Forsyth County

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?
		• Review of historical presidential disaster declarations • Review of the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan	are directly related to hurricane and costal hazard events. • The 50-year return period peak gust for hurricane and tropical storm events in Forsyth County is between 63-68 mph. • Hurricane hazards were addressed in the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan.
Lightning	**YES (Assessed under Tornadoes/Thunderstorms)**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of NOAA NCEI Storm Events Database, NOAA lightning statistics • Review of the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan	• Lightning events are discussed in the state plan as part of the severe thunderstorm hazard. • NCEI reports 3 lightning events for Forsyth County since 1996. These events have resulted in $225 thousand (2020 dollars) in property damage.
Nor'easter	**NO**	• Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database	• Nor'easters are discussed in the state plan. • NCEI does not report any nor'easter activity for Forsyth County. However, nor'easters may have affected the County as severe winter storms. In this case, the activity would be reported under winter storm events.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
			• Nor'easters were not addressed in the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan.
Tornadoes/Thunderstorm	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations.	• Tornado events are discussed in the NC State Hazard Mitigation Plan. • NCEI reports 16 tornado events in Forsyth County since 1973. These events have resulted in 56 injuries and over $85.8 million (2020 dollars) in property damage with the most severe being an F3. • Tornado events were addressed in the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan.
Severe Thunderstorm	**YES (Assessed under Tornadoes/Thunderstorms)**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations.	• Severe thunderstorm events are discussed in the NC State Hazard Mitigation Plan. • NCEI reports 272 thunderstorm wind events in Forsyth County since 1958. These events have resulted in $1.07 million (2020 dollars) in property damage. • Severe thunderstorm events were addressed in the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Severe Winter Weather	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations.	• Severe winter weather events, including snow storms and ice storms, are discussed in the state plan. • NCEI reports that Forsyth County has been affected by 67 snow and ice events since 1996. These events resulted in over $70,000 (2020 dollars) in damages. • Six of the region's ten disaster declarations were directly related to winter storm events. • Severe winter weather events were addressed in the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan.
Earthquakes	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan • Review of the National Geophysical Data Center USGS Earthquake Hazards Program website	• Earthquake events are discussed in the state plan and the University of North Carolina School of the Arts is considered to be at moderate risk to an earthquake event (Forsyth County as a whole is considered to be at a moderate risk to an earthquake). • Earthquakes were addressed in the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan. • 9 events are known to have occurred in the region according to the National Geophysical Data Center. The greatest MMI reported was a 5.

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?
			• According to USGS seismic hazard maps, the peak ground acceleration (PGA) with a 10% probability of exceedance in 50 years for the area is approximately 4%g. FEMA recommends that earthquakes be further evaluated for mitigation purposes in areas with a PGA of 3%g or more.
Expansive Soils	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan • Review of USDA Soil Conservation Service's Soil Survey	• Expansive soils are not identified in the state plan. • According to FEMA and USDA sources, University of North Carolina School of the Arts is located in an area that has a "little to no" clay swelling potential. • The previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan did not identify expansive soils as a potential hazard.
Geological (Landslides, Sinkholes, Erosion)	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan • Review of USGS Landslide Incidence and Susceptibility Hazard Map	• Landslide/debris flow events are discussed in the state plan. • USGS landslide hazard maps indicate "low landslide incidence" (more than 15% of the area is involved in land sliding) is found in Forsyth County. • Data provided by NCGS indicate no recorded landslide events in the University of North Carolina

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
		• Review of the North Carolina Geological Survey database of historic landslides	School of the Arts or Forsyth County. • Geological hazards were addressed in the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan.
Land Subsidence	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan	• The state plan delineates certain areas that are susceptible to land subsidence hazards in North Carolina; however, none of these areas are located in Forsyth County. • The plan identifies Forsyth County as having scored very low for the land subsidence hazard. • Land Subsidence was not addressed in the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan.
Tsunami	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan • Review of FEMA "How-to" mitigation planning guidance (Publication 386-2, "Understanding Your Risks –	• Tsunamis are discussed in the state plan. • Tsunamis were not addressed in the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan. • No record exists of a catastrophic Atlantic basin tsunami impacting the mid-Atlantic coast of the United States. • Tsunami inundation zone maps are not available for

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?
		Identifying Hazards and Estimating Losses).	communities located along the U.S. East Coast. • 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.
Volcano	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of USGS Volcano Hazards Program website	• There are no active volcanoes in North Carolina. • There has not been a volcanic eruption in North Carolina in over 1 million years. • No volcanoes are located near University of North Carolina School of the Arts.
Dam Failure	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan • Review of North Carolina Division of Land Management website	• Dam failure is discussed in the state plan as a hazard of concern. • Of the 221 dams reported on the National Inventory of Dams in Forsyth County, 55 are high hazard (25%), (High hazard is defined as "where failure or mis operation will probably cause loss of human life.") • Dam failure was not addressed in the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan.
Erosion	**YES (Referenced in Geological Hazards)**	• Review of NC State Hazard Mitigation Plan	• Riverine erosion is addressed in the previous University of North

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?
		• Review of the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan	Carolina School of the Arts Pre-Disaster Mitigation Plan. • Coastal erosion is discussed in the state plan but only for coastal areas (there is no discussion of riverine erosion).
Flooding	**YES**	• Review of NC State Hazard Mitigation Plan • Review of historical disaster declarations • Review of NOAA NCEI Storm Events Database • Review of the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan	• The flood hazard is thoroughly discussed in the state plan. • Four of the ten Presidential Disaster Declarations were directly associated with flooding events. • NCEI reports that Forsyth County have been affected by 44 flood events since 1996. These events in total caused over $555 thousand (2020 dollars) in property damages. • None of the buildings or facilities on the campus of University of North Carolina School of the Arts is located in an identified floodplain (100 or 500 year). • Flooding was addressed in the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan.
Storm Surge	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan	• Storm surge is discussed in the state plan under the hurricane hazard however, Forsyth County has zero vulnerability to storm surge. • Storm surge was not addressed in the previous University of

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?
		• Review of the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database	North Carolina School of the Arts Pre-Disaster Mitigation Plan. • No historical events were reported by NCEI • Given the inland location of University of North Carolina School of the Arts, storm surge would not affect the area.
OTHER HAZARDS			
Wildfires	**YES**	• Review of NC State Hazard Mitigation Plan • Review of the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan • Review of Southern Wildfire Risk Assessment (SWRA) Data • Review of the NC Division of Forest Resources website	• Wildfires occur in virtually all parts of the United States. Wildfire hazard risk will increase as low-density development along the urban/wildland interface increases. • Wildfires were not addressed in the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan. • According to the North Carolina Division of Forest Resources, Forsyth County experiences an average of 18 fires each year which burn a combined 24.94 acres.
Hazardous Substances	**YES**	• Review of the NC State Hazard Mitigation Plan. • Review of the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan	• Review of Pipeline and Hazardous Materials Safety Administration data indicates 24 HAZMAT incidents, which resulted in $557,148 in property damage, in Forsyth County. • EPA Toxic Release Inventory indicates 24 Toxic Release

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?
			Inventory (TRI) facilities in Forsyth County. • This update assesses hazardous materials, hazardous chemicals, and oil spills under this hazard.
Infectious Disease	**YES**	• Review of the NC State Hazard Mitigation Plan. • Review of the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan • Review of the NC State Hazard Mitigation Plan.	• Infectious Disease is identified as a hazard in the state plan. • Although the previous UNC School of the Arts Pre-Disaster Mitigation Plan did not include infectious disease as a hazard, it is assessed in this update to maintain consistency with the NC State Hazard Mitigation Plan • Infectious Disease has caused one of the ten disaster declarations in Forsyth County
TECHNOLOGICAL HAZARDS			
Terrorism	**YES**	• Review of the NC State Hazard Mitigation Plan • Review of previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan • Review of local official knowledge	• Although the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan did not include terrorism threat as a hazard, it is assessed in this update to maintain consistency with the NC State Hazard Mitigation Plan. • This hazard will assess chemical, biological, radiological, nuclear, and explosive terrorism events.
Radiological Emergency – Fixed Nuclear Facilities	**NO**	• Review of the previous University of North Carolina School of the Arts Pre-Disaster Mitigation Plan	• Although radiological emergencies are not identified in the previous plan.

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?
		• Review of IAEA list of fixed nuclear power stations in the United States • Discussion with local officials about location of nuclear power stations	• There are no nuclear facilities located within 50 miles of the University of North Carolina School of the Arts or Forsyth County
Cyber	**YES**	• Review of NC State Hazard Mitigation Plan	• Changing future conditions encourage the assessment of the possibility of a cyber-attack with the increase in global technology
Electromagnetic Pulse	**YES**	• Review of NC State Hazard Mitigation Plan	• Changing future conditions encourage the assessment of the possibility of an electromagnetic pulse with the increase in global technology

F.5 Hazard Profiles, Analysis, and Vulnerability

This section includes detailed hazard profiles for each of the hazards identified in the Hazard Identification section as significant enough for further evaluation in the UNC School of the Arts Hazard Mitigation Plan. It contains the following subsections:

- F.5.1 Overview
- F.5.2 Drought
- F.5.3 Excessive Heat
- F.5.4 Hurricane and Coastal Hazards
- F.5.5 Tornadoes/Thunderstorms
- F.5.10 Flooding
- F.5.11 Wildfires
- F.5.12 Infectious Disease
- F.5.13 Hazardous Substances
- F.5.14 Terrorism

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.

F.5.1 Overview

This section includes detailed hazard profiles for each of the hazards identified in the Hazard Identification section as significant enough for further evaluation in the University of North Carolina School of the Arts 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 Campus Hazard Mitigation Planning Team as it relates to unique historical or anecdotal hazard information as it applies specifically for UNCSA.

After reviewing the list of assessed hazards from the previous plan, the UNCSA Campus Hazard Mitigation 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**
  - 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

- Terrorism
- Cyber
- Electromagnetic Pulse

Much of the information in this section begins with a review of how the hazards impact Forsyth County because that is the level at which the most readily-available and best-available information is provided. Where feasible, County-level information is supplemented with campus-specific details.

F.5.2 DROUGHT

F.5.2.1 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, 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. It is also notable that drought conditions typically do not cause significant damage to the built environment.

F.5.2.2 Historical Occurrences

The North Carolina Drought Management Advisory Council also reports data on North Carolina drought conditions from 2000 to 2020 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 F.8.**

TABLE F.8: 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 NOAA, Forsyth County has had drought occurrences in seventeen of the last nineteen years (2000-2019) (**Table F.9**). 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 F.9: SUMMARY OF DROUGHT OCCURRENCES IN FORSYTH COUNTY (2000-2019)

Year	Forsyth County
2000	Extreme Drought
2001	Extreme Drought
2002	Exceptional Drought
2003	Abnormally Dry
2004	Abnormally Dry
2005	Severe Drought
2006	Severe Drought
2007	Exceptional Drought
2008	Exceptional Drought
2009	Moderate Drought
2010	Moderate Drought
2011	Moderate Drought
2012	Moderate Drought
2013	Moderate Drought
2014	Abnormally Dry
2015	Moderate Drought
2016	Moderate Drought
2017	Moderate Drought
2018	Moderate Drought
2019	Severe Drought

Source: NOAA, Storm and Weather Events Database

F.5.2.3 Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of Forsyth County, including the University of North Carolina School of the Arts campus, 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[1].

F.5.3 EXCESSIVE HEAT

F.5.3.1 Location and Spatial Extent

Excessive heat typically impacts a large area and cannot be confined to any geographic or political

[1] *U.S. Seasonal Drought Outlook. National Weather Service Climate Prediction Center. http://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php*

boundaries. The entire University of North Carolina School of the Arts campus is susceptible to extreme heat conditions.

F.5.3.2 Historical Occurrences

Data from the National Centers for Environmental Information showed that there have not been any historical excessive heat and heat wave events in Forsyth County. Typical weather conditions in Winston-Salem, North Carolina, where the campus is located, tend not to rise above 80 degrees Fahrenheit. **Table F.10** shows the average maximum temperatures from 2001 to 2019.

TABLE F.10: AVERAGE MAXIMUM TEMPERATURE IN WINSTON-SALEM, NORTH CAROLINA

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
49°F	53°F	61°F	71°F	78°F	85°F	89°F	86°F	80°F	71°F	62°F	51°F

Source: State Climate Office of North Carolina

The highest temperature ever recorded in Winston-Salem, was 104°F on June 26, 1952. There were no reported incidents of excessive heat events for Forsyth County within the National Centers for Environmental Information database.

F.5.3.3 Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of Forsyth County, including the University of North Carolina School of the Arts campus, has a probability level of possible (1 to 10 percent annual probability) for future extreme heat events to impact the region.

F.5.4 HURRICANE AND COASTAL HAZARDS

F.5.4.1 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 University of North Carolina School of the Arts Campus.

F.5.4.2 Historical Occurrences

According to the National Hurricane Center's historical storm track records, 14 tropical storm tracks have passed within 25 miles of UNCSA's campus since 1850[2]. This includes 11 tropical depressions and 3 tropical storms. **Table F.11** provides for each event the date of occurrence, name (if applicable), maximum wind speed (as recorded within 25 miles of Forsyth County) and Category of the storm based on the Saffir-Simpson Scale.

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

TABLE F.11: HISTORICAL STORM TRACKS WITHIN 25 MILES OF UNIVERSITY OF NORTH CAROLINA SCHOOL OF THE ARTS (1907–2020)

Year	Storm Name	Maximum Wind Speed (knots)	Storm Category
1907	UNNAMED	35	Tropical Depression
1911	UNNAMED	25	Tropical Depression
1915	UNNAMED	35	Tropical Depression
1920	UNNAMED	35	Tropical Depression
1927	UNNAMED	35	Tropical Depression
1928	UNNAMED	30	Tropical Depression
1952	Able	40	Tropical Storm
1968	Abby	25	Tropical Depression
1979	David	45	Tropical Storm
1985	Bob	45	Tropical Storm
1985	Danny	25	Tropical Depression
1988	Chris	20	Tropical Depression
1999	Dennis	25	Tropical Depression
2004	Jeanne	20	Tropical Depression

Source: National Hurricane Center

The National Centers for Environmental Information recorded 4 hurricane and 2 tropical storm events in Forsyth County between 1996 and 2020. A summary of these events is presented in **Table F.12**. Hurricane and tropical storm events have caused 5 presidential disaster declarations in Forsyth County. While these were not recorded in the database, effects from these types of storms were likely still felt in other hazards, including thunderstorms and flooding. Flooding is generally the greatest hazard of concern with hurricane and tropical storm events in the area near University of North Carolina School of the Arts.

TABLE F.12: HURRICANE AND TROPICAL STORM DATA FOR FORSYTH COUNTY

Location	Date	Type	Deaths/Injuries	Property Damage	Description
FORSYTH (ZONE)	1996-07-12	Hurricane (Typhoon)	0/0	$0	Hurricane Bertha moved along the edge of the NWSFO Raleigh county warning area. Three counties sustained substantial crop damage. Structural damage was light and was primarily caused by trees on homes and cars. The hardest hit county was Wayne where property damage was estimated at $500,000. Power outages were widespread in the eastern counties as trees took down power lines. Two F0 tornadoes occurred: one in Wake and one in Wilson counties. No injuries or deaths were reported

FORSYTH (ZONE)	1996-09-05	Hurricane (Typhoon)	0/0	$0	Hurricane Fran was the worst natural economic disaster to occur in North Carolina history. In the RAH county warning area along, the damage exceeded 2 billion dollars. Damage to crops, livestock, farm equipment/buildings was over 400 million. The agricultural damage was the greatest in Sampson, Johnston, and Wayne counties. Several hundred thousand trees were uprooted or broken. Tens of thousands of homes were damaged by falling trees. In the path of the storm's center, almost every neighborhood was affected.
FORSYTH (ZONE)	1999-09-04	Hurricane (Typhoon)	0/0	$0	After meandering off the coast and ruining the Labor Day weekend for millions, the remnants of Dennis finally moved inland across the central portion of the state. Its main impact was to end the drought in the eastern half of the state.
FORSYTH (ZONE)	1999-09-15	Hurricane (Typhoon)	0/0	$0	Hurricane Floyd produced more human misery and environmental impact in North Carolina than any disaster in memory. The 15-20 inches of rain that fell across the eastern half of the state caused every river and stream to flood. Many rivers set new flood records. Whole communities were underwater for days, even weeks in some areas. Thousands of homes were lost. Crop damage was extensive. The infrastructure of the eastern counties, mainly roads, bridges, water plants, etc., was heavily damaged. By the end of 1999, $1.5 billion had already been spent, with estimates that the cost would reach $3-4 billion. The counties within the Raleigh county total warning area probably sustained more than half of the state total.
FORSYTH (ZONE)	2016-09-02	Tropical Storm	0/0	$0	Tropical Storm Hermine tracked along the Southeast United States coastline and across coastal portions of the Carolina's. Tropical Storm Hermine produced heavy rain across portions of central North Carolina. However, due to dry antecedent conditions, no flooding occurred despite rainfall amounts of up to 3 to 5 inches across southeastern portions of central North Carolina. Given the rain and gusty winds associated with Hermine there were numerous reports of trees down and wind damage and resultant power outages.
FORSYTH (ZONE)	2018-10-11	Tropical Storm	0/0	$500,000	Tropical Storm Michael moved through North Carolina on Thursday, October 11th. Michael brought heavy rain and strong damaging winds to central North Carolina. While heavy rainfall of 3 to 6 inches produced minor flash flooding across the area, it was high wind gusts of 40 to 60 mph that caused the biggest problems, knocking down score of trees, leading to blocked roadways and thousands without power.

Source: National Centers for Environmental Information

F.5.4.3 Probability of Future Occurrences

Given the inland location of the campus, it is more likely to be affected by remnants of hurricane and tropical storm systems (as opposed to a major hurricane) which may result in flooding or high winds. The probability of being impacted is less than coastal areas, but still remains a real threat to University of North Carolina School of the Arts due to induced events like flooding and land sliding. Based on historical evidence, the probability level of future occurrence is possible (between 1 and 10 percent annual probability). However, when the area is impacted, the damage could be severe, threatening lives and property on campus.

F.5.5 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 hailstorms and lightning.

F.5.5.1 Location and Spatial Extent

Tornadoes

Tornadoes occur throughout the state of North Carolina, and thus in the area surrounding University of North Carolina School of the Arts. 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 area surrounding the University of North Carolina School of the Arts campus 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 University of North Carolina School of the Arts typically experiences several straight-line wind events each year. These wind events can and have caused significant damage. It is assumed that the area surrounding the University of North Carolina School of the Arts campus 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 all of the area surrounding the University of North Carolina School of the Arts campus is uniformly exposed to severe thunderstorms; therefore, the campus itself is also 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 area surrounding the University of North Carolina School of the Arts campus is uniformly exposed to lightning.

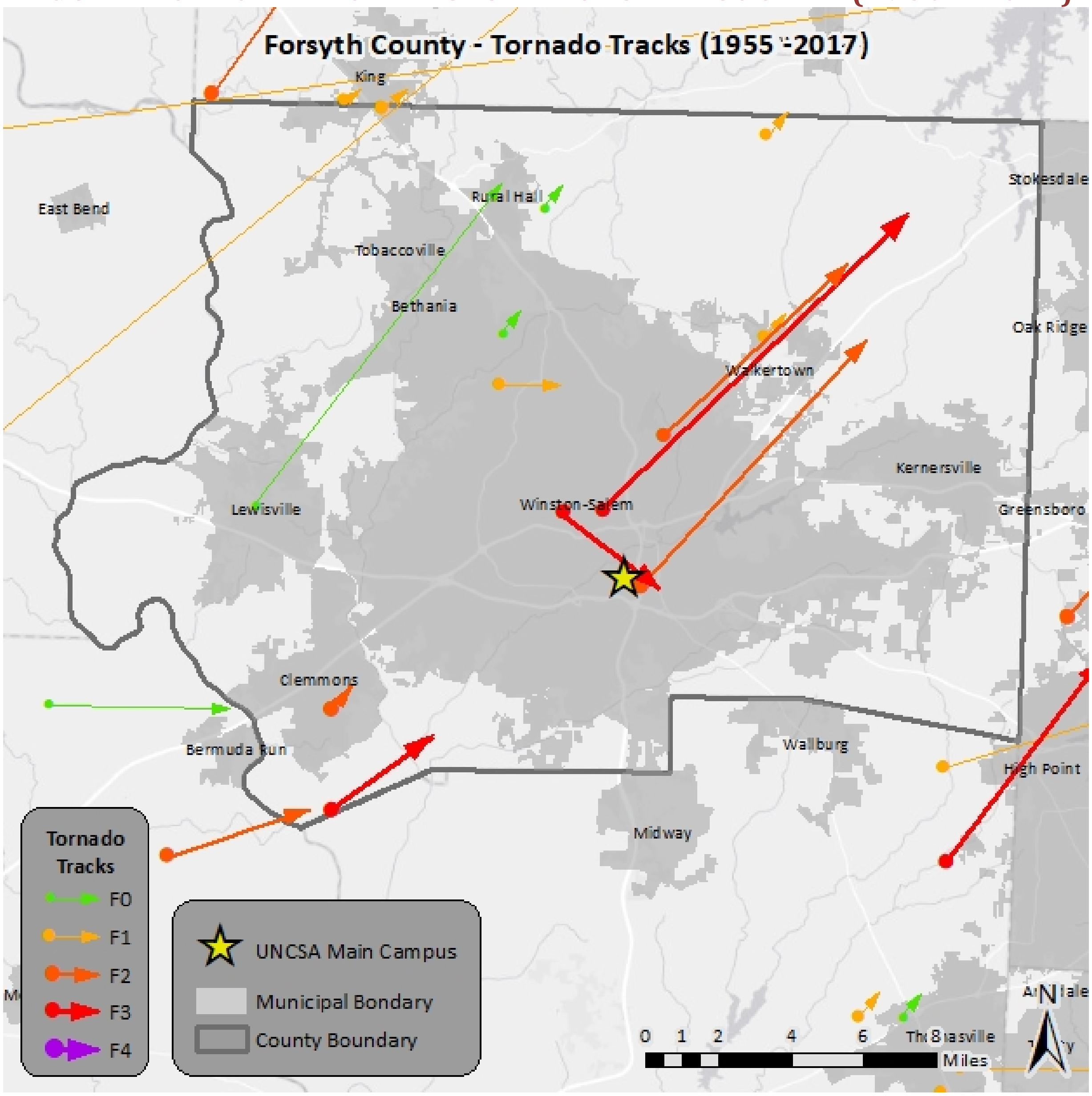
F.5.5.2 Historical Occurrences

Tornadoes

Tornadoes are a somewhat rare occurrence; however, they have and do occur in the area. According to the National Centers for Environmental Information, there have been 16 recorded tornado events in

Forsyth County since 1973 (**Table F.13**), resulting in over $85.8 million in property damages[3]. In addition, 56 injuries but no deaths were reported. The magnitude of these tornados' ranges from F0 to F3 in intensity, although an F5 event is possible but not likely. 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. **Figure F.5** shows a map of tornado impact in Forsyth County.

FIGURE F.5: TORNADO TRACKS IN FORSYTH COUNTY (1950 – 2017)



Source: National Centers for Environmental Information

[3] 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 Forsyth County. As additional local data becomes available, this hazard profile will be amended.

TABLE F.13: HISTORICAL TORNADO IMPACTS IN FORSYTH COUNTY

Date	Magnitude	Deaths/Injuries	Property Damage	Details
5/28/1973	F0	0/2	$25,000	N/A
4/9/1980	F1	0/0	$250,000	N/A
6/6/1981	F2	0/1	$250,000	N/A
6/3/1982	F0	0/0	$30	N/A
3/5/1983	F1	0/0	$25,000	N/A
7/22/1983	F1	0/0	$250,000	N/A
5/22/1985	F3	0/0	$2,500,000	N/A
5/5/1989	F2	0/8	$2,500,000	N/A
5/5/1989	F3	0/30	$25,000,000	N/A
5/5/1989	F2	0/10	$2,500,000	N/A
11/22/1992	F1	0/0	$0	N/A
5/7/1998	F3	0/5	$50,000,000	A large tornado tore through the Waterford Subdivision of Clemmons in southwest Forsyth county. The initial touchdown was at 630 pm local time. Several homes were completely destroyed, several hundred sustained major roof, wall, and window damage. Tree damage was extensive with debris scattered for miles.
7/7/2005	F0	0/0	$0	A weak tornado touched down near Lewisville, blowing several trees onto homes there and in Pfafftown as well. The tornado touched down repeatedly as it traveled northeast, finally lifting at Rural Hall. Mostly tree damage was reported along the path, at Highway 52 and Westinghouse Road, Boiling Springs Road, Ridge Road, and along NC Highway 67.
9/14/2007	EF0	0/0	$0	A weak brief tornado touched down damaging several homes along Peace Haven Street. The tornado ripped the siding off several homes and also knocked down several trees.
5/8/2008	EF2	0/0	$0	An EF-2 tornado tracked northeast out of Davie County and crossed the Yadkin River into Forsyth County. After crossing the Yadkin River, the tornado touched down near the Old Clemmons Water Treatment Plant along Idols Dam Road. The tornado tracked northeast through a heavily wooded area for just over one quarter of a mile and then lifted off the ground. The parent supercell thunderstorm went on to produce another tornado approximately one-mile northeast of the first tornado's ending point. This second tornado went on to produce significant damage to the Clemmons community in Forsyth County.

Date	Magnitude	Deaths/Injuries	Property Damage	Details
5/8/2008	EF3	0/2	$2,500,000	This tornado originated from the same parent supercell that produced the tornado in Davie County which lifted in Forsyth County just across the Yadkin River. This second tornado touched down just southwest of Hampton Road. Three metal barns sustained major damage around the 4800 block of Hampton Road with minor damage to two homes. The tornado continued northeast through wooded farmland before hitting the Bridgepoint Subdivision where the tornado strengthened to EF-3 intensity. Three homes were destroyed and approximately thirty homes sustained moderate damage. There were only two minor injuries in the subdivision. The tornado continued to track to the northeast across Frye Bridge Road and through a heavily wooded area. It then dissipated near the intersection of Cooper Road and Fraternity Church Road. A few homes suffered damage, primarily due to fallen trees. Hardwood tree damage in the area was consistent with EF-2 intensity as tree trunks were snapped in a 200 to 300-yard path. The overall path length of the tornado was around 3 miles with a maximum width of 300 yards.

Source: NCEI

Thunderstorms

According to NCEI, there have been 272 reported thunderstorm and high wind events since 1958 in Forsyth County[4]. These events caused over $1.07 million (2020 dollars) in damages. National Centers for Environmental Information reported 1 death and 3 injuries related to thunderstorm wind events. **Table F.14** summarizes this information.

TABLE F.14: HISTORICAL THUNDERSTORM IMPACTS IN FORSYTH COUNTY

Location	Date	Magnitude (kts)	Deaths	Injuries	Property Damage
Forsyth County	5/17/1958	55	0	0	$0
Forsyth County	8/24/1958	0	0	0	$0
Forsyth County	7/20/1959	0	0	0	$0
Forsyth County	8/29/1960	0	0	0	$0
Forsyth County	2/25/1961	84	0	0	$0
Forsyth County	7/15/1961	60	0	0	$0
Forsyth County	3/31/1962	64	0	0	$0
Forsyth County	5/15/1962	50	0	0	$0
Forsyth County	5/25/1962	60	0	0	$0
Forsyth County	6/6/1962	62	0	0	$0
Forsyth County	7/16/1962	100	0	0	$0

[4] 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 Forsyth County. As additional local data becomes available, this hazard profile will be amended.

Location	Date	Magnitude (kts)	Deaths	Injuries	Property Damage
Forsyth County	1/24/1965	0	0	0	$0
Forsyth County	5/15/1967	56	0	0	$0
Forsyth County	6/25/1967	0	0	0	$0
Forsyth County	6/24/1969	0	0	0	$0
Forsyth County	7/25/1969	0	0	0	$0
Forsyth County	5/22/1970	0	0	0	$0
Forsyth County	8/6/1970	55	0	0	$0
Forsyth County	6/29/1971	0	0	0	$0
Forsyth County	5/23/1973	0	0	0	$0
Forsyth County	4/2/1974	0	0	0	$0
Forsyth County	5/23/1975	0	0	0	$0
Forsyth County	5/25/1975	57	0	0	$0
Forsyth County	6/5/1975	0	0	0	$0
Forsyth County	2/18/1976	0	0	0	$0
Forsyth County	9/24/1980	65	0	0	$0
Forsyth County	6/6/1981	0	0	0	$0
Forsyth County	7/22/1983	60	0	0	$0
Forsyth County	7/24/1983	0	0	0	$0
Forsyth County	7/4/1984	0	0	1	$0
Forsyth County	7/25/1984	0	0	0	$0
Forsyth County	6/5/1985	63	0	0	$0
Forsyth County	6/11/1985	0	0	0	$0
Forsyth County	10/15/1985	0	0	0	$0
Forsyth County	6/12/1986	0	0	0	$0
Forsyth County	4/15/1987	0	0	0	$0
Forsyth County	7/24/1987	0	0	0	$0
Forsyth County	5/10/1988	0	0	0	$0
Forsyth County	6/26/1988	0	0	0	$0
Forsyth County	8/10/1988	0	0	0	$0
Forsyth County	5/6/1989	0	0	0	$0
Forsyth County	5/22/1989	0	0	0	$0
Forsyth County	8/23/1989	0	0	0	$0
Forsyth County	8/23/1989	0	0	0	$0
Forsyth County	4/9/1991	0	0	0	$0
Forsyth County	4/29/1991	0	0	0	$0
Forsyth County	4/16/1992	0	0	0	$0
Forsyth County	6/8/1992	50	0	0	$0
Forsyth County	11/22/1992	80	0	0	$0
Winston-Salem	8/20/1993	60	0	0	$0
Forsyth County	7/16/1995	0	0	0	$0
WINSTON-SALEM	4/20/1996	0	0	0	$0

Location	Date	Magnitude (kts)	Deaths	Injuries	Property Damage
WINSTON-SALEM	5/11/1996	0	0	0	$15,000
TOBACCOVILLE	5/27/1996	0	0	0	$10,000
WINSTON-SALEM	7/2/1996	0	0	0	$0
WINSTON-SALEM	11/8/1996	50	0	0	$0
WINSTON-SALEM	3/5/1997	50	1	1	$20,000
KERNERSVILLE	7/28/1997	50	0	0	$0
WINSTON SALEM	5/26/1998	50	0	0	$20,000
WINSTON SALEM	6/16/1998	50	0	0	$0
RURAL HALL	6/26/1998	50	0	0	$0
WINSTON SALEM	3/11/2000	50	0	0	$0
CLEMMONS	5/20/2000	60	0	0	$0
WINSTON SALEM	5/20/2000	60	0	0	$0
WALKERTOWN	5/25/2000	70	0	0	$0
COUNTYWIDE	6/15/2000	50	0	0	$0
WINSTON SALEM	8/7/2000	50	0	0	$0
RURAL HALL	8/10/2000	50	0	0	$0
BELEWS CREEK	9/14/2000	50	0	0	$0
CLEMMONS	6/28/2001	50	0	0	$0
BELEWS CREEK	5/13/2002	50	0	0	$0
WINSTON SALEM	11/11/2002	50	0	0	$0
LEWISVILLE	5/2/2003	60	0	0	$0
WINSTON SALEM	5/2/2003	60	0	0	$0
PFAFFTOWN	6/8/2003	57	0	0	$0
LEWISVILLE	6/8/2003	50	0	0	$0
PFAFFTOWN	11/24/2004	50	0	0	$0
SEWARD	1/14/2005	50	0	0	$0
WINSTON SALEM	6/6/2005	50	0	0	$0
WINSTON SALEM	6/7/2005	50	0	0	$0
TOBACCOVILLE	7/7/2005	50	0	0	$0
CLEMMONS	4/3/2006	50	0	0	$0
LEWISVILLE	4/17/2006	50	0	0	$0
CLEMMONS	4/17/2006	50	0	0	$0
WINSTON SALEM	4/22/2006	50	0	0	$0
KERNERSVILLE	4/22/2006	50	0	0	$0
WINSTON SALEM	6/23/2006	50	0	0	$0
WALKERTOWN	7/4/2006	50	0	0	$0
KERNERSVILLE	7/4/2006	50	0	0	$0
RURAL HALL	7/13/2006	50	0	0	$0
RURAL HALL	7/13/2006	50	0	0	$0
RURAL HALL	7/13/2006	50	0	0	$0
WINSTON SALEM	7/19/2006	50	0	0	$0

Location	Date	Magnitude (kts)	Deaths	Injuries	Property Damage
WINSTON SALEM	7/19/2006	50	0	0	$0
WINSTON SALEM	7/22/2006	50	0	0	$0
KERNERSVILLE	7/28/2006	50	0	0	$0
WINSTON SALEM	7/28/2006	50	0	0	$0
COUNTYWIDE	9/28/2006	50	0	0	$0
WINSTON SALEM	9/28/2006	50	0	0	$0
WINSTON SALEM	6/11/2007	50	0	0	$0
WINSTON SALEM	6/11/2007	50	0	0	$0
WINSTON SALEM	6/11/2007	50	0	0	$0
WINSTON SALEM	6/19/2007	50	0	0	$0
WINSTON SALEM	6/24/2007	50	0	0	$0
WALKERTOWN	6/27/2007	50	0	0	$0
WINSTON SALEM	6/28/2007	50	0	0	$0
WINSTON SALEM	8/21/2007	50	0	0	$0
WINSTON SALEM	3/4/2008	52	0	0	$0
WINSTON SALEM	3/4/2008	50	0	0	$0
WALKERTOWN	6/27/2008	50	0	0	$0
LEWISVILLE	6/27/2008	50	0	0	$10,000
LEWISVILLE	6/28/2008	50	0	0	$0
WINSTON SALEM	7/6/2008	54	0	0	$0
(INT)WINSTON-SALEM A	7/6/2008	63	0	0	$0
DONNAHA	7/9/2008	50	0	0	$0
DONNAHA	7/9/2008	50	0	0	$0
BETHANIA	7/9/2008	50	0	0	$0
CLEMMONS	7/9/2008	50	0	0	$0
WINSTON SALEM	7/22/2008	50	0	0	$0
LEWISVILLE	8/2/2008	50	0	0	$0
HANES	8/2/2008	50	0	0	$0
MUDDY CREEK	8/2/2008	50	0	0	$1,000
CLEMMONS STATION	6/9/2009	52	0	0	$0
KERNERSVILLE	6/10/2009	50	0	0	$0
BROOKWOOD	7/20/2009	50	0	0	$0
LEWISVILLE	9/28/2009	50	0	0	$0
LEWISVILLE	9/28/2009	50	0	0	$15,000
LEWISVILLE	9/28/2009	50	0	0	$0
WINSTON JCT	4/8/2010	50	0	0	$0
PFAFFTOWN	5/28/2010	50	0	0	$7,000
LEWISVILLE	5/28/2010	50	0	0	$0
LEWISVILLE	5/28/2010	50	0	0	$0
CLEMMONS	5/28/2010	50	0	0	$0
WINSTON SALEM	6/2/2010	50	0	0	$10,000

Location	Date	Magnitude (kts)	Deaths	Injuries	Property Damage
LEWISVILLE	6/2/2010	50	0	0	$10,000
LEWISVILLE	6/14/2010	50	0	0	$1,000
PARK TERRACE	6/14/2010	50	0	0	$5,000
STANLEYVILLE	7/13/2010	50	0	0	$0
WAUGHTOWN	7/13/2010	50	0	0	$0
GUTHRIE	7/27/2010	50	0	0	$0
UNION CROSS	8/5/2010	50	0	0	$0
LEWISVILLE	10/26/2010	50	0	0	$0
DENNIS	11/16/2010	50	0	0	$0
PFAFFTOWN	12/1/2010	50	0	0	$0
DONNAHA	5/13/2011	50	0	0	$0
DOSIER	5/26/2011	50	0	0	$5,000
TOBACCOVILLE	5/26/2011	50	0	0	$0
RURAL HALL	5/26/2011	50	0	0	$0
UNION CROSS	5/27/2011	50	0	0	$25,000
HANES	6/18/2011	50	0	0	$75,000
WALKERTOWN	6/18/2011	50	0	0	$0
CLEMMONS STATION	6/27/2011	50	0	0	$0
WAUGHTOWN	6/28/2011	50	0	0	$0
DONNAHA	7/4/2011	50	0	0	$0
VIENNA	7/4/2011	50	0	0	$0
UNION CROSS	7/8/2011	50	0	0	$0
GUTHRIE	7/8/2011	50	0	0	$0
STANLEYVILLE	8/14/2011	50	0	0	$0
WALKERTOWN	8/14/2011	50	0	0	$0
EASTON VIEW	8/14/2011	50	0	0	$0
TOBACCOVILLE	8/21/2011	50	0	0	$0
TOBACCOVILLE	9/2/2011	50	0	0	$0
DONNAHA	2/24/2012	50	0	0	$0
LEWISVILLE	2/24/2012	50	0	0	$0
UNION CROSS	2/24/2012	50	0	0	$0
WINSTON SALEM	2/24/2012	50	0	0	$0
LEWISVILLE	5/14/2012	50	0	0	$0
EASTON VIEW	5/14/2012	50	0	0	$0
WALKERTOWN	5/14/2012	50	0	0	$0
WALKERTOWN	5/14/2012	50	0	0	$0
KERNERSVILLE	5/14/2012	50	0	0	$2,000
WINSTON JCT	5/22/2012	50	0	0	$0
OLDTOWN	6/1/2012	50	0	0	$0
STANLEYVILLE	6/22/2012	50	0	0	$0
CLEMMONS	6/22/2012	50	0	0	$0

Location	Date	Magnitude (kts)	Deaths	Injuries	Property Damage
KERNERSVILLE	6/22/2012	50	0	0	$0
DOSIER	7/2/2012	50	0	0	$0
WALKERTOWN	7/2/2012	50	0	0	$0
LEWISVILLE	7/5/2012	50	0	0	$0
OLDTOWN	7/27/2012	50	0	0	$0
OLDTOWN	7/27/2012	50	0	0	$5,000
OLDTOWN	9/8/2012	50	0	0	$750
DONNAHA	1/30/2013	50	0	0	$200
ALSPAUGH	4/12/2013	50	0	0	$0
HANES	4/19/2013	50	0	0	$0
KERNERSVILLE	6/10/2013	50	0	0	$0
BETHANIA	6/13/2013	50	0	0	$500,000
BROOKWOOD	6/13/2013	50	0	0	$0
WINSTON SALEM	6/26/2013	50	0	0	$0
CLEMMONS	7/27/2013	50	0	0	$0
CLEMMONS	7/27/2013	50	0	0	$25,000
LEWISVILLE	3/12/2014	52	0	0	$0
KERNERSVILLE	6/10/2014	50	0	0	$500
KERNERSVILLE	6/11/2014	50	0	0	$2,000
RURAL HALL	6/19/2014	50	0	0	$0
LEWISVILLE	6/19/2014	50	0	0	$0
LEWISVILLE	5/11/2015	50	0	0	$0
CLEMMONS	6/2/2015	50	0	0	$0
EASTON VIEW	6/2/2015	50	0	0	$0
CLEMMONS	6/27/2015	50	0	0	$0
WALKERTOWN	7/13/2015	50	0	0	$10,000
STANLEYVILLE	8/6/2015	50	0	0	$15,000
HANES	2/24/2016	50	0	0	$7,000
CLEMMONS	5/3/2016	50	0	1	$10,000
CITYVIEW	5/12/2016	50	0	0	$10,000
KERNERSVILLE	7/8/2016	50	0	0	$2,500
CLEMMONS STATION	7/8/2016	50	0	0	$2,500
LEWISVILLE	7/19/2016	50	0	0	$0
LEWISVILLE	7/19/2016	50	0	0	$0
PFAFFTOWN	7/27/2016	50	0	0	$2,500
UNION CROSS	4/6/2017	50	0	0	$1,000
GUTHRIE	5/1/2017	50	0	0	$2,500
KERNERSVILLE	5/1/2017	50	0	0	$500
UNION CROSS	5/1/2017	50	0	0	$2,500
KERNERSVILLE	5/1/2017	50	0	0	$5,000
KERNERSVILLE	5/1/2017	50	0	0	$500

Location	Date	Magnitude (kts)	Deaths	Injuries	Property Damage
KERNERSVILLE	5/1/2017	50	0	0	$5,000
ALSPAUGH	5/19/2017	50	0	0	$3,000
TOBACCOVILLE	5/24/2017	50	0	0	$0
TOBACCOVILLE	5/24/2017	50	0	0	$0
DONNAHA	5/24/2017	50	0	0	$0
SOUTH WINSTON SALEM	7/18/2017	50	0	0	$10,000
FRONTIS	7/18/2017	50	0	0	$30,000
DONNAHA	7/22/2017	50	0	0	$0
DONNAHA	7/22/2017	50	0	0	$0
GUTHRIE	7/22/2017	50	0	0	$0
LEWISVILLE	7/22/2017	50	0	0	$0
LEWISVILLE	7/22/2017	50	0	0	$1,500
TOBACCOVILLE	7/23/2017	50	0	0	$20,000
KERNERSVILLE	10/23/2017	50	0	0	$1,000
LEWISVILLE	4/15/2018	50	0	0	$3,000
GUTHRIE	5/20/2018	50	0	0	$50,000
LEWISVILLE	6/1/2018	50	0	0	$2,000
LEWISVILLE	6/11/2018	50	0	0	$0
LEWISVILLE	6/11/2018	50	0	0	$1,000
LEWISVILLE	6/25/2018	50	0	0	$0
CLEMMONS	6/25/2018	50	0	0	$0
CLEMMONS	7/6/2018	50	0	0	$0
KERNERSVILLE	7/6/2018	50	0	0	$0
(INT)WINSTON-SALEM A	7/22/2018	50	0	0	$5,000
LEWISVILLE	7/22/2018	50	0	0	$0
PFAFFTOWN	7/22/2018	50	0	0	$0
WALKERTOWN	7/22/2018	50	0	0	$0
WALKERTOWN	7/22/2018	50	0	0	$0
DENNIS	7/22/2018	50	0	0	$0
LEWISVILLE	8/2/2018	50	0	0	$10,000
BETHANIA	8/2/2018	50	0	0	$15,000
BETHANIA	8/7/2018	50	0	0	$0
RURAL HALL	8/8/2018	50	0	0	$250
STANLEYVILLE	8/8/2018	50	0	0	$250
WINSTON JCT	8/8/2018	50	0	0	$0
CLEMMONS	4/19/2019	50	0	0	$0
OLDTOWN	4/19/2019	50	0	0	$0
OLDTOWN	5/29/2019	50	0	0	$10,000
BELEWS CREEK	6/20/2019	50	0	0	$2,500
OLDTOWN	7/22/2019	50	0	0	$0
LEWISVILLE	8/13/2019	50	0	0	$0

Location	Date	Magnitude (kts)	Deaths	Injuries	Property Damage
LEWISVILLE	8/17/2019	50	0	0	$5,000
LEWISVILLE	8/17/2019	50	0	0	$1,500
LEWISVILLE	8/19/2019	50	0	0	$5,000
RURAL HALL	8/21/2019	50	0	0	$5,000
KERNERSVILLE	8/21/2019	50	0	0	$5,000
CLEMMONS	8/22/2019	50	0	0	$0
WALKERTOWN	8/22/2019	50	0	0	$0
DENNIS	8/22/2019	50	0	0	$0
WALKERTOWN	8/22/2019	50	0	0	$0
VIENNA	10/31/2019	50	0	0	$5,000
GRIMS XRDS	10/31/2019	50	0	0	$0
TOBACCOVILLE	1/11/2020	50	0	0	$25,000
CLEMMONS	2/6/2020	50	0	0	$5,000
UNION CROSS	2/6/2020	50	0	0	$5,000
UNION CROSS	2/6/2020	50	0	0	$5,000

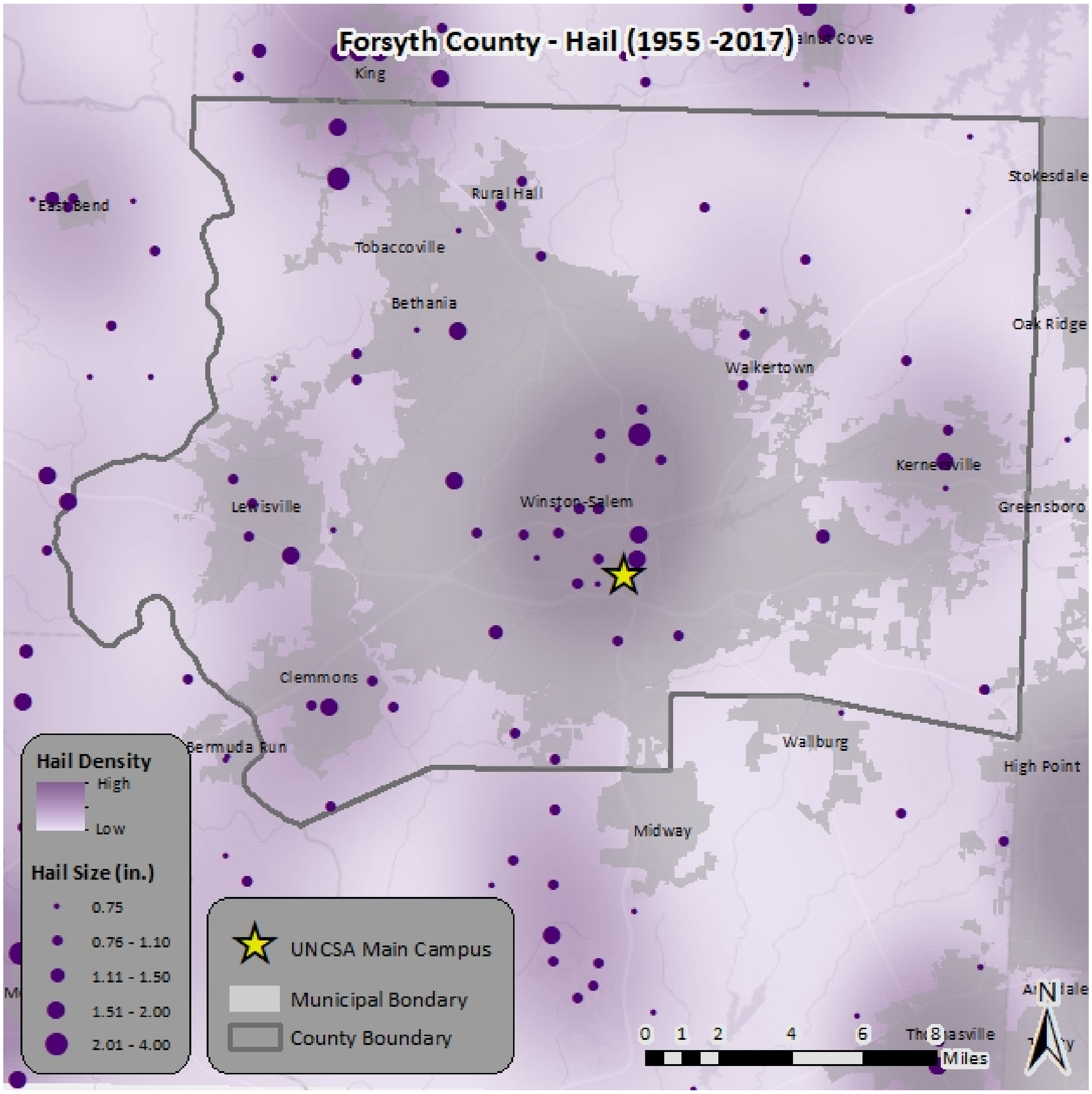
Source: NCEI

Hailstorms

According to the National Centers for Environmental Information, 100 recorded hailstorm events have affected Forsyth County since 1970 summarized in **Table F.15.** [5] But, hail occurrences resulted in no reported property or crop damages. Hail ranged in diameter from 0.75 inches to 2.75 inches. It should be noted that hail is notorious for causing substantial damage to cars, roofs, and other areas of the built environment that may not be reported to the National Centers for Environmental Information. **Figure F.6** shows a map of hailstorm occurrences in Forsyth County.

[5] 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 Forsyth County. 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.

FIGURE F.6: HAIL OCCURANCES IN FORSYTH COUNTY



Source: National Centers for Environmental Information

TABLE F.15: HISTORICAL HAIL OCCURANCES IN FORSYTH COUNTY

Location	Date	Magnitude (inches)	Deaths	Injuries	Property Damage
Forsyth County	4/13/1970	1.75	0	0	$0
Forsyth County	5/22/1970	1	0	0	$0
Forsyth County	5/29/1982	1	0	0	$0
Forsyth County	4/14/1984	2.5	0	0	$0
Forsyth County	7/25/1984	1.75	0	0	$0
Forsyth County	4/16/1985	1.75	0	0	$0
Forsyth County	6/5/1985	0.75	0	0	$0

Location	Date	Magnitude (inches)	Deaths	Injuries	Property Damage
Forsyth County	7/12/1985	1	0	0	$0
Forsyth County	4/26/1986	0.88	0	0	$0
Forsyth County	5/16/1988	0.75	0	0	$0
Forsyth County	5/17/1988	0.75	0	0	$0
Forsyth County	3/15/1989	0.75	0	0	$0
Forsyth County	4/27/1989	1.75	0	0	$0
Forsyth County	6/15/1989	1	0	0	$0
Forsyth County	4/29/1991	1	0	0	$0
Winston-Salem	8/20/1993	1	0	0	$0
Clemmons	8/16/1994	0.75	0	0	$0
Forsyth County	6/16/1995	0.75	0	0	$0
WINSTON-SALEM	7/2/1996	0.88	0	0	$0
BELOWS LAKE	6/2/1997	0.75	0	0	$0
PFAFFTOWN	3/20/1998	1	0	0	$0
WINSTON SALEM	3/20/1998	1	0	0	$0
WINSTON SALEM	4/17/1998	0.88	0	0	$0
WALKERTOWN	5/1/1998	0.75	0	0	$0
KERNERSVILLE	5/7/1998	1	0	0	$0
BELEWS CREEK	5/8/1998	0.75	0	0	$0
LEWISVILLE	5/26/1998	0.75	0	0	$0
WINSTON SALEM	6/14/1998	0.75	0	0	$0
WINSTON SALEM	6/15/1998	0.75	0	0	$0
KERNERSVILLE	6/3/2000	1.75	0	0	$0
LEWISVILLE	6/15/2000	0.75	0	0	$0
LEWISVILLE	6/1/2002	0.75	0	0	$0
WINSTON SALEM	7/3/2002	1	0	0	$0
CLEMMONS	4/29/2003	1	0	0	$0
WINSTON SALEM	5/2/2003	0.75	0	0	$0
CLEMMONS	5/3/2003	1.75	0	0	$0
RURAL HALL	8/5/2003	1.75	0	0	$0
RURAL HALL	8/5/2003	0.75	0	0	$0
WALKERTOWN	5/9/2004	0.75	0	0	$0
WINSTON SALEM	5/9/2004	0.75	0	0	$0
LEWISVILLE	3/23/2005	1	0	0	$0
TOBACCOVILLE	3/23/2005	2.75	0	0	$0
CLEMMONS	4/3/2006	1	0	0	$0
RURAL HALL	4/3/2006	1	0	0	$0
WINSTON SALEM	4/3/2006	0.88	0	0	$0
CLEMMONS	4/3/2006	0.75	0	0	$0
WINSTON SALEM	4/3/2006	1	0	0	$0
WINSTON SALEM	5/26/2006	0.75	0	0	$0
WINSTON SALEM	5/26/2006	0.75	0	0	$0
KERNERSVILLE	6/11/2006	0.75	0	0	$0
CLEMMONS	6/11/2006	0.75	0	0	$0

Location	Date	Magnitude (inches)	Deaths	Injuries	Property Damage
WINSTON SALEM	7/19/2006	0.75	0	0	$0
KERNERSVILLE	7/22/2006	0.88	0	0	$0
WINSTON SALEM	8/30/2006	0.75	0	0	$0
WINSTON SALEM	9/28/2006	0.88	0	0	$0
CLEMMONS	10/11/2006	1	0	0	$0
CLEMMONS	4/15/2007	0.75	0	0	$0
WINSTON SALEM	6/4/2007	0.75	0	0	$0
RURAL HALL	6/16/2007	0.75	0	0	$0
WINSTON SALEM	6/16/2007	0.88	0	0	$0
WINSTON SALEM	6/16/2007	0.88	0	0	$0
WINSTON SALEM	6/16/2007	0.88	0	0	$0
PFAFFTOWN	6/19/2007	0.75	0	0	$0
PFAFFTOWN	6/19/2007	0.75	0	0	$0
WINSTON SALEM	6/25/2007	0.75	0	0	$0
WALKERTOWN	6/27/2007	0.75	0	0	$0
KERNERSVILLE	8/3/2007	0.75	0	0	$0
WALKERTOWN	8/22/2007	0.88	0	0	$0
PFAFFTOWN	8/22/2007	0.75	0	0	$0
LEWISVILLE	8/22/2007	1.75	0	0	$0
PFAFFTOWN	6/9/2009	1	0	0	$0
BROOKWOOD	7/20/2009	1	0	0	$0
KERNERSVILLE	7/20/2009	0.88	0	0	$0
HANES	9/28/2009	0.88	0	0	$0
DENNIS	6/2/2010	0.88	0	0	$0
WINSTON SALEM	4/9/2011	1	0	0	$0
WINSTON SALEM	4/9/2011	1	0	0	$0
BROOKWOOD	4/9/2011	1	0	0	$0
WINSTON SALEM	4/9/2011	1	0	0	$0
UNION CROSS	4/27/2011	1	0	0	$0
UNION CROSS	5/16/2011	1	0	0	$0
KERNERSVILLE	5/27/2011	1	0	0	$0
CLEMMONS	6/9/2011	1	0	0	$0
TOBACCOVILLE	8/14/2011	1.75	0	0	$0
FIVE PTS	3/20/2012	1	0	0	$0
LEWISVILLE	5/22/2012	0.75	0	0	$0
KERNERSVILLE	6/16/2014	1	0	0	$0
LEWISVILLE	6/19/2014	1	0	0	$0
EASTON VIEW	6/19/2014	1	0	0	$0
LEWISVILLE	4/9/2015	1	0	0	$0
SWAINTOWN	4/20/2015	1.25	0	0	$0
HANES	5/2/2016	1	0	0	$0
HANES	5/2/2016	1.75	0	0	$0
CITYVIEW	5/12/2016	1.75	0	0	$0
GUTHRIE	9/28/2016	1.25	0	0	$0

Location	Date	Magnitude (inches)	Deaths	Injuries	Property Damage
RURAL HALL	5/19/2017	1	0	0	$0
EASTON VIEW	7/18/2017	1	0	0	$0
LEWISVILLE	4/15/2018	1.25	0	0	$0
KERNERSVILLE	5/31/2019	1	0	0	$0
GUTHRIE	5/31/2019	1	0	0	$0

Lightning

According to the National Centers for Environmental Information, there have been a total of 3 recorded lightning events in Forsyth County since 2003[6]. These events resulted in nearly $225,000 (2020 dollars) in damages, as listed in summary **Table F.16**.

It is certain that more than 3 events have impacted the county. 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 F.16: HISTORICAL LIGHTNING IMPACTS IN FORSYTH COUNTY

Location	Date	Deaths	Injuries	Property Damage	Details
LEWISVILLE	4/30/2003	0	0	$40,000	Lightning struck a house, starting a fire.
KERNERSVILLE	6/11/2007	0	0	$175,000	A two-story home in the Tredegar subdivision sustained heavy damage when it was hit by lightning and caught on fire. The entire second floor was damaged. 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.

[6] 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 Forsyth County. The State Fire Marshall's office was also contacted for additional information but none could be provided. As additional local data becomes available, this hazard profile will be amended.

Location	Date	Deaths	Injuries	Property Damage	Details
KERNERSVILLE	6/10/2009	0	0	$10,000	Lightning caused an apartment fire last night when it struck an air conditioning unit in the attic of McConnell Apartments. The fire was confined to the attic. Severe thunderstorms developed across the Northwest Piedmont during the evening hours as a strong mid-level shortwave trough moved across the Appalachians and across the area. The severe thunderstorm wind damage was confined to the Triad. Lightning associated with the convection was excessive with over 600 cloud-to-ground lightning strikes per hour. Two structures were hit by lightning, with one of the structures being completely destroyed as fire consumed the mobile home.

Source: NCEI

F.5.5.3 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 University of North Carolina School of the Arts experience a direct tornado strike. The probability of future tornado occurrences affecting University of North Carolina School of the Arts 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 are likely (10 to 100 percent annual probability). Since hail is an atmospheric hazard (coinciding with thunderstorms), it is assumed that University of North Carolina School of the Arts 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 Forsyth County 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), University of North Carolina School of the Arts 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 2020. 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.

F.5.6 SEVERE WINTER WEATHER

F.5.6.1 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. University of North Carolina School of the Arts 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.

F.5.6.2 Historical Occurrences

Winter weather has resulted in six disaster declarations Forsyth County. This includes drought and freezing conditions in 1977, a winter storm in 1993, the Blizzard of 1996, another winter storm in 1996, a severe ice storm in 2002, and an additional ice storm in 2003. According to the National Centers for Environmental Information, there have been a total of 67 recorded winter storm events Forsyth County since 1996 (**Table F.17**)[7]. These events resulted in $70,000 (2020 dollars) in damages.

[7] These ice and winter storm events are only inclusive of those reported by the National Centers for Environmental Information (NCEI). It is likely that additional winter storm conditions have affected Forsyth County.

TABLE F.17: WINTER STORM EVENTS IN FORSYTH COUNTY

Date	Deaths	Injuries	Property Damage	Detail
1/8/1997	0	0	$0	Sleet and freezing rain developed across the western piedmont of North Carolina during the midafternoon hours then spread across the Northern Piedmont by sunset, becoming a major ice storm overnight. The hardest hit areas extended from the Winston-Salem and Greensboro areas east to near Burlington where 1 to 2 inches of sleet fell before the precipitation changed to freezing rain. Freezing rain accumulated to between 1/4 to 3/8 of an inch on top of the sleet. This caused major travel problems with some road closures mainly in Davidson, Forsyth, and Guilford counties. Two traffic fatalities occurred in Davidson county during the evening of the 8th. Two thousand residents lost power during the storm in the Piedmont Triad area. Temperature remained in the 25 to 30-degree range throughout the storm. Over the eastern and southern piedmont from Albemarle and Troy northeast to Raleigh/Durham to Warrenton, a narrow band of mixed freezing rain and rain fell with a little sleet at the onset. Temperatures remained in the low to mid 30's during the event, preventing a major ice storm. There were some icy bridges and overpasses reported but glaze accumulations were limited to metal objects and in the tree tops. A few tree limbs fell mainly in Durham and Roxboro which caused some power outages but these problems were minor compared to the areas to the west.
2/13/1997	0	0	$0	Over the eastern and southern piedmont from Albemarle and Troy northeast to Raleigh/Durham to Warrenton, a narrow band of mixed freezing rain and rain fell with a little sleet at the onset. Temperatures remained in the low to mid 30's during the event, preventing a major ice storm. There were some icy bridges and overpasses reported but glaze accumulations were limited to metal objects and in the tree tops. A few tree limbs fell mainly in Durham and Roxboro which caused some power outages but these problems were minor compared to the areas to the west.
12/29/1997	0	0	$0	A Winter Storm affected the western and central portions of North Carolina. Snow fell over the western piedmont with a mixture of snow, sleet, and rain over the central piedmont. Rain fell to the east. Snow developed over the western piedmont of North Carolina just after sunrise and continued through the day. The snow tapered off in the late afternoon. The main rain / snow line set up from near Salisbury northeast to Greensboro and extended northeast to the North Carolina / Virginia border, just west of Roxboro. Snow fell to the west of this line, while rain fell to the east. Along the narrow transition zone from near Salisbury northeast to Roxboro, a mixture of rain and snow fell, occasionally mixed with sleet. Accumulations of snow were heaviest in the city of Winston-Salem and points west and north of the city. Totals there were from 6 to 8 inches, with 4 to 6 inches of snow in Davidson and Guilford counties, including the cities of Lexington and Greensboro. Near the snow to rain transition line...snow accumulations were limited to 1 to 3 inches in a zone from Albemarle in Stanly county northeast through Randolph county including Asheboro and into Alamance and Person counties. Burlington and Roxboro reported around 2 inches of snow. Hundreds of traffic accidents were reported in Davidson, Forsyth, Guilford, Randolph, and Alamance counties. Power outages were also heaviest in Forsyth county.

Date	Deaths	Injuries	Property Damage	Detail
1/18/2000	0	0	$0	Light snow moved over the Triad area in the early morning hours of the 18th and spread slowly east-southeast, reaching the Sandhills and Coastal Plain before daybreak. The snow intensified in the morning in the Triad area where 4 to 6 inches of snow fell. The Sandhills and Coastal Plain received 1 to 3 inches before changing over to sleet and freezing rain in the mid-morning hours. Total accumulations of ice were less than a quarter of an inch. The snow and ice made for slick road conditions across the entire area. Most counties reported numerous accidents, causing many major roads to close.
1/20/2000	0	0	$0	An average of 2 to 3 inches of snow fell in the northern half of central North Carolina with a few locations near the Virginia border receiving up to 4 inches. The southern counties in central North Carolina received mostly rain with a trace of snow. The snow began around midnight on the 20th over the Northwest Piedmont and moved east. The light snow tapered off to rain and freezing drizzle in the early morning hours. Some secondary roads were reported to be slick while most major roads remained clear.
1/22/2000	0	0	$0	A winter storm producing snow and ice moved from west to east across central North Carolina beginning on the evening of the 22nd. The storm produced 2 to 5 inches of snow across the western Piedmont where Stanly and Anson counties reported 4 to 5 inches and the Triad around 2 inches. Amounts less than an inch covered the ground in the Triangle and Rocky Mount areas while the southern tier counties got 1 to 3 inches. After a lull in the late-night precipitation, sleet and freezing rain developed early on the 23rd. The accumulation of ice was less than a quarter inch in the southern counties where precipitation was mostly rain. In the central counties including Nash, Wake, Chatham, and Randolph, the ice accumulated to around a quarter inch, causing scattered power outages and downed tree limbs. Precipitation in the northern counties remained mostly snow throughout the event.

Date	Deaths	Injuries	Property Damage	Detail
1/24/2000	0	0	$0	This record-setting snow storm began with freezing drizzle in the early morning hours of the 24th. Road surfaces quickly froze during this time when the temperature dropped from 32 degrees to 27 degrees. Numerous traffic accidents were reported. By mid-morning, additional precipitation was advancing northward into the southern portions of central North Carolina. During the afternoon of the 24th, rain was falling across southeastern North Carolina while an area of snow was located over the southwest Piedmont to the western Sandhills. Later that evening the precipitation reached the Triangle area, beginning as mostly sleet before quickly changing to all snow. The snowfall became heavy early on the 25th with snowfall rates estimated at 4 inches per hour. A north-to-south oriented band of heavy snow remained in place over Moore, Lee, Wake, Franklin, Granville, Vance, and Warren counties for several hours. Snowfall amounts exceeded 20 inches in some locations in these counties. The western Piedmont counties recorded 8 to 12 inches of snow, while the Coastal Plain received 4 to 8 inches of snow with light icing at the end of the event. The heavy snow brought central North Carolina to a standstill. Many roads were impassable, and power outages were reported across the entire area. Statewide, an estimated 260,000 people were without power, mostly in the Sandhills. Strong, gusty winds produced snow drifts several feet high. At the Raleigh-Durham Airport, the record snowfall from one storm was set at 20.3 inches. The total cost of the storm to the state was estimated at $800 million.
1/28/2000	0	0	$0	Sleet and freezing rain began to fall in the western Piedmont of North Carolina on the evening of the 28th. The ice accumulated to a half inch in some locations near the Triad area and along the Virginia border, with most locations in the area receiving around a quarter of an inch of ice. The rest of central North Carolina received a thin coating of less than a quarter inch, creating patchy spots of ice on roads and causing downed trees and power lines. Approximately 30,000 people were without power across the state at the peak of the storm. In eastern portions of the Sandhills and in the Coastal Plain, the freezing rain changed to light rain, preventing more widespread icing in that area. A lull in the precipitation from the predawn hours on Sunday until Sunday morning also kept ice accumulation minimal.
2/12/2001	0	0	$0	A mixture of snow, sleet, and freezing rain fell in the early morning hours of February 12. The precipitation began as snow, then changed to sleet a few hours later. Around sunrise, the precipitation fell as freezing rain before ending late in the morning. The snow accumulated to around an inch in some locations with an additional quarter inch of ice accumulation in the Northwest Piedmont. The frozen precipitation made roads slick, which led to several accidents.
1/3/2002	0	0	$0	The first winter storm of the season brought significant snowfall to central North Carolina. An initial round of snow began to fall during the evening of the 2nd. The snow was heavy at times, and accumulated between 3 and 5 inches. The snow changed to sleet and light freezing rain in the Coastal Plain through the early morning hours of the 3rd. After a period of little or no precipitation on the morning of the 3rd, snow began to fall again across the entire area, and was heavy at times, adding an additional 4 to 8 inches. Storm total snowfall amounts were over a foot from the Sandhills northeast across the Piedmont to the Virginia border. The Northwest Piedmont, including the Triad area, received 6 to 10 inches. Snowfall amounts were

Date	Deaths	Injuries	Property Damage	Detail
				lower in the Southern and Central Coastal Plain, between 4 and 8 inches, due to the snow mixing with sleet and freezing rain.
1/6/2002	0	0	$0	A period of freezing rain caused dangerous driving conditions across the Northwest Piedmont on the morning of January 6. Icy roads were reported across the Northwest Piedmont, mainly to the north of Interstate 40. Conditions were made worse by existing snow cover from a snow storm a few days earlier. The freezing rain fell for a few hours before changing over to rain in the afternoon.
12/4/2002	0	0	$0	One of the worst ice storms to ever hit Central North Carolina began in the late afternoon on December 4, and ended in the early morning hours of December 5. Precipitation mainly began as a mix of snow and sleet, then turned to freezing rain. A quarter inch of ice or more covered locations mainly to the west of I-95. The highest precipitation amounts stretched across the Piedmont, from Albemarle to Asheboro to Durham to Warrenton, where a half inch to one-inch thick layer of ice was reported. 1 to 2 inches of snow also fell in the Triad area and in the counties bordering Virginia with trace amounts elsewhere. Large trees and power lines were downed by the ice all across the area. The storm caused a record number of power outages, as nearly one million people lost power in Central North Carolina, some for nearly a week.
1/23/2003	0	0	$0	Snow accumulated to three to five inches across portions of the northern Piedmont and northwest Piedmont on the morning of the 23rd. The snow began to fall shortly after midnight, and continued to fall into the late morning hours. An area of three to four inches accumulated in the northern Piedmont from Person to Franklin counties, and four to five inches were reported in Davidson and Forsyth counties. Less than three inches of snow was reported elsewhere in Central North Carolina.
2/16/2003	0	0	$0	Sleet and freezing rain fell across much of central North Carolina. Sleet accumulated between 1 and 3 inches across the Piedmont, mainly west of a line from Southern Pines to Raleigh to Roanoke Rapids. The highest accumulations were near the Virginia border and in the Triad area. Mainly freezing rain fell across the Sandhills and Coastal Plain, with ice accumulations around a quarter inch along a narrow corridor from Wadesboro to Smithfield to Rocky Mount.
2/27/2003	0	0	$0	Freezing rain began in the early morning hours of the 27th, and continued into the afternoon. Ice accumulated to nearly one inch just north of the Triad area. Much of the Piedmont from Raleigh north and west received a quarter to a half inch of ice. Numerous trees were downed and power outages were widespread across the Piedmont.
12/13/2003	0	0	$0	A mix of freezing rain and sleet fell across the northwest piedmont from Roxboro, Burlington, Asheboro and Denton west across the Triad. Accumulation of freezing rain reached a quarter of an inch in addition to as much as an inch of sleet. Numerous traffic accidents were reported due to icy road conditions.
1/26/2004	0	0	$0	A winter storm occurred on January 25th and 26th when snow and sleet fell across central North Carolina. The precipitation fell as snow and sleet over much of the area on the 25th, then became freezing rain over the southeastern sections on the 26th. 3 to 6 inches of snow and sleet fell over the Piedmont on the 25th, with as much as 1/4 inch of freezing rain reported in the southern coastal plain on the 26th.
2/15/2004	0	0	$0	Snow began falling on the evening of the 15th, and ended the morning of the 16th. Bands of snow spread northward across the area, producing between 3 and 6 inches across the northern half of central North Carolina.

Date	Deaths	Injuries	Property Damage	Detail
2/26/2004	0	0	$0	A strong storm arrived on February 26th and continued into the morning of the 27th. This storm hit the area with a one-two punch, affecting southern sections on the 26th, then northern sections late on the 26th and the 27th. The first punch dumped heavy snow over portions of the southern Piedmont and Sandhills. Accumulations totaled 6 to locally 10 inches in areas such as Laurinburg, Hamlet, Fayetteville, and Raeford. Much lighter amounts fell to the north during the day. The second punch arrived in western sections of the area late in the day and shifted northeast across central and eastern portions overnight. The heavy snow was accompanied by thunder and lightning across the western Piedmont. Snowfall amounts ranged between 12 to 18 inches from Albemarle northeast to Greensboro. Other sections of the Piedmont, including the Triangle, received between 3 and 6 inches.
1/29/2005	0	0	$0	A mix of snow and sleet moved across the Piedmont on Saturday afternoon. This brought a half inch of sleet to the Winston-Salem area. A lull in the precipitation was followed by a period of freezing rain Sunday morning. A quarter inch of ice accrued in the central and western Piedmont, which created icy roads and caused numerous accidents.
12/15/2005	0	0	$0	Freezing rain fell across the Triad from around 4 am to noon with accumulations up to a quarter of an inch. No major power outages were reported in the area, however, hundreds of automobile accidents resulted from the freezing rain.
1/18/2007	0	0	$0	Snow moved into Central North Carolina just prior to sunrise on January 18th impacting local schools and morning commuters. Between one to two inches of snow fell across the area resulting in numerous accidents. About eight children were injured in Asheboro when a school bus over turned and two indirect deaths were reported near Goldsboro as a result of a single vehicle accident. Snow changed over all rain by afternoon.
1/21/2007	0	0	$0	A light glaze of freezing rain up to a tenth of an inch thick accumulated over the piedmont from 5pm to midnight.
12/7/2007	0	0	$20,000	Light freezing rain during the early morning hours just prior to sunrise resulted in several automobile accidents from black ice on numerous bridges.
1/17/2008	0	0	$0	Around one inch of snow fell countywide with a few locations in the western portion of the county receiving 2 to 3 inches of snow.
1/19/2008	0	0	$0	Around one-half inches of snow accumulated during the afternoon and early evening hours.
2/13/2008	0	0	$0	Between one to three inches of snow fell across Forsyth County with the heavier amounts north of Winston Salem.
1/22/2009	0	0	$0	Up to 1 inch of snow fell across the county resulting in the closing of local schools.
2/3/2009	0	0	$0	Between one to two inches of snow fell across the county around the time of evening rush hour.
3/1/2009	0	0	$0	Between six to eight inches of snow fell countywide. Several automobile accidents were reported the mornings following the storm due to the re-freezing of the melting snow overnight.
12/18/2009	0	0	$0	Between 4 to 8 inches of snow fell across Forsyth county and Winston-Salem. Many primary roads including Highway 52, Highway 421 and portions Interstate 40 became impassible during the evening. Law enforcement responded to hundreds of automobile accidents.

Date	Deaths	Injuries	Property Damage	Detail
12/30/2009	0	0	$0	Light freezing rain was reported across the area resulting in a light coating of ice on elevated surfaces such as trees, bushes and power lines. Area roads remained clear.
1/29/2010	0	0	$0	Between 8 to 10 inches of snow fell across the county. Power outages in the county totaled 9400. The heavy wet snow caused numerous trees to fall countywide resulting in blocked roads and some damage. Due to the cold temperatures icy road conditions persisted for several days resulting in the closure of schools and businesses.
2/5/2010	0	0	$50,000	Up to three inches of snow fell across portions of the county along with up to a quarter inch of freezing rain. Twelve thousand homes in the county were without power at one point during the storm. A total of over fifty thousand people were without power in North Carolina. North Carolina Highway patrol responded to over 725 calls involving vehicle accidents. Numerous trees fell due to the weight of the freezing rain.
2/12/2010	0	0	$0	Around one to two inches of snow fell across the county Friday night and early Saturday.
3/2/2010	0	0	$0	Around 3 to 4 inches of snow fell across the county. Only a few minor vehicle accidents and power outages were reported.
12/4/2010	0	0	$0	Two to three inches of snow fell across the county with the heaviest amounts reports along and north of Interstate 40.
12/16/2010	0	0	$0	A half inch of snow combined with a tenth of an inch of freezing rain to create hazardous driving conditions across the area.
12/25/2010	0	0	$0	Six to eight inches of snow fell countywide including in Winston-Salem. Many roads were impassible due to the heavy snow, however, other than a few minor accidents no other problems were reported due to the holiday.
1/6/2011	0	0	$0	A high school student attending Regan High School was killed on his way to school when his SUV slid on a patch of ice then striking a tree. Rapidly clearing skies allowed temperatures to fall below freezing in the morning resulting in areas of ice on road surfaces. Numerous other accidents were reported.
1/10/2011	0	0	$0	One to three 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. A man was killed in a head on collision near Walkertown as a result of slippery roads.
11/26/2013	0	0	$0	Light freezing rain resulted in minor glazing on trees and other elevated surfaces in the area.
1/21/2014	0	0	$0	A dusting of snow was reported.
1/28/2014	0	0	$0	Snowfall averaged 1 to 2 inches across the county.
2/12/2014	0	0	$0	Snow fall averaged 7-9 inches across the county. In addition, ice accrual averaged 1/10 of an inch.
3/3/2014	0	0	$0	Snowfall amounts averaged between 1 to 1.5 inches across the county. A glaze of ice from freezing rain was also reported on trees and power-lines.
3/6/2014	0	0	$0	Snowfall of 2 to 5 inches fell across the county.

Date	Deaths	Injuries	Property Damage	Detail
3/17/2014	0	0	$0	Ice accretion averaged around five hundredths of an inch across the county, with also a tenth or two of snow.
1/13/2015	0	0	$0	A thin glaze of ice was reported on trees and elevated surfaces. Icy bridges and overpasses created difficult travel conditions during the morning on the 14th, with several automobile accidents reported across the county.
2/16/2015	0	0	$0	Snowfall amounts 1 to 3 inches fell across the county. In addition, a trace of freezing rain accrual was reported.
2/24/2015	0	0	$0	Snowfall amounts of 1 to 2 inches fell across the county.
2/25/2015	0	0	$0	Snowfall/sleet amounts of 4 to 5 inches fell across the county.
1/17/2016	0	0	$0	Northwestern portions of Forsyth County received up to one inch of snow.
1/20/2016	0	0	$0	Snowfall amounts of 0.25 to 0.5 inches fell across the county.
1/22/2016	0	0	$0	Snowfall/sleet amounts of 2 to 5 inches fell across the county.
2/14/2016	0	0	$0	Snowfall/sleet amounts of 2 to 3 inches fell across the county. In addition, a tenth to a quarter of freezing rain accrual was reported.
1/6/2017	0	0	$0	Snowfall amounts of 8 to 11 inches fell across the county.
12/8/2017	0	0	$0	Three to six inches of snow fell across Forsyth county.
1/17/2018	0	0	$0	Five to seven inches of snow fell across the county.
3/12/2018	0	0	$0	Snowfall totals across the county averaged 2 inches, with a few locations reporting 2.5 to 3.5 inches.
3/21/2018	0	0	$0	One-half inch to one inch of snow fell across northern portions of the county.
3/24/2018	0	0	$0	One inch of snow fell across the county.
12/9/2018	0	0	$0	Snowfall amounts ranged between 11 to 14 inches across the county.
1/12/2019	0	0	$0	One-quarter to one-third of an inch of ice from freezing rain downed numerous trees across the county. At its peak, nearly 40,000 customers in the county were without power.
1/23/2019	0	0	$0	A trace to 0.02 inches of ice from freezing rain was reported across northern portions of the county, resulting in several automotive accidents due to icy roads.
12/13/2019	0	0	$0	Freezing rain was reported across the county. Freezing rain amounts were less than a tenth of an inch.
2/20/2020	0	0	$0	Snowfall amounts ranged from 1 to 2 inches across the county.

Source: National Centers for Environmental Information

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.

F.5.6.3 Probability of Future Occurrences

Winter storm events will remain a regular occurrence for University of North Carolina School of the Arts due to its location in the central piedmont part of the state. According to historical information the

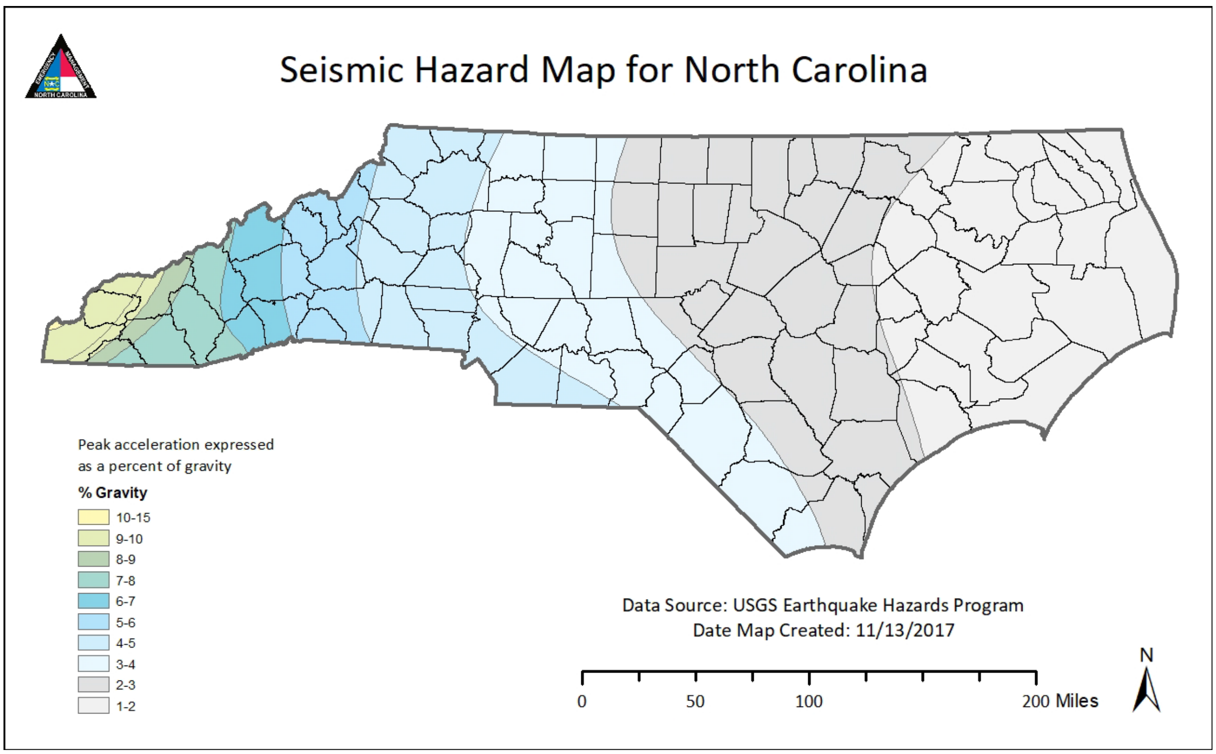
University often experiences several winter storms events each year. Therefore, the annual probability is likely (10 to 100 percent

F.5.7 EARTHQUAKES

F.5.7.1 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 F.7** is a map showing geological and seismic information for North Carolina.

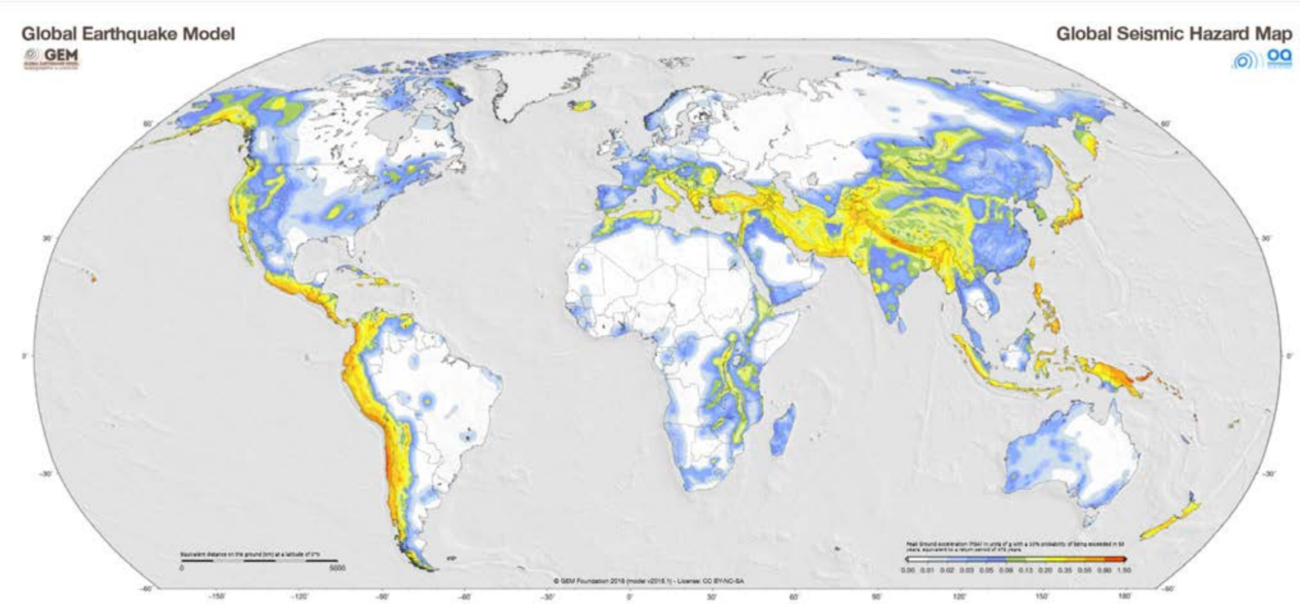
FIGURE F.7: GEOLOGICAL AND SEISMIC INFORMATION FOR NORTH CAROLINA



Source: North Carolina Geological Survey

Figure F.8 shows the intensity level associated with the world 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 campus as a whole exists within an area of moderate seismic risk.

FIGURE F.8: PEAK ACCELERATION WITH 10 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS



Source: Global Earthquake Model, 2018

F.5.7.2 Historical Occurrences

At least 9 earthquakes are known to have affected Forsyth County since 1886. The strongest of these measured a V on the Modified Mercalli Intensity (MMI) scale. **Table F.18** provides a summary of earthquake events reported by the National Geophysical Data Center between 1898 and 1980.

TABLE F.18: EARTHQUAKES IMPACTING FORSYTH COUNTY

Location	Date	Magnitude	MMI
Winston Salem	2/21/1916	--	3
Winston Salem	11/3/1928	--	3
Winston Salem	11/20/1969	4.3	4
Winston Salem	9/10/1970	--	3
Lewisville	9/13/1976	3.3	4
Rural Hall	9/13/1976	3.3	5
Winston Salem	7/27/1980	5.1	2
Winston Salem	11/25/1898	--	4
Winston Salem	5/3/1897	--	3

Source: USGS; National Geophysical Data Center

A list of earthquakes that have caused damage throughout North Carolina is presented below in **Table 5.19.**

TABLE F.19: EARTHQUAKES WHICH HAVE CAUSED DAMAGE IN NC

Date	Location	Richter Scale (Magnitude)	MMI (Intensity)	MMI in North Carolina
12/16/1811 - 1	NE Arkansas	8.5	XI	VI
12/16/1811 - 2	NE Arkansas	8.0	X	VI
12/18/1811 - 3	NE Arkansas	8.0	X	VI
01/23/1812	New Madrid, MO	8.4	XI	VI
02/071812	New Madrid, MO	8.7	XII	VI
04/29/1852	Wytheville, VA	5.0	VI	VI
08/31/1861	Wilkesboro, NC	5.1	VII	VII
12/23/1875	Central Virginia	5.0	VII	VI
08/31/1886	Charleston, SC	7.3	X	VII
05/31/1897	Giles County, VA	5.8	VIII	VI
01/01/1913*	Union County, SC	4.8	VII	VI
02/21/1916*	Asheville, NC	5.5	VII	VII
07/08/1926	Mitchell County, NC	5.2	VII	VII
11/03/1928*	Newport, TN	4.5	VI	VI
05/13/1957*	McDowell County, NC	4.1	VI	VI
07/02/1957	Buncombe County, NC	3.7	VI	VI
11/24/1957	Jackson County, NC	4.0	VI	VI
10/27/1959 **	Chesterfield, SC	4.0	VI	VI
07/13/1971	Newry, SC	3.8	VI	VI
11/30/1973*	Alcoa, TN	4.6	VI	VI
11/13/1976	Southwest Virginia	4.1	VI	VI
05/05/1981	Henderson County, NC	3.5	VI	VI
2020	Sparta, NC			

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).

F.5.7.3 Probability of Future Occurrences

The probability of significant, damaging earthquake events affecting the area surrounding University of North Carolina School of the Arts 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 campus. The annual probability level for the campus 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, and for Forsyth County the likelihood was 4 - 5%.

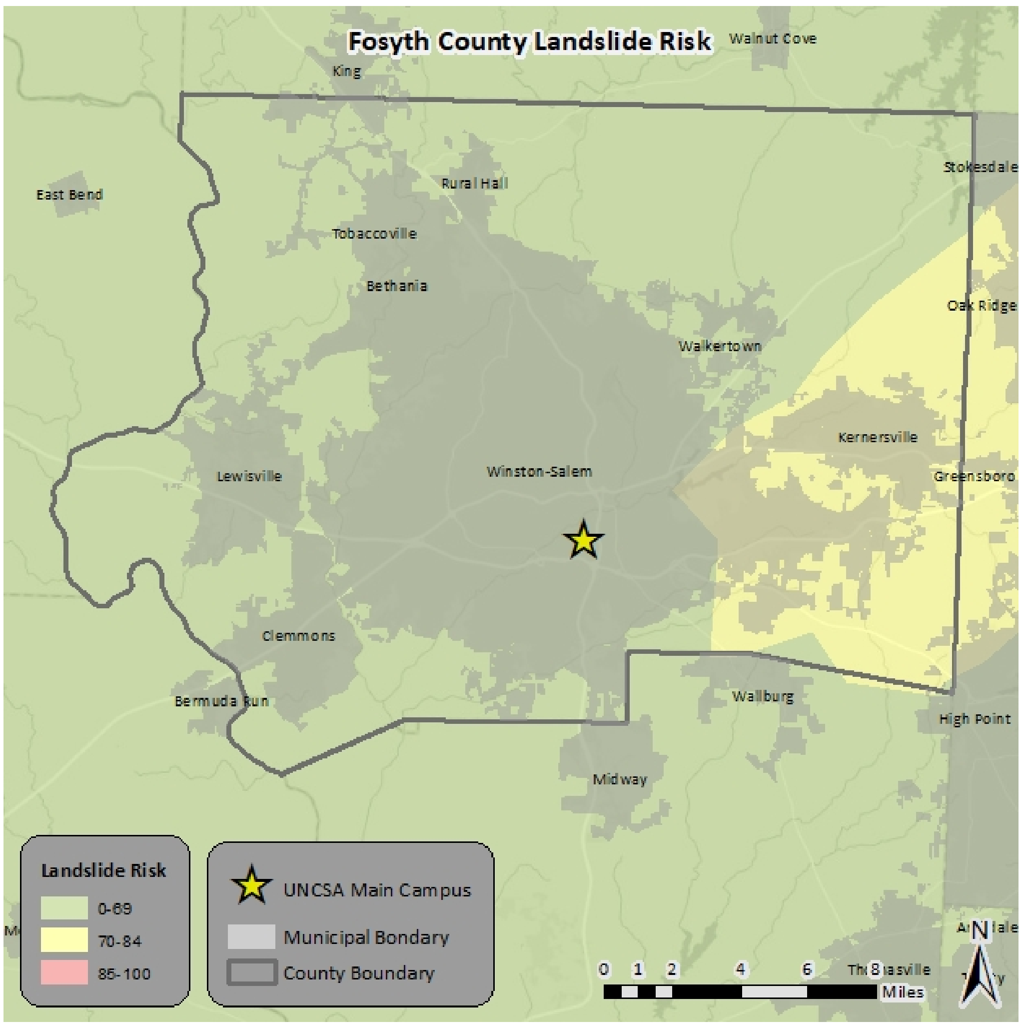
F.5.8 GEOLOGICAL

F.5.8.1 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). Forsyth County and University of North Carolina School of the Arts has a gently sloping terrain throughout the county. Any landslide event that may occur within Forsyth county will probably be in the form of very isolated and small-scale slumps of steep slope areas that are heavily saturated and/or under a load condition from a nearby structure such as a house or road. **Figure F.9** shows the landslide risk in Forsyth County according to the USGS.

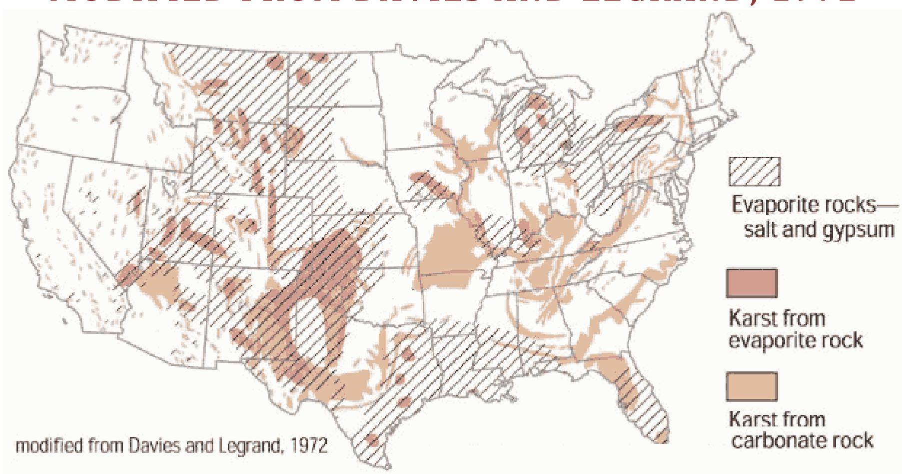
FIGURE F.9: LANDSLIDE RISK AREAS FOR FORSYTH COUNTY



Sinkholes

Figure F.10 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 F.10: UNITED STATES GEOLOGICAL SURVEY OF KARST MODIFIED FROM DAVIES AND LEGRAND, 1972



Erosion

Erosion on the University of North Carolina School of the Arts campus is typically caused by flash flooding events. Unlike coastal areas, where the soil is mainly composed of fine-grained particles such as sand, Forsyth County soils have much greater organic matter content. Furthermore, vegetation also helps to prevent erosion in the area. Erosion occurs on the University of North Carolina School of the Arts campus, particularly along the banks of rivers and streams, but it is not an extreme threat to any of the buildings on campus. No areas of concern were reported by the Campus Hazard Mitigation Planning Team.

F.5.8.2 Historical Occurrences

Landslides

Due to the low sloping topography in Forsyth County, there is a minimal risk to landslides. There are no historic reports of landslides for UNCSA.

Sinkholes

In North Carolina, most sinkholes occur in the southern coastal plain due to the high concentration of limestone. Therefore, previous hazard mitigation plans, geological data, and local media outlets were considered for sinkhole activity in Forsyth County. Local media reports suggest there have been a few sinkholes which have occurred due to leaking water and sewer line main breaks under state-maintained roads and highways and some local roads.

Erosion

Most historical occurrences of erosion are seen near the coast of North Carolina, but University of North Carolina School of the Arts is still susceptible to the hazard. Several sources were vetted to identify areas of erosion at University of North Carolina School of the Arts. This includes searching local newspapers, interviewing local officials, and reviewing previous hazard mitigation plans. Forsyth County have previous mitigation actions that address erosion including bank stabilization and meeting erosion control requirements. Such actions will continue to be implemented as necessary throughout the region. There was no recorded history of significant erosion events and it was found to be hazard with a negligible potential impact.

F.5.8.3 Probability of Future Occurrences

Landslides

Based on historical information and the USGS susceptibility index, the probability of future landslide events are possible (1 to 10 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 of the University of North Carolina School of the Arts campus 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 in Forsyth County. While many sinkholes have been relatively small, it is still unlikely (between 1 and 33.3 percent annual probability) that the campus will continue to be affected in the future.

Erosion

Erosion remains a natural, dynamic, and continuous process for University of North Carolina School of the Arts, 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*.

F.5.9 DAM FAILURE

F.5.9.1 Location and Spatial Extent

The North Carolina Division of Energy, Mineral and 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 F.20** explains these classifications.

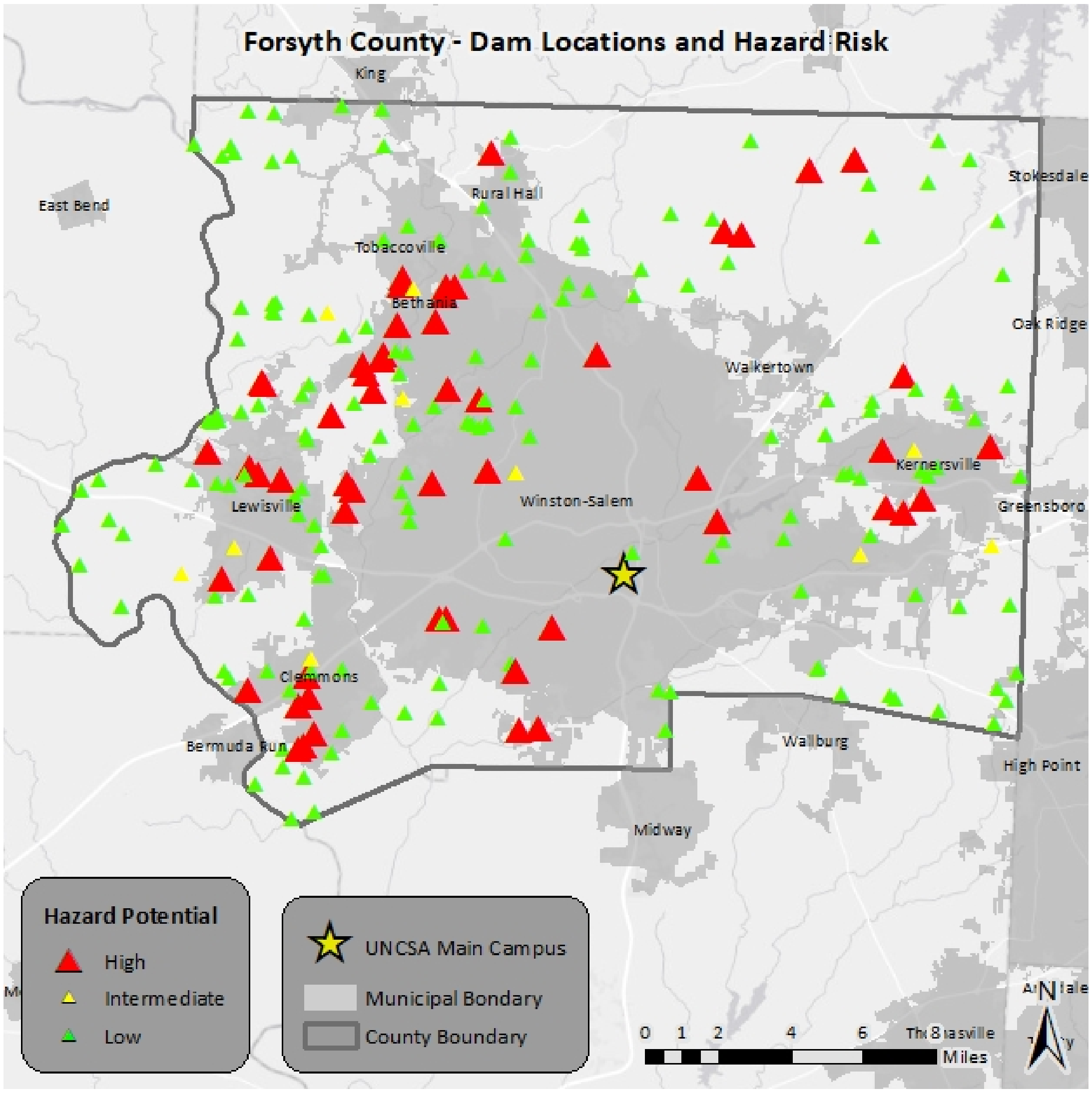
TABLE F.20: NORTH CAROLINA DAM HAZARD CLASSIFICATIONS

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 Management, there are 221 dams in Forsyth County. **Figure F.11** shows the dam location and the corresponding hazard ranking for each. Of these dams, 55 are classified as high hazard potential. These high hazard dams are listed in **Table F.21.** According to a consensus of the Campus Hazard Mitigation Planning Team, there is an extremely low possibility that any of these state-recognized dams would cause any damage whatsoever to University of North Carolina School of the Arts should a dam breach or failure occur, despite the hazard classifications assigned to these dams by the state.

FIGURE F.11: FORSYTH COUNTY DAM LOCATION AND HAZARD RANKING



Source: North Carolina Division of Land Resources

TABLE F.21: FORSYTH COUNTY HIGH HAZARD DAMS

Dame Name	Hazard Potential	Surface Area (acres)	Max Capacity (Ac-ft)	State Regulated?
Forsyth County				
Shelton Lake Dam	High	10.0	122	N
Haynes Estate Lake Dam #1	High	4.0	35	N
Haynes Estate Lake Dam #2	High	4.0	22	Y
Lea Lake Dam	High	6.1	43	N
Reynolds Lake Dam #1	High	4.5	32	Y
Lasater Mill Pond Dam	High	30.6	245	N

Dame Name	Hazard Potential	Surface Area (acres)	Max Capacity (Ac-ft)	State Regulated?
Lake Falmouth Dam	High	7.0	112	Y
Parker Lake Dam #2	High	3.1	32	Y
Conrad Lake Dam	High	10.5	176	Y
Shallowford Lakes Dam #1	High	11.0	203	Y
Shallowford Lakes Dam #2	High	8.0	80	Y
Beroth Lake Dam	High	1.3	10	N
Salem Lake Dam	High	297.5	9230	Y
Winston Lake Dam	High	16.5	1368	Y
Joyner Lake Dam	High	20.0	96	Y
Hauser Lake Dam	High	2.1	14	Y
Kernersville Water Supply Dam	High	40.0	300	N
Sabrina Lake Dam	High	5.8	42	N
Janita Lake Dam Upper	High	2.5	16	N
Myers Lake Dam	High	5.4	65	N
Haynes Lake Dam	High	3.6	30	Y
Whitaker Lake Dam	High	3.3	27	Y
Brookberry Farm Lake Dam West	High	6.0	58	Y
Brookberry Farm Lake - South Dam	High	3.5	25	Y
Beauchamp Lake Dam	High	6.3	42	N
Town Fork Creek Watershed Dam #5	High	12.0	112	Y
Town Fork Creek Watershed Dam #6	High	11.5	173	Y
Town Fork Creek Watershed Dam #2	High	34.0	584	Y
Town Fork Creek Watershed Dam #1-B	High	17.4	271	Y
Young Lake Dam #2	High	5.0	58	Y
Hanes Lake Dam	High	25.0	288	N
Gambill Lake Dam Middle	High	3.0	30	N
Fowler Lake Dam #2	High	2.8	46	Y
Fowler Lake Dam #1	High	2.0	40	N
Fowler Lake Dam #3	High	2.9	20	N
Creeson Lake Dam	High	3.0	60	N
K & W Lake Dam	High	3.4	43	Y
Mallard Lake Dam Lower	High	15.9	170	Y
Mallard Lake Dam Upper West	High	5.0	42	Y
Lake Hills Club Dam	High	10.6	111	Y
Woodview Lake Dam-Lower	High	3.2	25	Y
Wall Lake Dam	High	5.0	37	Y
Gambill Pond Dam Lower	High	3.1	22	N
Mallard Lake Dam Upper	High	8.3	77	Y
Town and Country Lake Dam	High	3.7	29	Y
Century Park Lake Dam	High	5.0	39	Y
Brookdale Lake Dam	High	1.7	15	Y

Dame Name	Hazard Potential	Surface Area (acres)	Max Capacity (Ac-ft)	State Regulated?
Beaver Brook Drive Dam	High	3.4	11	N
Arboretum Townhouse Dam	High	1.5	17	Y
Northwest Water Treatment Plant Dam #1	High	8.0	131	Y
Northwest Water Treatment Plant Dam #2	High	15.4	231	Y
Dell Phase 1 SWDP Dam	High		3	Y
Hillcrest Towne Center Pond B Dam	High	1.0	4	Y
Hillcrest Towne Center Pond E Dam	High	2.4	22	Y
Kaymoore Dam	High	1.9	9	N

Source: North Carolina Division of Land Resources

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

F.5.9.2 Historical Occurrences

According to information from the North Carolina Division of Energy, Mineral and Land Resources, there has only been fifteen dams breached in Forsyth County. There are no reports of death, injury, or property damage with any of this event. Further, there are no known levees in Forsyth County.

F.5.9.3 Probability of Future Occurrence

Given the current dam inventory and historic data, a dam breech is possible (between 1 and 10 percent annual probability) in the future. However, with regular monitoring, these events can be prevented as has been demonstrated in the past.

Inventories of statewide dam inundation data is an area that NCEM-RM is currently working hard to improve. At this time, there is geospatial data in final quality control review for 19 dams in North Carolina and that number is expected to increase significantly over the next several years. Additionally,

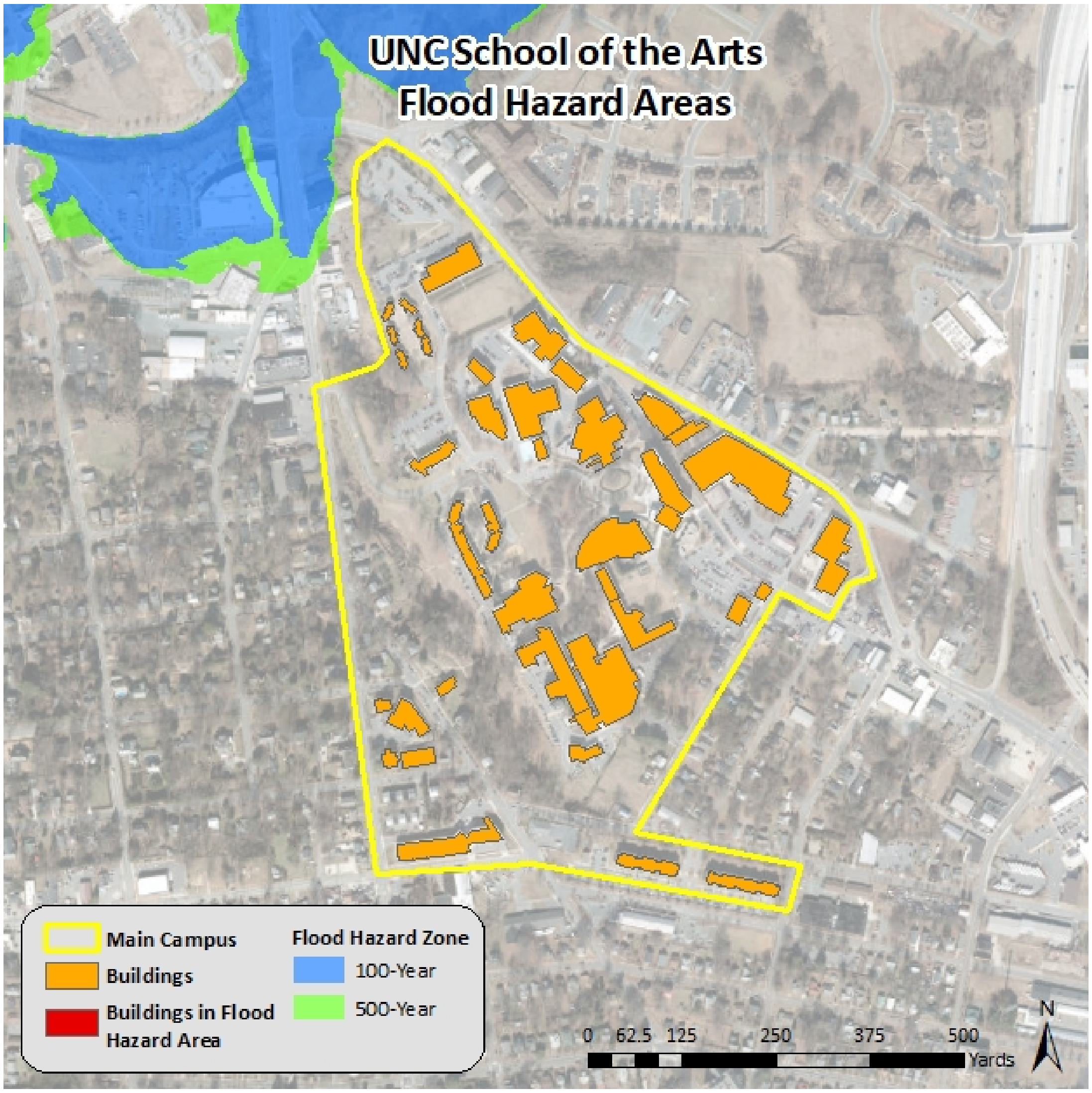
NCEM is currently working with the USACE to acquire inundation data for 9 dams under the Corps' management. As this data becomes available, detailed assessments can be run to better determine vulnerability to dam failures. The 2025 update of this plan may include a much more robust analysis of dam failure vulnerability at the County level.

F.5.10 FLOODING

F.5.10.1 Location and Spatial Extent

There are areas on the University of North Carolina School of the Arts campus that are susceptible to flooding from Salem Creek and Brushy Fork Creek. Special flood hazard areas on the University of North Carolina School of the Arts campus were mapped using Geographic Information System (GIS) and FEMA Digital Flood Insurance Rate Maps (DFIRM). This includes the 1-percent annual chance floodplain (100-year), and the 0.2-percent annual chance floodplain (500-year). **Figure F.12** illustrates the location and extent of currently mapped special flood hazard areas for the campus based on best available FEMA DFIRM data from October of 2018. 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 F.12: SPECIAL FLOOD HAZARD AREAS ON THE UNIVERSITY OF NORTH CAROLINA SCHOOL OF THE ARTS CAMPUS



Source: Federal Emergency Management Agency

Of the 39 buildings on the main campus, none were found to lie in a special flood hazard area.

F.5.10.2 Historical Occurrences

Information from the National Centers for Environmental Information was used to ascertain historical flood events. A summary of major flooding events is presented in **Table F.22.** The National Centers for Environmental Information reported a total of 44 events throughout Forsyth County since 1996[8]. A

[8] These events are only inclusive of those reported by NCEI. It is likely that additional occurrences have occurred and have gone unreported.

summary of these events is presented in **Table F.23.** These events accounted for over $555,000 (2020 dollars) in property damage throughout the county.

TABLE F.22: MAJOR FLOOD OCCURRENCES IN FORSYTH COUNTY

Area	Date	Type	Property Damage	Crop Damage	Description
WINSTON-SALEM	6/19/1996	Flash Flood	$0	$0	Three feet of water at intersection of Popular and First streets in downtown. Several other roads in town were also seriously flooded due to 3 or more inches of rain in one hour.
WINSTON-SALEM	9/10/1996	Flash Flood	$0	$0	Several major roads in Winston-Salem were covered with 3 feet of water due to persistent heavy rain.
WALKERTOWN	1/8/1998	Flood	$0	$0	Thunderstorms produced very heavy rain over eastern Forsyth county. Street flooding was reported at several locations in Walkertown.
WINSTON SALEM	4/17/1998	Flash Flood	$0	$0	An isolated strong thunderstorm moved over the Winston-Salem area very slowly from the northwest. Flooding was reported in many locations including Reynolda Road at Wake Forest University and along Interstate 40 and Highway 52 near downtown. 2 to 2.5 inches of rain fell in an hour over the western and downtown sections of the city. The slow-moving storm also caused streams to come out of their banks west of the city all the way to the Yadkin River.
CLEMMONS	8/7/2000	Flash Flood	$0	$0	Flooding on I-40 at Silas Creek Parkway.
KERNERSVILLE	9/14/2000	Flash Flood	$0	$0	Hwy. 158 was flooded along with several secondary roads.
NORTH CENTRAL PORTION	9/18/2002	Flash Flood	$0	$0	Flooding occurred on Highway 52 and University Parkway, and on Highway 65 near Winston-Salem. Creeks overflowed their banks near Pfafftown, flooding several roads.
RURAL HALL	2/22/2003	Flash Flood	$0	$0	Residences were flooded.
	3/20/2003	Flood	$150,000	$0	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.
	4/10/2003	Flood	$0	$0	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.
PFAFFTOWN	5/25/2003	Flash Flood	$0	$0	Streets were flooded and a basement of a home was flooded off Highway 67.

Area	Date	Type	Property Damage	Crop Damage	Description
WINSTON SALEM	7/29/2003	Flash Flood	$100,000	$0	Little Creek overflowed its banks, and an apartment complex was damaged from flooding. A furniture store also sustained flood damage.
KERNERSVILLE	9/23/2003	Flash Flood	$0	$0	Some homes were flooded.
WINSTON SALEM	8/2/2004	Flash Flood	$0	$0	Salem Chapel United Methodist Church on Salem Chapel Road was flooded.
WINSTON SALEM	8/12/2004	Flash Flood	$0	$0	Flash flooding was reported on 28th Street and Liberty, with two cars disabled due to high water.
WINSTON SALEM	9/27/2004	Flash Flood	$0	$0	Several blocks of downtown Winston-Salem were flooded. One apartment complex had to be evacuated.
PFAFFTOWN	7/7/2005	Flash Flood	$0	$0	Heavy rainfall flooded a golf course with several inches of water, and the back yards of several homes had high water as well. Several ponds and small lakes overflowed and threatened homes. A spotter reported 6.79 inches of rainfall in just over five hours.
HANES	5/8/2008	Flash Flood	$0	$0	Flash flooding caused the evacuation of apartments on Johnsborough Court in the western portion of Winston-Salem. In total, five water rescues were conducted.
SWAINTOWN	5/8/2008	Flash Flood	$0	$0	Heavy rain caused flash flooding on Peters Creek Parkway.
BETHANIA	8/27/2008	Flash Flood	$0	$0	Law enforcement reported several roads flooded including Beroth Road in the Lewisville area.
PFAFFTOWN	1/25/2010	Flash Flood	$0	$0	Flash flooding resulted in the closure of several roads due to flooding and a landslide.
CLEMMONS	5/28/2010	Flash Flood	$10,000	$0	Flash flooding was reported at several locations in Clemmons, NC, including Lewisville Clemmons Road. In addition, a vehicle was reported to be under water at the intersection of Stadium Drive and Brookland Drive.
GUTHRIE	6/2/2010	Flash Flood	$0	$0	Flooding was reported on many side streets around Winston-Salem resulting in numerous road closures.
KERNERSVILLE	8/11/2010	Flash Flood	$0	$0	Flash flooding resulted in road closures at the intersection of Highway 66 and Business 40, the intersection of Piney Grove Road and North Main Street and portions of East Mountain Street.
GUTHRIE	9/30/2010	Flash Flood	$0	$0	Linville Road was closed due to flashing flooding.
(INT)WINSTON-SALEM A	10/27/2010	Flash Flood	$0	$0	The 3300 block of New Walkertown Road was closed due to flooding.
OLDTOWN	10/27/2010	Flash Flood	$0	$0	Bethabara Road and North Point Boulevard was closed due to flash flooding.
LEWISVILLE	10/27/2010	Flash Flood	$0	$0	Flash flooding was reported near the intersection of Grapevine Road and Conrad Road.
MUDDY CREEK	7/8/2011	Flash Flood	$0	$0	Road was closed due to flooding near the intersection of Griffith Road and West Clemmonsville Road.

Area	Date	Type	Property Damage	Crop Damage	Description
WNSTN SALEM SIDES AR	3/20/2012	Flash Flood	$0	$0	Minor flooding was reported just south of the Winston Salem area. The flooding resulted in a couple of road closures, including the 4200 block of Fox Meadow Lane and Bridgeton Road near Peters Creek Parkway.
WINSTON SALEM	5/14/2012	Flash Flood	$0	$0	Two to three feet of water was reported over some roads and parking lots in downtown Winston-Salem, North Carolina near Business Highway 40. Some cars were reported to be partly submerged.
PFAFFTOWN	5/14/2012	Flash Flood	$0	$0	Two feet of water was reported over Claredon Avenue.
BETHANIA	5/14/2012	Flash Flood	$0	$0	Up to two feet of water was reported inside of businesses along Reynolda Road.
PFAFFTOWN	5/14/2012	Flash Flood	$5,000	$0	Hilltop Drive was closed due to flash flooding as the culvert failed resulting in 30 feet of asphalt washing away.
PARK TERRACE	8/28/2012	Flash Flood	$30,000	$0	Street flooding resulted in the closings of several roads in the area. Approximately 30 people were evacuated by inflatable rafts at a local business on Northwest Boulevard. Additionally, flash flood waters swept five vehicles from the parking lot into Peter's Creek.
OLDTOWN	7/27/2013	Flash Flood	$0	$0	Several roads closed due to flooding in the Bethabara Park area.
TOBACCOVILLE	10/8/2016	Flash Flood	$0	$0	Widespread heavy rainfall of 3 to 4 inches caused minor flash flooding on several roads across the county.
WAUGHTOWN	7/22/2018	Flash Flood	$0	$0	Flash flooding was reported on numerous roads around the US Highway 52 corridor, running through Winston Salem. This includes but not limited to the following roads: |US-421 N at S Main Street, Wake Forest University in the coliseum area, US-52 and along Peters Creek Parkway in multiple areas from Silas Creek Parkway to US-421.
LEWISVILLE	7/24/2018	Flash Flood	$0	$0	Heavy rain caused Mills Creek to overflow, flooding Conrad Sawmill Road near the intersection of Grapevine Road.
DONNAHA	7/25/2018	Flash Flood	$0	$0	Heavy rain caused nearby creeks and streams to overflow their banks, flooding portions of Reynolda Road.
GUTHRIE	8/2/2018	Flash Flood	$0	$0	Several roads were closed due to flash flooding in the Sedge Garden area. The road closures included Gumtree Road near NC-109, High Point Road at Union Cross Road, Sawmill Road, and Longreen Drive.
WALKERTOWN	8/2/2018	Flash Flood	$10,000	$0	Several roads were closed due to flash flooding in the Walkertown area, including the intersection of Highway 66 and Highway 311.
TOBACCOVILLE	9/17/2018	Flash Flood	$0	$0	Heavy rainfall of 4 to 8 inches flooded several roads across the county.
UNION CROSS	10/11/2018	Flash Flood	$250,000	$0	Heavy rainfall of 4 to 6 inches flooded several roads across the county. Several water rescues were also performed throughout the county.

Source: National Centers for Environmental Information

TABLE F.23: SUMMARY OF FLOOD OCCURRENCES

Location	Number of Occurrences	Deaths	Injuries	Property Damage (2020)
Bethania	2	0	0	$0
High Point	0	0	0	$0
Kernersville	3	0	0	$0
King	0	0	0	$0
Lewisville	2	0	0	$0
Rural Hall	1	0	0	$0
Walkertown	2	0	0	$10,000
Winston-Salem	9	0	0	$100,000
Unincorporated Area	25	0	0	$445,000
Forsyth County Total	**44**	**0**	**0**	**$555,000**

Source: National Centers for Environmental Information

F.5.10.3 Probability of Future Occurrences

Flood events will remain a threat to University of North Carolina School of the Arts, 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).

It can be inferred from the floodplain location maps, previous occurrences, and repetitive loss properties that risk varies throughout the University of North Carolina School of the Arts campus.

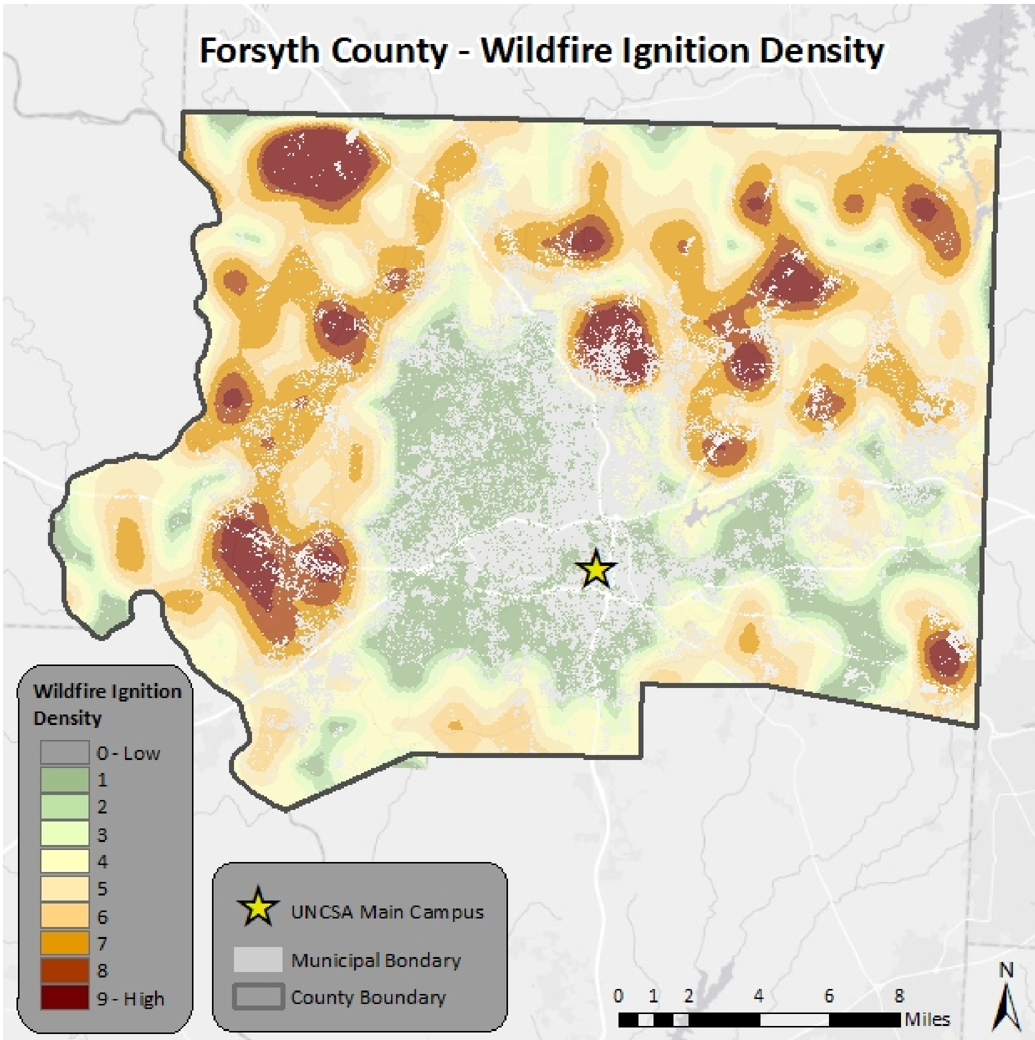
F.5.11 WILDFIRES

F.5.11.1 Location and Spatial Extent

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

Figure F.13 shows the Wildfire Ignition Density Forsyth County 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.

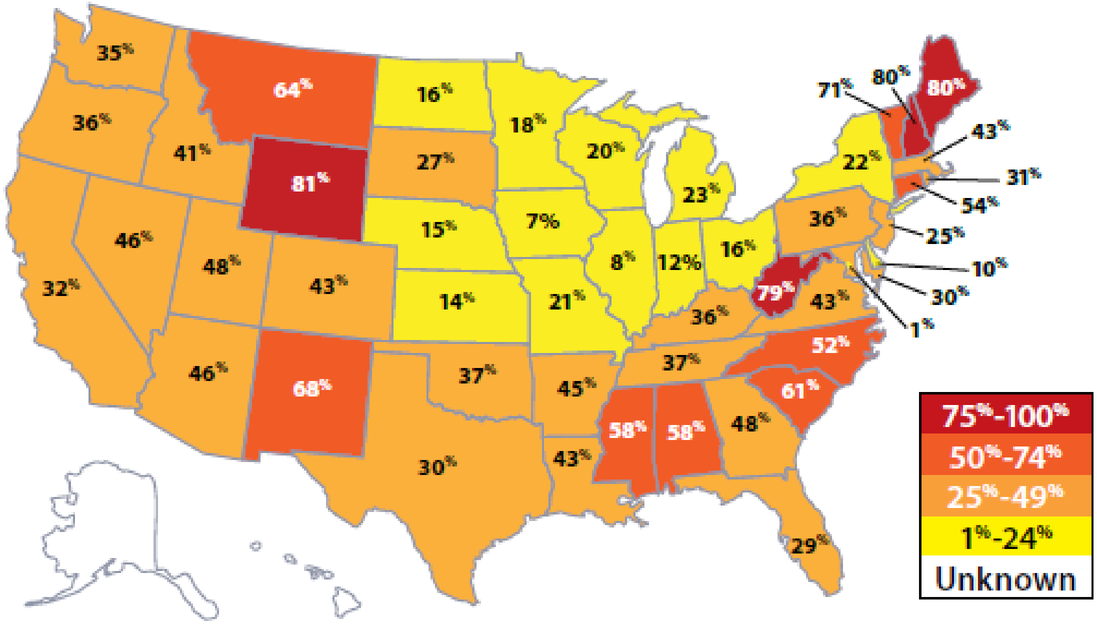
FIGURE F.13: WILDFIRE IGNITION DENSITY IN FORSYTH COUNTY



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 F.14** 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.

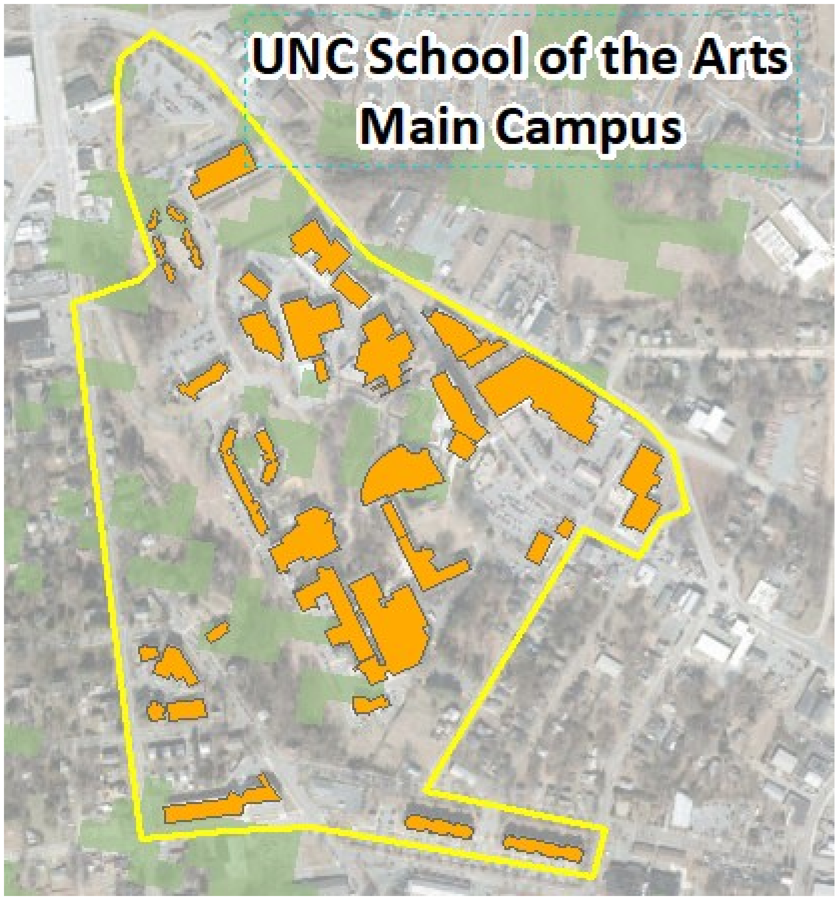
FIGURE F.14: % OF HOMES IN THE WILDLAND URBAN INTERFACE



Source: US Department of Agriculture

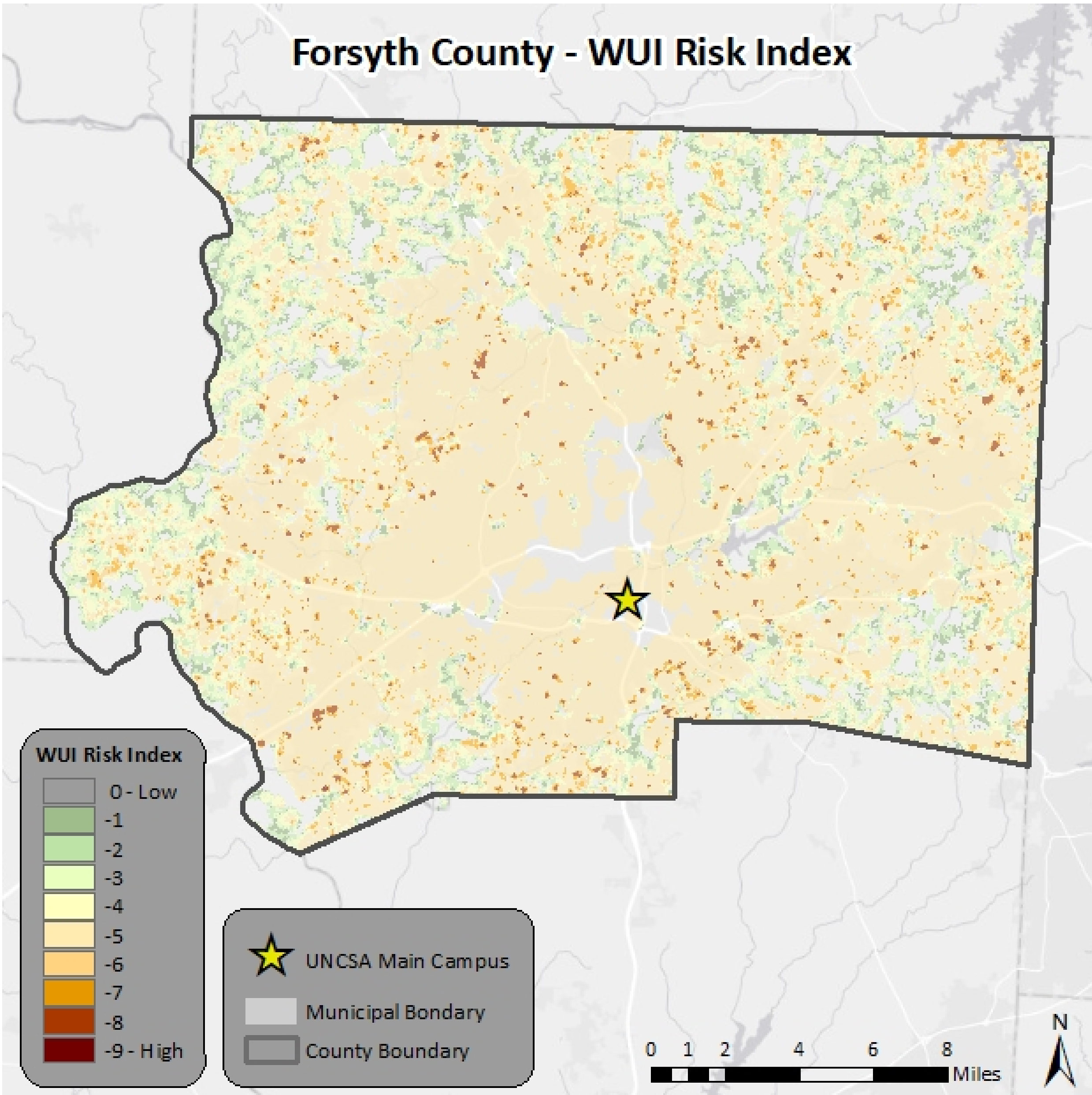
Below, **Figure F.15** displays the Wildfire Ignition Density specifically for University of North Carolina School of the Arts, and **Figure F.16** shows the WUI Risk Index for Forsyth County.

FIGURE F.15: UNCSA CAMPUS WILDFIRE IGNITION DENSITY



Source: Southern Wildfire Risk Assessment

FIGURE F.16: WATUAGA COUNTY WILDFIRE URBAN INTERFACE RISK INDEX



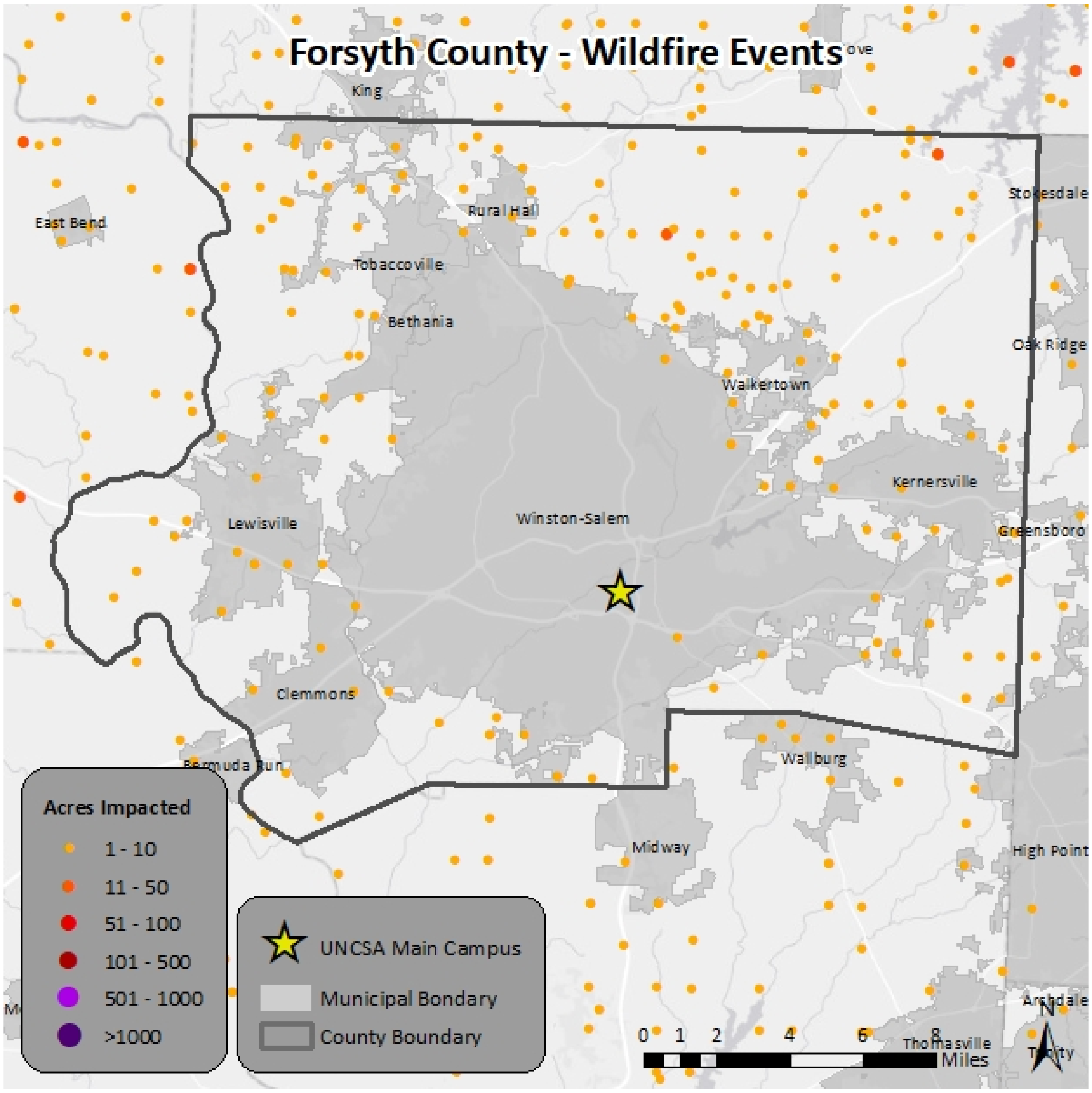
Source: Southern Wildfire Risk Assessment

F.5.11.2 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 335 events that impacted an area greater than 1 acre have occurred throughout the Forsyth County since 2001[9]. **Figure F.17** displays wildfire events in Forsyth County.

[9] These events are only inclusive of those reported by NASFI. It is likely that additional events have occurred and have gone unreported.

FIGURE F.17: WILDFIRE EVENTS IN FORSYTH COUNTY



Source: NASFI

Based on data from the North Carolina Division of Forest Resources from 2001 to 2018, Forsyth County experiences an average of 18 wildfires annually which burn a combined 24.94 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.

F.5.11.3 Probability of Future Occurrences

Wildfire events will be an ongoing occurrence in Forsyth County and for University of North Carolina School of the Arts. 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 University of North Carolina School of the Arts for future wildfire events are likely (10 to 100 percent annual probability).

F.5.12 INFECTIOUS DISEASE

F.5.12.1 Location and Spatial Extent

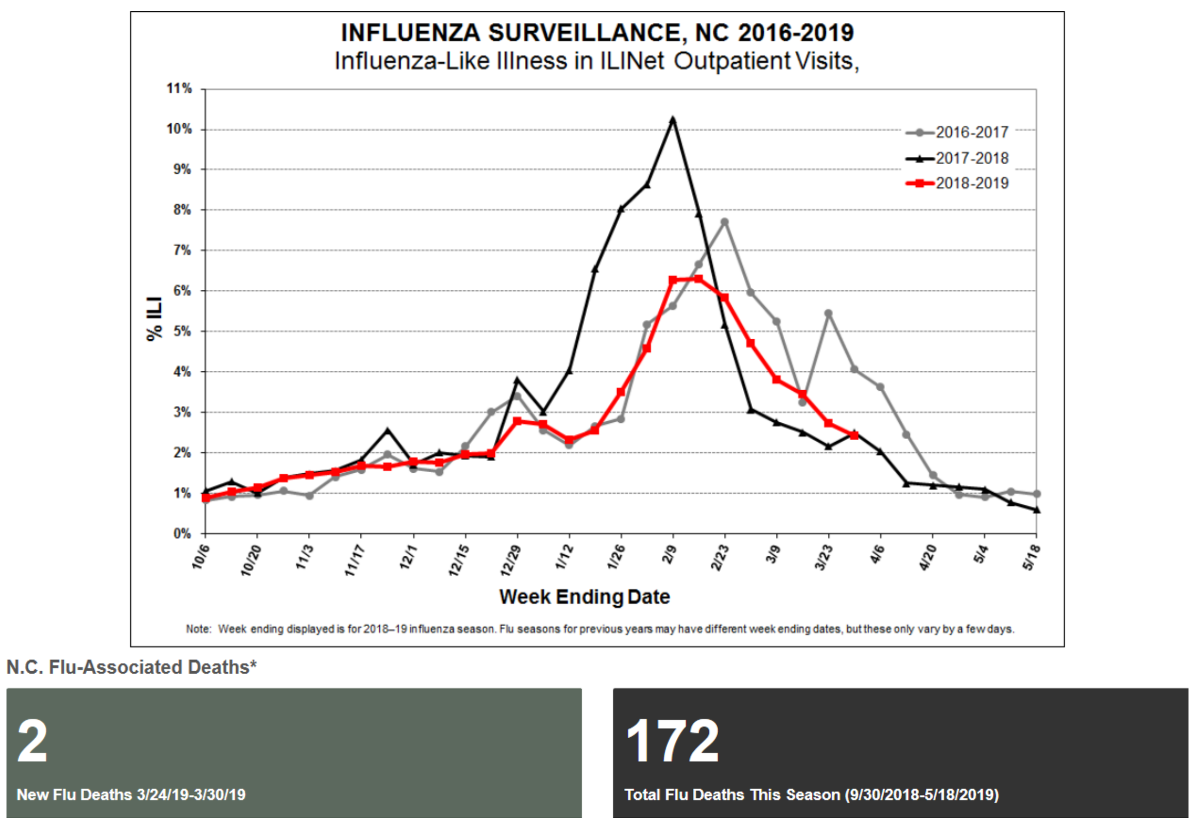
Extent is difficult to measure for an infectious disease event as the extent is largely dependent on the type of disease and on the effect that it has on the population. Extent can be somewhat defined by the number of people impacted, which depending on the type of disease could number in the tens of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

F.5.12.2 Historical Occurrences

Infectious Disease

Influenza is historically the most common infectious disease that has occurred in Forsyth County. Cases of the flu tend to occur in the late fall to early winter months. In recent years, cases of the influenza and influenza-like illnesses have been reported in hospitals. As seen in **Figure F.18** below, 172 people throughout North Carolina died from the flu between 2018 and 2019.

FIGURE F.18: INFLUENZA SURVEILLANCE, NC 2016-2019



Source: NC Department of Health and Human Services

Starting in 2020, the COVID-19 infectious disease pandemic began to impact North Carolina and Forsyth County. The NC Department of Health and Human Services has been actively monitoring and tracking cases since the first case arrived in the State. A Presidential disaster declaration was declared for North Carolina on March 24, 2020 for the COVID-19 pandemic. **Table F.24** provides a summary of confirmed cases of COVID–19 in Forsyth County as of the date of the final version of this plan in 2021. The COVID-19 pandemic is still evolving even though vaccines have been created that are slowing the spread. The pandemic unfolded as this plan was being developed, so the information below presents only a small sample of the pandemic's impacts on Forsyth County. On April 27, 2020, the UNC System made the decision to postpone in-person classes for the remainder of the school year. As a result, UNCSA and all other universities in North Carolina, shifted to online courses. Due to Executive Order 135, which extended the existing statewide stay-at-home order through May 8, 2020; college campuses were asked to vacate any on-campus university housing.

TABLE F.24: SUMMARY OF CONFIRMED COVID – 19 CASES IN FORSYTH COUNTY

Location	Number of Cases	Number of Deaths*
Forsyth County	**35,824**	**378**

Source: North Carolina Department of Health and Human Services as of 5/13/21
** Deaths reflect deaths in persons with laboratory-confirmed COVID-19 reported by local health departments to the 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[10].

F.5.12.3 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 University of North Carolina School of the Arts will experience an outbreak of infectious diseases in the future.

Technological Hazards

F.5.13 HAZARDOUS SUBSTANCES

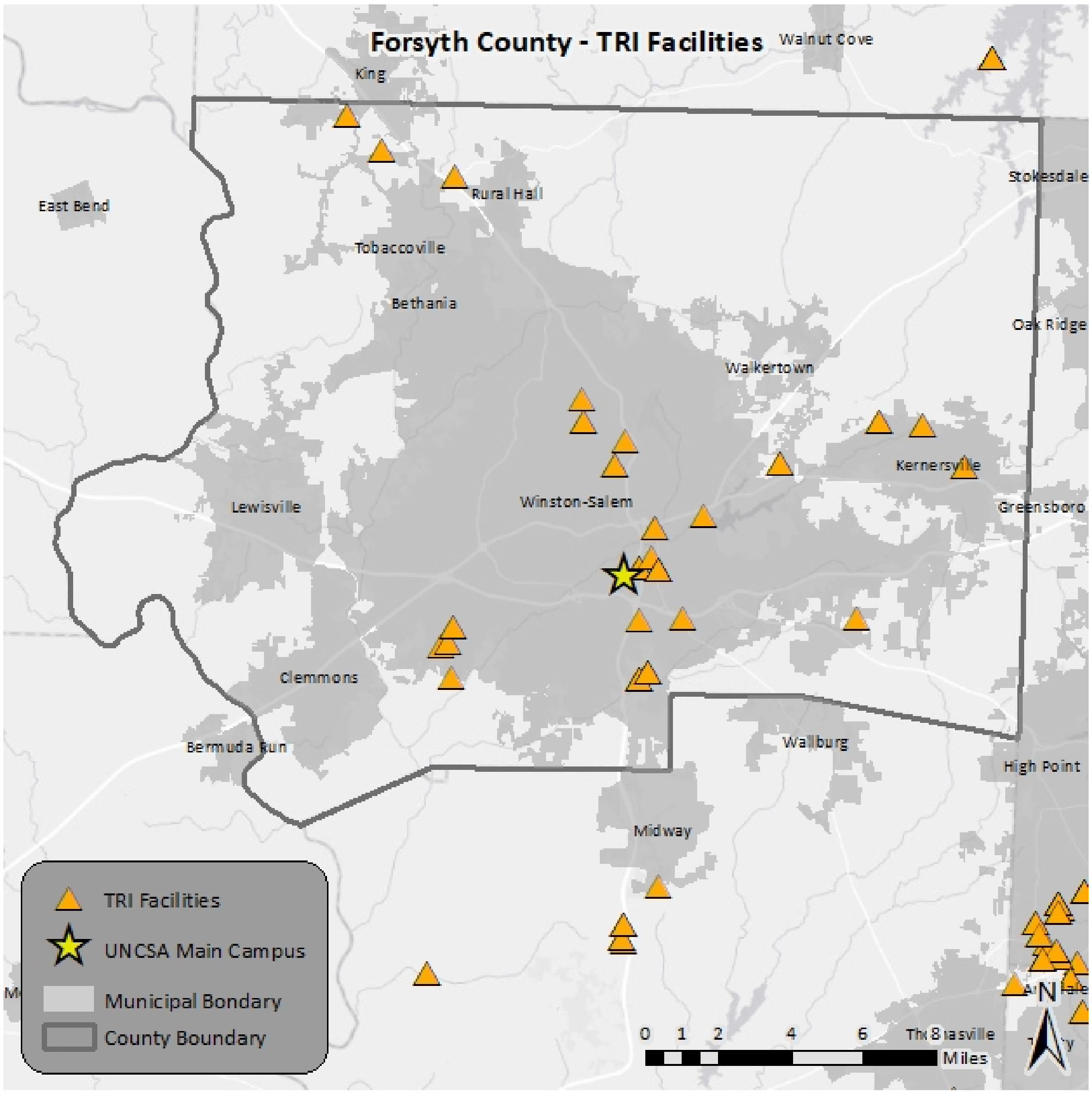
F.5.13.1 Location and Spatial Extent

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 collection information from industrial facilities on the releases and transfers of

[10] https://www.ncdhhs.gov/news/press-releases/nc-prepared-zika-virus-risk-local-virus-carrying-mosquitoes-low

certain toxic agents. This information is then reported in the Toxic Release Inventory (TRI). TRI sites indicate where such activity is occurring. Forsyth County has 24 TRI sites. A map for Forsyth County TRI Facilities is shown in **Figure F.19.**

FIGURE F.19: TOXIC RELEASE INVENTORY (TRI) SITES



Source: EPA

F.5.13.2 Historical Occurrences

The U.S. Department of Transportation Pipeline and Hazard 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.

The Pipeline and Hazardous Materials Safety Administration (PHMSA) is an agency of the United States Department of Transportation that was established in 2004. The PHMSA maintains a database of hazardous materials incidents for communities across the United States. Summary results of their data for events that have occurred in Forsyth County can be found in **Table F.25.**

TABLE F.25: SUMMARY OF HAZMAT INCIDENTS IN FORSYTH COUNTY

Location	Incidents Reported	Injuries	Fatalities	Type	Costs
Bethania	0	0	0	n/n	$0
High Point*	3	0	0	Highway	$0
Kernersville**	5	0	0	Highway	$159,163
King***	0	0	0	n/a	$0
Lewisville	1	0	0	Highway	$83,473
Rural Hall	1	0	0	Highway	$33,681
Walkertown	0	0	0	n/a	$0
Winston-Salem	13	0	0	Highway and Rail	$280,831
Unincorporated Areas	1	0	0	Highway	$0
Forsyth County Total	**24**	**0**	**0**		**$557,148**

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

F.5.13.3 Probability of Future Occurrence

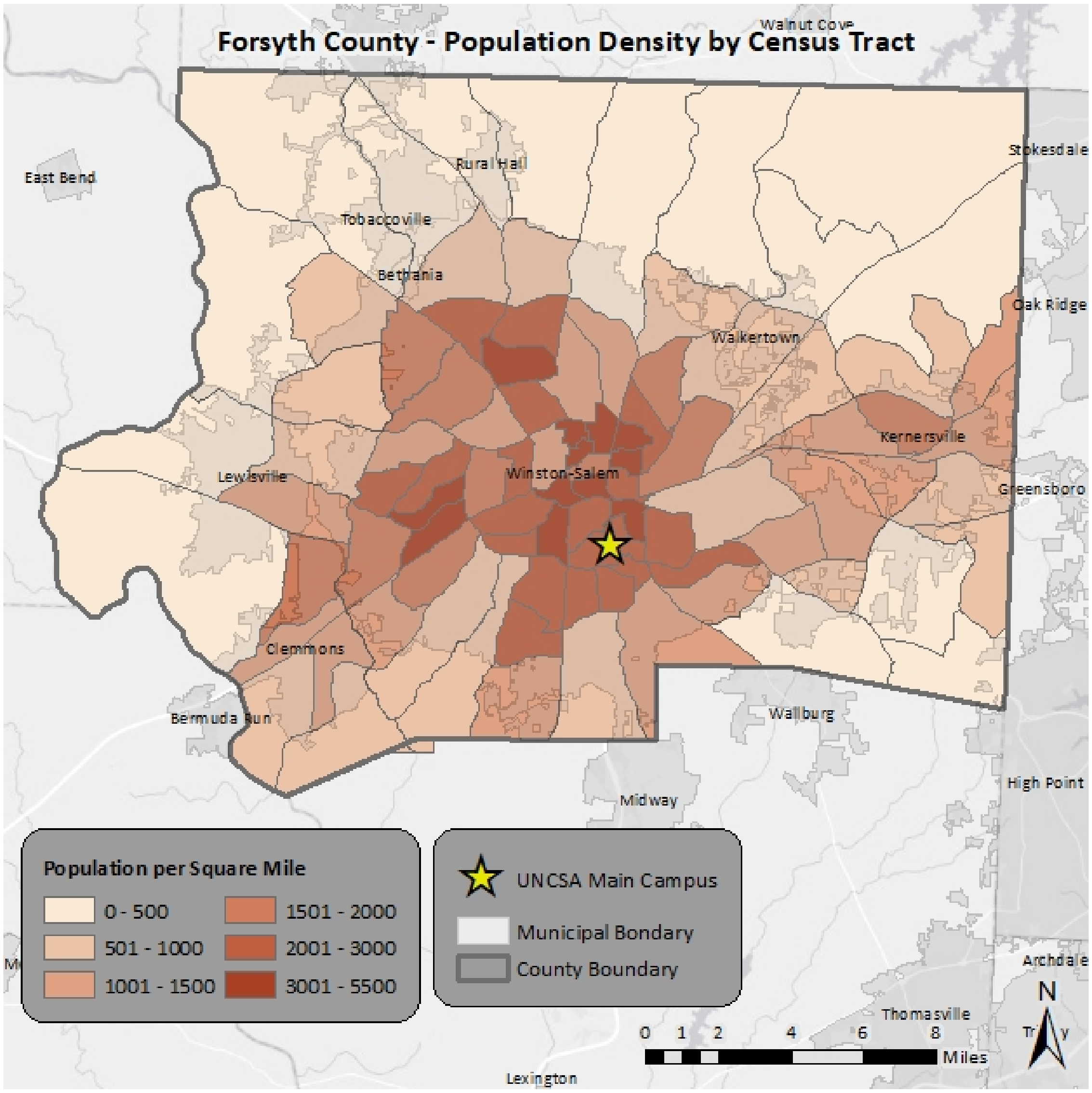
Given the location of toxic release inventory sites in Forsyth County, it is possible that a hazardous material incident may occur. University officials are mindful of this possibility and take precautions to prevent such an event from occurring.

F.5.14 TERRORISM

F.5.14.1 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 F.20** displays the population density in Forsyth County using census tract levels.

FIGURE 5.20: POPULATION DENSITY



Source: US Census Bureau

Furthermore, the most recent population counts of each participating county and jurisdictions can be seen in **Table F.26** below.

TABLE F.26: 2018 POPULATION ESTIMATES IN FORSYTH COUNTY

Location	2018 Population Estimate
Bethania	350
High Point*	112,791
Kernersville**	24,660
King***	6,877
Lewisville	14,228
Rural Hall	3,216
Walkertown	5,150
Winston-Salem	247,945
University of North Carolina School of the Arts	1,144
Unincorporated Areas	4,690
Forsyth County Total	**382,295**

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

**High Point population estimate from mostly in Guilford County, also in Randolph County, Davidson County*

***Kernersville population estimate partially in Guilford County*

****King mostly in Guilford County, also in Randolph County, Davidson County*

F.5.14.2 Historical Occurrences

No extreme cases of terror attacks have previously affected Forsyth County or University of North Carolina School of the Arts. However, as the population in the area continues to increase, so does the chance of an attack. There is an ongoing concern on college campuses about active shooter events. Information from the National Center on Safe and Supportive Learning Environments, a recent study found between the 2001-2002 and 2015-2016 school years, 437 people were shot in 190 college campus shooting incidents.

F.5.14.3 Probability of Future Occurrence

Neither Forsyth County nor University of North Carolina School of the Arts have experienced a 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.

F.5.15 CYBER

F.5.15.1 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. University of North Carolina School of the Arts is susceptible to cyber-attacks. The ITS Office of Information Security (ITS-OIS) and the Student Cyber Security Operations Center (SCSOC) are UNCSA's information security unit.

F.5.15.2 Historical Occurrences

In North Carolina, 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. **Table F.27** displays the North Carolina Cybercrimes and Victim Counts in 2018.

Table F.27: North Carolina Cybercrimes and Victim Counts in 2018

Crime Type by Victim Count			
Crime Type	*Victim Count*	*Crime Type*	*Victim Count*
Advanced Fee	436	Identity Theft	330
BEC/EAC	430	Investment	47
Charity	11	Lottery/Sweepstakes/Inheritance	213
Civil Matter	15	Malware/Scareware/Virus	49
Confidence Fraud/Romance	432	Misrepresentation	148
Corporate Data Breach	39	No Lead Value	246
Credit Card Fraud	306	Non-payment/Non-Delivery	1,647
Crimes Against Children	28	Other	172
Denial of Service/TDos	28	Overpayment	406
Employment	391	Personal Data Breach	1,125
Extortion	1,219	Phishing/Vishing/Smishing/Pharming	947
Gambling	4	Ransomware	29
Government Impersonation	255	Re-shipping	31
Hacktivist	2	Real Estate/Rental	286
Harassment/Threats of Violence	330	Spoofing	430
Health Care Related	9	Tech Support	361
IPR/Copyright and Counterfeit	30	Terrorism	2
Descriptors*			
Social Media	902	Virtual Currency	790

Source: FBI Internet Crime Compliant Center, 2018

Although University of North Carolina School of the Arts has not reported any major catastrophic cyberattacks, the potential to experience one is unpredictable and can happen at any time.

F.5.15.3 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 at University of North Carolina School of the Arts, and it is considered likely (between 10 and 100 percent annual probability) to experience one in the near future.

F.5.16 ELECTROMAGNETIC PULSE

F.5.16.2 Historical Occurrences

There have been no reports of EMP occurrences at University of North Carolina School of the Arts.

F.5.16.1 Location and Spatial Extent

An EMP can happen in any location, and they are relatively unpredictable. Due to advancing technologies, densely populated areas may be more prone to damages from an EMP. Therefore, Winston-Salem and the University of North Carolina School of the Arts campus may be more susceptible.

F.5.16.3 Probability of Future Occurrences

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

F.5.17 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.

F.5.17.1 Hazard Extent

Table F.28 describes the extent of each natural hazard identified for University of North Carolina School of the Arts. The extent of a hazard is defined as its severity or magnitude, as it relates to the planning area.

TABLE F.28 EXTENT OF UNIVERSITY OF NORTH CAROLINA SCHOOL OF THE ARTS 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. According to the North Carolina Drought Monitor Classifications, the most severe drought condition is Exceptional. Forsyth County has received this ranking (three times) over the nineteen-year reporting period. According to the NOAA, Forsyth County has had drought occurrences in seventeen of the last nineteen years (2000-2019).
Hurricane and Coastal Hazards	Hurricane extent is defined by the Saffir-Simpson Scale which classifies hurricanes into Category 1 through Category 5. The greatest classification of hurricane to traverse directly through Forsyth County was Tropical Storm David in 1979 which carried tropical force winds of 45 kts (51 miles per hour) upon arrival.
Tornadoes /Thunderstorms	Tornadoes: Tornado hazard extent is measured by tornado occurrences in the US provided by FEMA as well as the Fujita/Enhanced Fujita Scale. The greatest magnitude reported in Forsyth County was an F3 (reported on May 22, 1985). Thunderstorms: Thunderstorm extent is defined by the number of thunder events and wind speeds reported. According to a 63-year history from the National Centers for Environmental Information, the strongest recorded wind event in Forsyth County was reported on July 16, 1962 at 100 knots (approximately 115 mph). It should be noted that future events may exceed these historical occurrences.

	Lightning: According to the Vaisala flash density map, University of North Carolina School of the Arts 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. Hailstorms: Hail extent can be defined by the size of the hail stone. The largest hail stone reported in Forsyth County was 2.75 inches (reported on March 23, 2005). It should be noted that future events may exceed this.
Severe Winter Weather	The extent of winter storms can be measured by the amount of snowfall received (in inches). The greatest 24-hour snowfall was reported in Forsyth County was 18 inches reported on December 17, 1930.
Earthquakes	Earthquake extent can be measured by the Richter Scale and the Modified Mercalli Intensity (MMI) scale and the distance of the epicenter to Forsyth County. According to data provided by the National Geophysical Data Center, the greatest MMI to impact Forsyth County was VI (strong) with a correlating Richter Scale measurement of approximately 5 (reported on September 9, 1976). The epicenter of this earthquake was located between 236 and 284 km away.
Geological	Landslide: As noted above in the landslide profile, the landslide data provided by the North Carolina Geological survey is incomplete. This provides a challenge when trying to determine an accurate extent for the landslide hazard. However, when using the USGS landslide susceptibility index, extent can be measured with incidence, which is low throughout most of Forsyth County. There is also a low susceptibility throughout a majority of the county. Sinkhole: The central piedmont part of North Carolina and University of North Carolina School of the Arts are susceptible to sinkholes; however, there are no historical records of sinkholes in Forsyth County. Erosion: The extent of erosion can be defined by the measurable rate of erosion that occurs. There are no erosion rate records available for Forsyth County or University of North Carolina School of the Arts.
Dam Failure	Dam failure extent is defined using the North Carolina Division of Land Resources criteria. Of the 221 dams in Forsyth County, 55 are classified as high-hazard.
Flooding	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 7 percent of the total land area for University of North Carolina School of the Arts. Flood depth and velocity are recorded via United States Geological Survey stream gages throughout the region. While a gauge does not exist on University of North Carolina School of the Arts' campus, there is one at or near many areas. The greatest peak discharge recorded for the area was reported in June 21, 1972. Water reached a discharge of 73,300 cubic feet per second and the stream gage height was recorded at 27.83 feet. Peak discharge for the gage on the Yadkin River near Enon, NC is in the table below.

Location/Jurisdiction	Date	Peak Discharge (cfs)	Gage Height (ft)
Forsyth County			

	Yadkin River at Enon, NC	1972-06-21	73,300	27.83

Other Hazards	
Wildfires	Wildfire data was provided by the North Carolina Division of Forest Resources and is reported annually by county from 2001-2018. Analyzing the data by county indicates the following wildfire hazard extent for Forsyth County: ▪ The greatest number of fires to occur in any year was 69 in 2001. ▪ The greatest number of acres to burn in a single year occurred in 2001 when 110 acres were burned. ▪ The largest acres burned in a single incidence occurred in 2001 when 20 acres were burned. Although this data lists the extent that has occurred, larger and more frequent wildfires are possible throughout Forsyth County.
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 University of North Carolina School of the Arts is susceptible to infectious diseases such as the flu, which kills hundreds of people annually. As of November 1, 2020, the number of COVID-19 cases in Forsyth County was 9,369 and the number of deaths related to COVID-19 was 102. On April 27, 2020, the UNC System made the decision to postpone in-person classes for the remainder of the school year. As a result, UNCSA and all other universities in North Carolina, shifted on online classes. There is no tangible way of determining dollar losses due to the pandemic in Forsyth County.
Technological Hazards	
Hazardous Materials Incident	According to USDOT PHMSA, the largest hazardous materials incident reported in Forsyth County is 7500 LGA released on the highway on November 25, 1986. It should be noted that larger events are possible.
Terrorism	Although no severe terrorism attacks have been reported at University of North Carolina School of the Arts, the entire campus 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 for University of North Carolina School of the Arts. Technology usage, however, is increasing. A cyber-attack could potentially devastate the campus and could have lasting negative impacts.

Electromagnetic Pulse	Electromagnetic Pulse (EMP) occurrences have not taken place at University of North Carolina School of the Arts, 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.

F.5.17.2 Priority Risk Index

In order to draw some meaningful planning conclusions on hazard risk for University of North Carolina School of the Arts, the results of the hazard profiling process were used to generate hazard classifications according to a “Priority Risk Index” (PRI). The purpose of the PRI is to categorize and prioritize all potential hazards for University of North Carolina School of the Arts 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 University of North Carolina School of the Arts to consider as part of their proposed mitigation strategy.

The prioritization and categorization of identified hazards for University of North Carolina School of the Arts 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 University of North Carolina School of the Arts Campus Hazard Mitigation Planning Team in gaining consensus on the determination of those hazards that pose the most significant threat to the campus 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 at University of North Carolina School of the Arts 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[11], as summarized in **Table 5.29**. 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:

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

According to the weighting scheme and point system applied, the highest possible value for any hazard is 4.0. When the scheme is applied for University of North Carolina School of the Arts, the highest PRI value is 3.2 (Tornadoes/Thunderstorms). Prior to being finalized, PRI values for each identified hazard were reviewed and accepted by the members of the University of North Carolina School of the Arts Campus Hazard Mitigation Planning Team.

[11] The Campus 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.

TABLE F.29: PRIORITY RISK INDEX FOR THE UNIVERSITY OF NORTH CAROLINA SCHOOL OF THE ARTS

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	

F.5.17.3 Priority Risk Index Results

Table F.30 summarizes the degree of risk assigned to each category for all initially identified hazards based on the application of the PRI. Assigned risk levels were based on the detailed hazard profiles developed for this section, as well as input from the Campus Hazard Mitigation Planning Team. The results were then used in calculating PRI values and making final determinations for the risk assessment.

TABLE F.30: SUMMARY OF PRI RESULTS FOR THE UNIVERSITY OF NORTH CAROLINA SCHOOL OF THE ARTS

Hazard	Sub hazard(s) Assessed	Category/Degree of Risk					
		Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Natural Hazards							
Drought		Likely	Minor	Large	More than 24 hours	More than one week	2.5
Excessive Heat		Likely	Minor	Large	More than 24 hours	Less than one week	2.5
Hurricane and Coastal Hazards		Likely	Critical	Large	More than 24 hours	Less than 24 hours	2.9
Tornadoes/ Thunderstorms	Hailstorm, Lightning	Highly Likely	Critical	Moderate	Less than 6 hours	Less than 6 hours	3.2
Severe Winter Weather		Likely	Limited	Large	12 to 24 hours	Less than 6 hours	2.6
Earthquakes		Possible	Minor	Moderate	Less than 6 hours	Less than 6 hours	2

Geological	Landslide, Sinkholes, Erosion	Possible	Limited	Small	Less than 6 hours	Less than 6 hours	1.9
Dam Failure		Unlikely	Critical	Moderate	More than 24 hours	Less than 6 hours	2
Flooding		Likely	Limited	Moderate	6 to 12 hours	Less than 24 hours	2.5
Other Hazards							
Wildfires		Likely	Minor	Small	Less than 6 hours	Less than 1 week	2.3
Infectious Disease		Unlikely	Minor	Small	More than 24 hours	More than one week	1.5
Technological Hazards							
Hazardous Substances		Unlikely	Limited	Small	Less than 6 hours	Less than 24 hours	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

F.5.18 FINAL DETERMINATIONS

The conclusions drawn from the hazard profiling process for University of North Carolina School of the Arts, including the PRI results and input from the Campus 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 at University of North Carolina School of the Arts. It should be noted that although some hazards are classified below as posing low risk, their occurrence of varying or unprecedented magnitudes is still possible in some cases and their assigned classification will continue to be evaluated during future plan updates.

Table F.31 ranks the hazards that were assessed in the update that were renamed to be consistent with the State of North Carolina Hazard Mitigation Plan. These conclusions were based on the PRI calculations and input from the University of North Carolina School of the Arts Campus Hazard Mitigation Planning Team.

TABLE F.31: 2021 CONCLUSIONS ON HAZARD RISK FOR UNIVERSITY OF NORTH CAROLINA SCHOOL OF THE ARTS

HIGH RISK	Tornadoes/Thunderstorms Severe Winter Weather
MODERATE RISK	Flooding Hurricanes and Costal Hazards Cyber Hazardous Substances Excessive Heat Infectious Disease Terrorism
LOW RISK	Wildfires Drought Earthquakes Geological (Landslide) Radiological Emergency Electromagnetic Pulse

F.6 Capability Assessment

The purpose of conducting a capability assessment for an institution of higher learning is to determine the ability of the institution to implement a comprehensive mitigation strategy and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs, or projects[12]. 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 the university's regulatory framework, level of administrative and technical support, access to fiscal resources, and current political climate.

A capability assessment is generally based upon two primary components: 1) an inventory of the university's relevant plans, programs and policies already in place and 2) an analysis of the university's capacity to carry them out. Careful examination of campus capabilities will detect any existing gaps, shortfalls, or weaknesses with ongoing 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 university, which should continue to be supported and enhanced through future mitigation efforts.

The capability assessment completed for UNCSA 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.

Capability Assessment Findings and Conclusion

Collectively, UNCSA's administrative, technical and fiscal capabilities are high. Some of the highlights of UNCSA's capabilities include the following:

- Designated a StormReady Campus by the National Weather Service

UNCSA's high capability will help ensure that the Mitigation Strategy is effectively carried out and that hazard risk reduction for the campus is an attainable goal. 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 Campus Hazard Mitigation Planning Committee considered not only their level of hazard risk, but also their existing capability to minimize or eliminate that risk.

[12] While the Final Rule for implementing the Disaster Mitigation Act of 2000 does not require a local capability assessment to be completed for hazard mitigation plans, it is a critical step in developing a mitigation strategy that meets the needs of the campus while taking into account their own unique abilities. The Rule does state that a 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)).

F.7 Mitigation Action Plan

The Mitigation Action Plan, or MAP, provides a functional plan of action for each building at the University of North Carolina School of the Arts. It is designed to achieve the mitigation goals established in Section 4, Mitigation Strategy, of the main plan and will be maintained on a regular basis according to the plan maintenance procedures established in Section 5, Plan Maintenance, of the main plan.

Each proposed mitigation action has been identified as an effective measure (policy or project) to reduce hazard risk to the buildings on UNCSA's campus. 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's 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. 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.

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 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.
- Relative Cost
- Identification of University Department Responsible for each action
- Implementation Schedule—Date by which the action should be completed. More information is provided when possible.
- Implementation Status (2021)—Indication of completion, progress, deferment, or no change since the previous plan. If the action is new, that will be noted here.

All of the mitigation actions in this section have been assigned to Emergency Management and Facilities staff to ensure their implementation. Other University Departments will be consulted for input on an as-needed basis.

For the update of this plan, the UNCSA Campus Hazard Mitigation Planning Team participated in three activities related to the mitigation strategy for the university. Those activities included the following:

1. Review and reapproval of previous mitigation goals for the UNC Western Campuses. All eight of the campuses in the Western region decided to leave the previous mitigation goals in place and unchanged.
2. Review and update of existing mitigation actions. The Campus Hazard Mitigation Planning Team reviewed each existing action to determine if it was still relevant, if the prioritization of the action remained the same and to provide an update on the status of implementation for the actions.
3. Identification of any new mitigation actions as determined necessary. The Campus Hazard Mitigation Team identified several new actions for inclusion in the plan. New mitigation actions for this update are marked as such in the Mitigation Action Plan.

For the 2021 update, the UNCSA Campus Hazard Mitigation Planning Team determined the need to reduce the number of mitigation actions identified in this plan. Therefore, they decided to focus only on campus-wide initiatives and mitigation actions for their most critical buildings, listed in Section F.3.2. That means that mitigation actions identified in the previous plan for the following buildings have been deleted or deferred until such a time that they can be revisited to determine relevancy:

- College Residence Halls (A-F) Lower Housing
- Design and Production
- Film School Building 2
- Gray Building
- Performance Place
- Work Place

The Mitigation Action Plan for UNCSA is found on the following pages.

Campus-wide Actions

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Emergency Services							
CW-ES-1	Upgrade current 30+ blue lights that are over 20 years old and operate with a 2-way radio. Upgrades to include: -Design of blue light towers and wall mounts -Relocation -360 fisheye camera that records when activated -Speakers, -Reliable power source/back up battery Blue lights act as integrated security stations that provide an additional resource of communications directly with police department when all other capabilities are not available. Blue lights provide exact location, durability, can be integrated with other mass notifications systems, accessible to everyone, reliable with a push of button to receive immediate emergency assistance and visible deterrent for a safer environment.	All	Moderate	$12,000 per blue light plus infrastructure costs to run Fiber/Ethernet/Power to each site. No funding source identified as of yet.	Police and Public Safety	When funding is available	New action for the 2021 update.

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
CW-ES-2	Provide evacuation maps to all campus buildings. Evacuation maps should include: -Primary and secondary egress routes, -Fire extinguisher locations, -Fire alarm pull stations locations,-AED and first aid kit locations -ADA egress, -Area of refuge, -Tornado or hurricane safe shelter locations -Room numbers	All hazards	High	$40,000 – No funding source identified as of yet.	Facilities Management	As soon as funding is available and architectural firm is identified.	New action for the 2021 update.
Property Protection							
CW-PP-1	As feasible and as funding is available, install generators/back-up power, for critical facilities campus wide	All Hazards	Moderate	$25,000-$100,000 per generator	Police and Public Safety	New action for the 2021 update.	CW-PP-1

Administration Building Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Structural Projects							
AB-SP-1	Add additional roof drains to prevent ponding.	Severe Winter Weather, Flood	Moderate	$5,000-$25,000	Facilities Management	2026	Defer until funding is available.
Property Protection							
AB-PP-1	A fire suppression system should be installed to protect the occupants during a fire.	Lightning	Moderate	$25,000-$100,000	Facilities Management	2026	Defer until funding is available.
AB-PP-2	Overhead power lines should be rerouted underground to protect them against damage from a high wind, snow or ice storm.	High Wind/ Tornado, Winter Weather, Lightning	NA	$25,000-$100,000	Facilities Management	Action completed	Action completed. Overhead power lines have been removed.
AB-PP-3	Secure loose cables on the roof.	High Wind/ Tornado, Winter Weather, Lightning	Moderate	<$5,000	Facilities Management	2026	Defer until funding is available.
AB-PP-4	A permanent backup generator should be provided to supply adequate power to the facility during an outage.	All Hazards	Moderate	$25,000-$100,000	Facilities Management	2026	Defer until funding is available.

Center Stage Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Prevention							
CS-P-1	Relocate emergency congregating point to facility rear entrance, away from structures and clear of arriving emergency vehicles.	All	NA	<$5,000	Police and Public Safety	Action completed	Action completed.
Structural Projects							
CS-SP-1	The façade should be repaired to prevent further water intrusion.	Flood	Low	$5,000-$25,000	Facilities Management	Action to be deleted	The campus hazard mitigation planning team decided to delete this action because they do not feel that water intrusion is a problem at this site.
Property Protection							
CS-PP-1	Install dry standpipe sprinklers in breezeways and attics to protect means of egress in the event of a fire.	Tornadoes/Thunderstorms, Wildfire	Moderate	$25,000-$100,000	Facilities Management	2026	Defer until funding is available.
CS-PP-2	Routinely maintain drainage at rear of facility. Additional drainage should be added if current drainage is inadequate.	Flood	Low	<$5,000	Facilities Management	Action to be deleted	The campus hazard mitigation planning team decided to delete this action because they do not feel that drainage is an issue at this site.
Emergency Services							

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
CS-ES-1	Install centralized fire alarms with notification sirens and strobes in each apartment to enhance emergency notification.	All Hazards	Moderate	$25,000-$100,000	Facilities Management and Police and Public Safety	2026	Implementation pending staff time and funding

Facilities, 300 Waughtown Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Property Protection							
FW-PP-1	Vehicle barriers should be provided to prevent vehicles from colliding into the building or utility services during an ice or snow event.	Severe Winter Weather	Moderate	<$5,000	Facilities Management	Acton completed	Action completed. Bollards were added in front of the NG meter and around the overhead power line pole.
FW-PP-2	Add sprinklers to the facility.	Tornadoes/Thunderstorms, Wildfire	Moderate	$25,000-$100,000	Facilities Management	2026	Defer until funding is available.
FW-PP-3	Loose items should be appropriately secured to prevent them from becoming airborne in the event of a hurricane or tornado.	Tornadoes/Thunderstorms	Moderate	<$5,000	Facilities Management	Acton completed	Action completed. The back yard has been cleaned and most of the items removed.
FW-PP-4	Roof joists in the maintenance shop did not appear to have positive attachment to support members. Consider engineering review to determine if roof deck anchorage complied with uplift requirements.	Tornadoes/Thunderstorms, Severe Winter Weather	Moderate	<$5,000	Facilities Management	2026	Defer until funding is available.
FW-PP-5	A backup generator should be provided to supply power to the facility during a power outage.	All Hazards	Moderate	$25,000-$100,000	Facilities Management	2026	Defer until funding is available.

Fitness Center Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Structural Projects							
FC-SP-1	The overhead power lines serving the facility should be buried to protect the power supply	Tornadoes/Thunderstorms, Severe Winter Weather, Flood	Low	>$100,000	Facilities Management	Action completed.	Action completed. The overhead powerline has been buried.
Property Protection							
FC-PP-1	Loose drain lines for roof mounted mechanical equipment should be secured to prevent them from become windborne debris.	High Wind/ Tornado, Winter Weather, Flood, Lightning	Moderate	<$5,000	Facilities Management	2026	Defer until funding is available.
FC-PP-2	The plastic cable conduit should be secured to prevent it from become windborne debris.	High Wind/ Tornado, Winter Weather, Flood, Lightning	Moderate	<$5,000	Facilities Management	2026	Defer until funding is available.
FC-PP-3	A backup generator should be provided to supply power to the facility during a power outage. The generator should be sufficient to provide air conditioning to the facility for emergency shelter purposes.	All Hazards	Moderate	>$100,000	Facilities Management	2026	Defer until funding is available.

Hanes Student Commons Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Property Protection							
HSC-PP-1	Vehicle barriers should be provided to prevent vehicles from colliding with the building or utility services during an ice or snow event.	Severe Winter Weather	Moderate	<$5,000	Facilities Management	2026	Defer until funding is available.
HSC-PP-2	Trees that are located adjacent to the facility should be regularly pruned to prevent damage to the facility and overhead power lines during ice and high wind events. Dead or dying trees should be completely removed.	Tornadoes/Thunderstorms, Severe Winter Weather	NA	<$5,000	Facilities Management	Action completed	Action completed. Overhead power lines have been removed.
HSC-PP-3	The drainage system should be routinely serviced to prevent system failure. Facilities maintenance should provide emergency pumping equipment that can be used in the event of a system failure. Consider providing redundant drainage paths.	Severe Winter Weather, Flood	Moderate	$5,000-$25,000	Facilities Management	2026	Defer until funding is available.

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
HSC-PP-4	Provide sufficient backup power to continue dining and health services in the event of an outage.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood	Moderate	>$100,000	Facilities Management	2026	Defer until funding is available.

Moore & Sanford Student Housing Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Property Protection							
MS-PP-1	The facility should be equipped with a fire suppression system. Enhance access around the building exterior for fire and rescue vehicles. This can be accomplished by removing tress or other obstructions and adding paved access roads. The installation of strategically located fire hydrants would also be beneficial.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood	NA	>$100,000	Facilities Management	Action completed	Action completed. Fire suppression system has been installed.
MS-PP-2	Trees growing into overhead power lines should be pruned back or the lines should be buried.	High Wind/ Tornado, Winter Weather, Flood, Lightning	NA	<$5,000	Facilities Management	Action completed	Action completed. Overhead power lines have been removed.
Emergency Services							
MS-ES-1	A larger backup generator should be provided to supply power to the facility during a power outage. The generator should be sufficient to provide climate control to the facility for emergency shelter purposes.	High Wind/ Tornado, Winter Weather, Flood, Lightning	NA	>$100,000	Facilities Management	Action completed	Action completed. New generator installed, but only operates Life/Safety.

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
MS-ES-2	The emergency generator should be anchored to its foundation.	High Wind/ Tornado, Winter Weather, Flood, Lightning	NA	<$5,000	Facilities Management	Action completed	Action completed. New generator installed and relocated along with the new chillers.

Annex G Western Carolina University

This section provides planning process, campus profile, hazard risk, vulnerability, capability, and mitigation action information specific to Western Carolina University (WCU). This section contains the following subsections:

- G.1 Planning Process Details
- G.2 Campus Profile
- G.3 Asset Inventory
- G.4 Hazard Identification
- G.5 Hazard Profiles, Analysis, and Vulnerability
- G.6 Capability Assessment
- G.7 Mitigation Strategy

G.1 Planning Process Details

The update of the campus hazard mitigation plan was conducted by a Campus Hazard Mitigation Planning Committee comprised of university staff and faculty. The committee followed a planning process prescribed by FEMA and participated in a series of meetings to update the plan. Details about the meetings help by the committee are provided below.

TABLE G.1: WESTERN CAROLINA UNIVERSITY CAMPUS HAZARD MITIGATION PLANNING COMMITTEE

LAST NAME	FIRST NAME	TITLE	ATTENDED FIRST MEETING	FACILITATED INFORMATION COLLECTION
Buchanan	Pam	Director of Health Services	X	X
Lillard	Steve	WCU Police Department	X	X
Maddy	Jon	Director of Safety and Risk	X	
Mullen	Brian	Chief Marketing and Communications Strategist		X
Smith	Lee	Director O&M	X	X
Stovall*	Shane	Emergency Services Director	X	X
Studenc	Bill	Chief Communications Officer	X	

LAST NAME	FIRST NAME	TITLE	ATTENDED FIRST MEETING	FACILITATED INFORMATION COLLECTION
Swartzentruber	Scott	IT Manager – Networking		X
Walker	Joe	AVC for Facilities Management		X

* Primary Point of Contact

February 17, 2020 – Project Kickoff Meeting

ESP Associates' Project Manager, Nathan Slaughter, 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 Campus Hazard Mitigation Planning Team and began by having attendees introduce themselves. The 6 attendees included faculty and staff from various departments at the University. 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 was managing the planning effort and had assigned ESP Associates, Inc. to manage the update.

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 on campus (buildings, infrastructure 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 a discussion about various mitigation techniques. He briefly explained the six different categories of mitigation techniques: emergency services, prevention, natural resource protection, structural projects, public education and awareness, and property protection. The attendees were then asked what types of mitigation projects would be needed the most at WCU if FEMA funding was available. This helped demonstrate how priorities in mitigation actions should be considered for the plan.

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

- Coordinate between the eight participating campuses to update the existing plan,
- Update the plan to demonstrate progress and reflect current conditions,
- Complete the update in a timely manner because the existing plan expired in October of 2017,
- Increase public awareness and education,
- Maintain grant eligibility for participating campuses, and
- Maintain compliance with State and Federal requirements.

Mr. Slaughter reviewed the list of participating campuses with the group. He also explained the project tasks to be accomplished. These included the planning process, risk assessment, capability assessment, mitigation strategy, mitigation action plan, and plain maintenance procedures.

He explained that the project as being managed by a Campus Hazard Mitigation Steering Committee that had one representative from each of the eight campuses. For WCU, that representative was Shane Stovall, Emergency Services Director. He explained that the group currently in the room would be known as the Campus Hazard Mitigation Planning Team.

Mr. Slaughter explained that this update would expand the scope of the plan to not only address natural hazards, as was previously done for the existing plan, but that it would also address manmade/technological hazards as well. This was done to ensure alignment with the State of North Carolina's Hazard Mitigation Plan.

Mr. Slaughter explained that the plan would address campus vulnerability, where feasible, to identify specific types and numbers of campus assets that are at risk to the identified hazards. He said that an attempt would be made to address other types of vulnerability as well to include social, economic and environmental vulnerabilities.

He then discussed the capability assessment and how the plan would include a discussion on the University's capability to address their hazard vulnerability through mitigation. Next, he discussed the mitigation strategy and explained how that section of the plan would be reviewed and updated as required by FEMA.

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

Mr. Slaughter then reviewed the roles and responsibilities of ESP Associates, Inc, the campus leads and stakeholders. The presentation concluded with a discussion of the next steps to be taken in the project development. He explained that a Hazard Mitigation Public Survey was being developed and that it would be distributed soon. The next campus HMPT meeting was discussed and would be held sometime in the Spring or Summer of 2020. The purpose of the second meeting would be to discuss the findings of the risk and capability assessments and to begin updating existing mitigation actions and identify new goals.

April 30, 2021 - Outstanding Information Discussion – Google Meeting

Because of the ongoing COVID-19 pandemic, the WCU Campus Hazard Mitigation Team was unable to formally meet a second time for the Mitigation Strategy meeting and presentation. However, the Project Manager from ESP Associates and the Emergency Services Director from WCU were able to have a phone conference to discuss the information needed from UNCC to complete the project. Mr. Slaughter and Mr. Stovall met and determined that the following information was needed from WCU, and would be returned in short order to the project consultant:

- Status updates for the existing hazard mitigation actions from the previous plan,
- Any new actions that UNCC wishes to include in the plan for this update, and
- Scoring and reranking of the most critical buildings on campus to include in the plan.

Involving the Public

Because this plan update was developed during the COVID-19 pandemic, the planning teams had to get creative in order to solicit feedback from the public about the plan and their thoughts on hazard mitigation. A public survey instrument was developed to provide an opportunity for the public to provide comment on their concerns about hazard impacts on the campuses and their thoughts on how mitigation could help reduce vulnerability. The public survey was distributed by each campus through different means to outreach to faculty, staff and students.

For WCU, 4 public survey responses were received and the results from those surveys were shared with the Campus Hazard Mitigation Planning Team. Feedback from the surveys was reviewed and considered for inclusion in this plan, as applicable, where determined to be relevant. A summary of the responses can be found in **Appendix B** and detailed survey responses can be obtained through North Carolina Emergency Management, Hazard Mitigation Planning staff.

G.2 Campus Profile

This section of the plan provides a general overview of the Western Carolina University Campus and surrounding area.

G.2.1 Geography and the Environment

Established in 1888, Western Carolina University is located in Cullowhee, North Carolina, in the valley of the Tuckasegee River. North Carolina Highway 107 runs through the community. Cullowhee was originally a Cherokee village, when European settlers moved to the area much of the land area was converted to farmland. In the 1800's many of the farms were cleared. Today, many old farms are now wooded, have homes built on them, or college buildings. Western Carolina's campus covers 589 acres which includes the main campus and several outlying properties. The main campus in Cullowhee offers most of the amenities of a small town, including thirteen residence halls, one full-service cafeteria, two food courts with fast-food outlets, health services, counseling, a bookstore, library, two indoor swimming pools, tennis courts, movie theater, jogging trail and quarter-mile track, and intramural fields. An orientation map of Western Carolina University can be seen in **Figure G.1** and a map of the main-campus can be seen in **Figure G.2**.

FIGURE G.1: WESTERN CAROLINA UNIVERSITY LOCATOR MAP

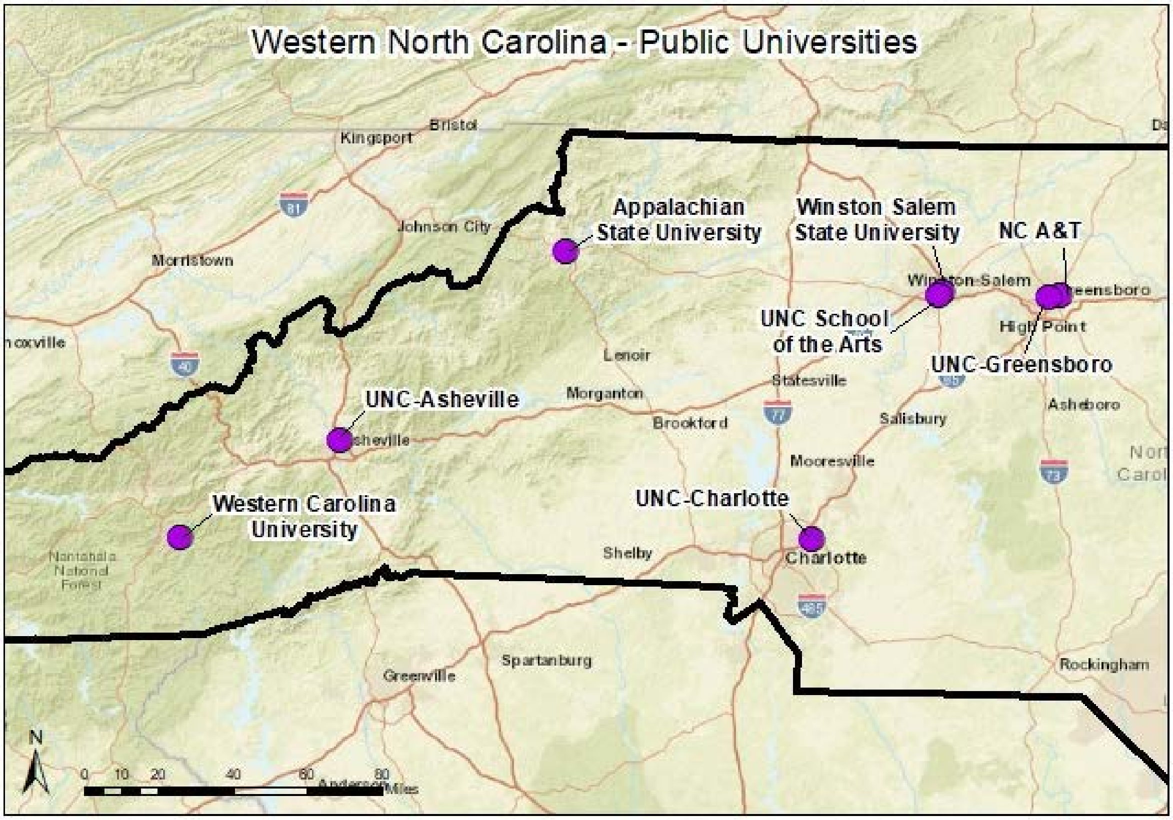
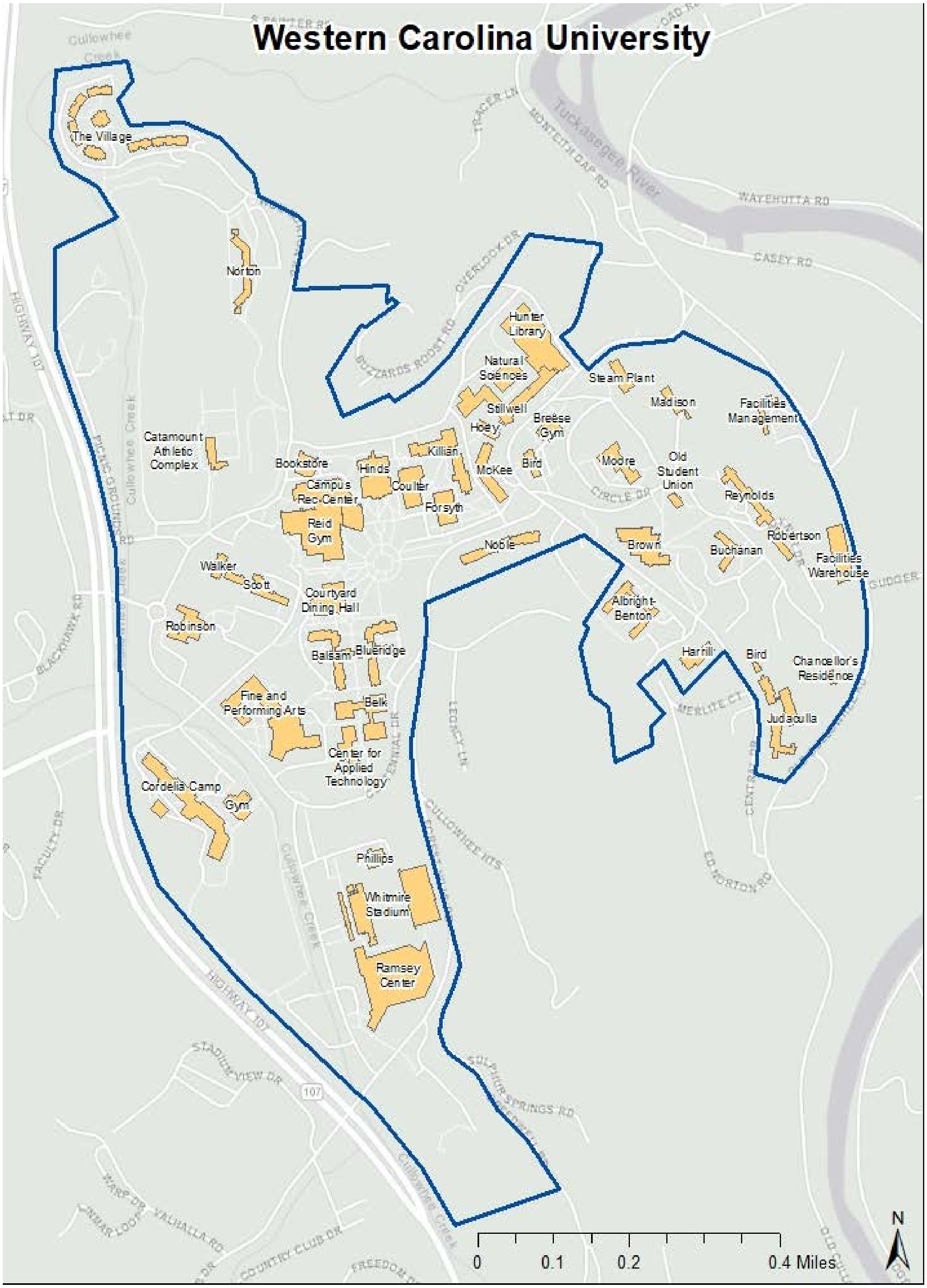


FIGURE G.2 WCU MAIN CAMPUS MAP



Cullowhee enjoys all the mountains have to offer. From hiking mountain trails to kayaking down the Tuckasegee River, there are many adventures to undergo. The area in which the university is nestled in sees four distinct seasons, with mild temperatures year-round. The average temperature during winter is 36 degrees with a summer average of 73 degrees. The campus area is situated in a thermal valley providing warmer temperatures than that of the surrounding mountain tops. The area sees approximately 4 inches of rain each month. The monthly averages for Cullowhee are presented in **Table G.2**.

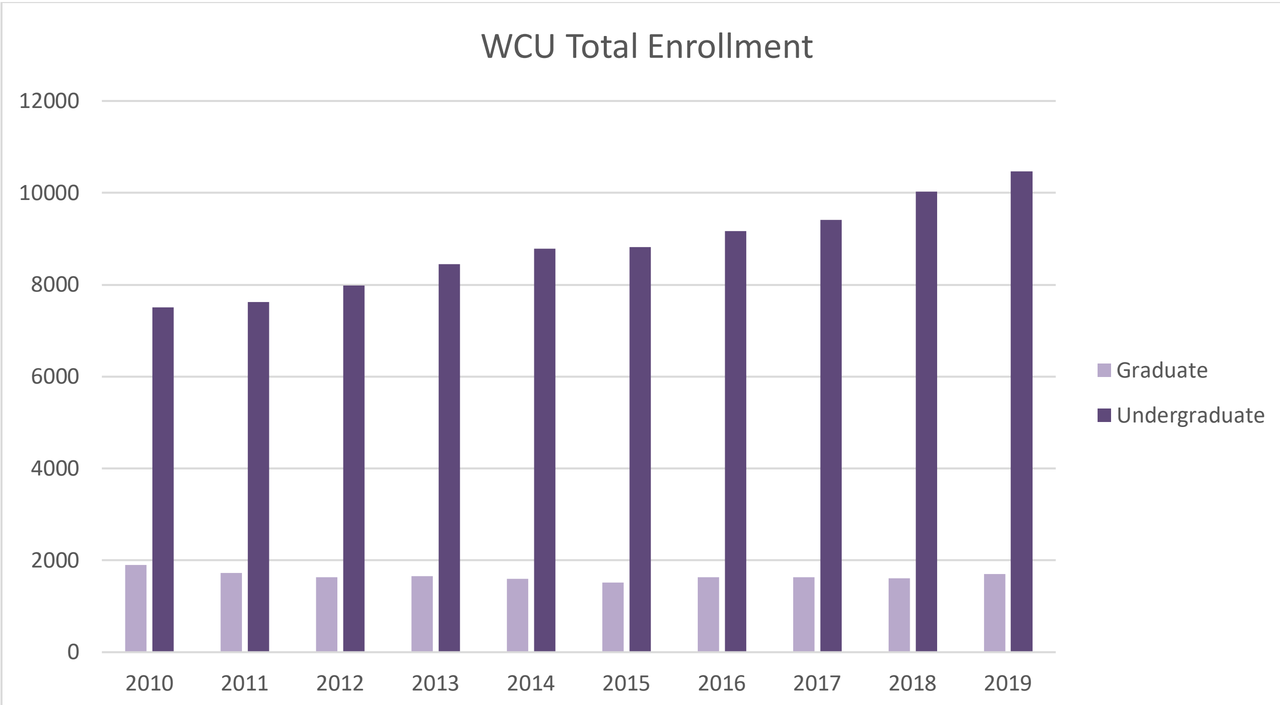
TABLE G.2: MONTHLY AVERAGES FOR CULLOWHEE, NORTH CAROLINA

Month	Average High	Average Low	Average Precipitation
January	48°F	24°F	4.65 in
February	52°F	27°F	4.63 in
March	61°F	33°F	4.45 in
April	69°F	40°F	3.90 in
May	76°F	50°F	4.48 in
June	82°F	58°F	4.85 in
July	85°F	62°F	4.41 in
August	84°F	61°F	4.07 in
September	78°F	55°F	4.22 in
October	70°F	43°F	3.01 in
November	60°F	33°F	4.23 in
December	50°F	27°F	4.42 in

G.2.2 Population and Demographics

Western Carolina has grown substantially over the years. Starting as a community school in 1888, Western has come a long way in the school's 130+ years of existence. Since 2008 the school has grown nearly 29% and shows no sign of slowing down. The majority of students attending this are White representing almost 80% of the student population, with the second most prevalent ethnicity being Hispanic or of Latino descent representing nearly 7%. Native Hawaiian's make up the least represented group for this consisting of less than 1% of the total student population. The enrollment trends over the past ten years can be seen in **Figure G.3**.

FIGURE G.3: ENROLLMENT DEMOGRAPHICS (2018)



Source: UNC System- Interactive Data Dashboards

For a breakdown of enrollment demographics please see **Table G.3** below.

TABLE G.3 ENROLLMENT DEMOGRAPHICS (2018)

Race/Ethnicity	Enrollment (Fall 2018)	Percentage
White	9,558	78.55%
Hispanic or Latino	865	7.10%
Black or African American	669	5.49%
Two or More Races	439	3.58%
Asian	132	1.08%
Nonresident Alien	251	2.06%
American Indian or Alaska Native	103	0.84%
Native Hawaiian or Other Pacific Islander	4	0.03%
Unknown	146	1.19%

Source: UNC System – Interactive Data Dashboards

G.3 Asset Inventory

An inventory of assets was compiled to identify the total count and value of property exposure on the Western Carolina University campus. This asset inventory serves as the basis for evaluating exposure and vulnerability by hazard. Assets for analysis include buildings, critical facilities, and critical infrastructure.

G.3.1 Building Inventory

This section provides total building exposure for the campus, which was estimated by summarizing building footprints provided by North Carolina Emergency Management and property values derived from 2020 insurance assessment data. According to that data, there are 115 buildings associated with WCU totaling a value of $781,462,447 (building and contents).

G.3.2 Critical Buildings and Infrastructure Exposure

Of significant concern with respect to any disaster event is the location of critical facilities and infrastructure in the planning area. Critical facilities are those essential services and lifelines that, if damaged during and emergency event, would disrupt campus continuity of operations or result in severe consequences to public health, safety, and welfare.

Critical buildings are a subset of the total building exposure and were identified by WCU's HMPC representatives. The WCU HMPC updated the list of critical facilities from the previous DRU plan and ranked each facility on a set of standardized criteria designed to evaluate all critical buildings in the UNC System DRU plans. Factors considered for this ranking included:

- the building's use for emergency response,
- the building's use for essential campus operations
- the building's use as an emergency shelter or for essential sheltering services,
- the presence of a generator or generator hook-ups,
- the building's use for provision of energy, chilled water or HVAC for sensitive or essential systems,
- the storage of hazardous materials,
- the building's use for sensitive research functions,
- the building's cultural or historical significance, and
- building-specific hazard vulnerabilities

Figure G.4 below shows the scoring sheet that the WCU Campus Mitigation Planning Team used to rate critical buildings on campus. All of the campuses in the UNC system used to same scoring methodology for consistency.

FIGURE G.4: CRITICAL BUILDING SCORING WORKSHEET

Critical Building Scoring Worksheet

Campus:
Facility Name:

		Score
1	Does the facility serve as the campus Emergency Operations Center (EOC)? Yes, Primary EOC = 6 pts Yes, Secondary EOC = 3 pts No = 0 pts	0
2	Does the facility house functions essential to campus operations? Main Telecommunication Center = 3 pts; Maintenance = 1 pt Computer Network Hub = 3 pts; Public Safety = 1 pt Adminstrative Operations = 1 pts	0
3	Is the facility equiped with a generator or hook-ups? Generator = 3 pts Hook-ups = 1 pt Neither = 0 pts	0
4	Does the facility serve as a pre or post disaster shelter? Both pre and post disaster shelter = 6 pts Either pre or post disaster shelter = 3 pts Neither = 0 pts	0
5	Does the facility provide services essential to sheltering? Resident Housing = 1 pt; Food Preperation Facility = 1 pt Assesmbly Space = 1 pt; Shower Facilities = 1 pt	0
6	Does the facility provide chilled water distribution or contain HVAC systems necessary to sensitive or essential systems? Yes = 3 pts No = 0 pts	0
7	Are there hazardous materials on-site? (greater than 25 gallons) Yes = 3 pts No = 0 pts	0
8	Does the facility house research functions that have a low level of tolerance for disruption? Yes = 2 pts No = 0 pts	0
9	Does the facility serve as storage for rare or unique collections (art, artifacts, letters, etc) or is it a historically or culturally significant building? Yes = 2 pts No = 0 pts	0
10	Does the facility have hazard specific vulnerabilities (basement susceptible to flood, etc.) Yes = 3 pts No = 0 pts	0
Notes/ Comments		

Total Score:	0
Total Possible Score:	**42**

The identified critical facilities for WCU, as scored by the WCU Campus Hazard Mitigation Planning Team are listed below:

- HRF Administration Building (Campus Administration and Campus EOC and 911 Center)
- Ramsey Center (Secondary/Backup EOC, Regional Activity Center, Sports Arena, Athletics Offices)
- Brown Hall (Tertiary EOC, Residential Living and Dining Services and Dining Hall)
- Steam Plant (Steam generation and distribution)
- Substation & Electrical Distribution (Electrical distribution network)
- Water Treatment & Distribution (Water treatment & distribution)
- Forsyth Building & Telecommunications System (Classrooms, offices, data center)
- Bird Building (Health Services and Psychological Services, infirmary)
- Camp Annex Building - Police (Police station, offices)
- Facilities Management & Grounds Shop (Offices, mechanical shop)

G.4 Hazard Identification

This section describes how the Campus Hazard Mitigation Planning Team identified the hazards to be included this plan

G.4.1 Hazard Identification

Upon a review of the full range of natural hazards suggested under FEMA planning guidance, the WCU Campus Hazard Mitigation Planning Team identified a number of hazards that are to be addressed in its Hazard Mitigation Plan. These hazards were identified through a process that utilized input from the Campus Hazard Mitigation Planning Team members, research of past disaster declarations in the surrounding county, and review of the previous WCU Pre-Disaster Mitigation Plan. To maintain consistency, the Multi-Campus Hazard Mitigation Steering Committee and the Campus Hazard Mitigation Planning Teams voted to assess the same hazards that were identified in the most recent update of the North Carolina State Hazard Mitigation Plan. Therefore, since the development of the previous plan, the hazard identified and included in the plan have changed. A list of all previous hazards covered in the previous WCU Pre-Disaster Mitigation Plans are viewable in **Table G.4**, 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.

TABLE G.4: 2021 WESTERN CAROLINA UNIVERSITY HAZARDS UPDATE

2010 Western Carolina University Identified Hazards		2021 Western Carolina University Identified Hazards		Description of hazards covered in 2021 Plan and Explanations
Atmospheric Hazards	Drought	**Natural Hazards**	Drought	Agricultural Drought, Hydrological Drought
	Driving Rain			
	Other High Wind events			
			Excessive Heat	
	Hurricane		Hurricane and Coastal Hazards	Storm Surge associated with Hurricanes and Nor'easters, High Wind associated with

2010 Western Carolina University Identified Hazards		2021 Western Carolina University Identified Hazards		Description of hazards covered in 2021 Plan and Explanations
				Hurricanes and Nor'easters, Torrential Rain, Tornadoes Associates with Hurricanes, Severe Winter Weather associated with Nor'easters
	Tornado		Tornadoes/Thunderstorms	Hailstorm, Torrential Rain associated with Severe Thunderstorms, Thunderstorm Wind, Lightning, Waterspout, High Wind
	Electrical Storm			
	Severe Winter Weather, including ice or snow events		Severe Winter Weather	Freezing Rain, Snowstorms, Blizzards, Wind Chill, Extreme Cold
Hydrologic Hazards			Dam Failures	
	Flood		Flooding	
Geologic Hazards	Earthquake		Earthquakes	
	Landslide, Rockslide, and other Geologic		Geological	Landslides, Sinkholes, Erosion
Other Hazards	Wildfire or Building Fire	**Other Hazards**	Wildfires	
	Animal borne and other Infectious Diseases		Infectious Disease	
	Accidental Explosion	**Technological Hazards**		
			Hazardous Substances	Hazardous Materials, Hazardous Chemicals, Oil Spill
			Terrorism	Chemical, Biological, Radiological, Nuclear, Explosive
			Cyber	
			Electromagnetic Pulse	

G.4.2 Disaster Declarations

Disaster declarations provide insight into the hazards that may impact Western Carolina University. **Table G.5** shows every declared presidential disaster to impact Jackson County since 1977. There have been eight total disaster declarations in Jackson County since 1973.

TABLE G.5: JACKSON COUTNY DISASTER DECLARATIONS

Year	Disaster Number	Description
1973	394	SEVERE STORMS & FLOODING
1995	1073	SEVERE STORMS, FLOODING, HIGH WINDS
1996	1087	BLIZZARD OF '96
2004	1553	HURRICANE IVAN
2004	1546	TROPICAL STORM FRANCES
2010	1871	SEVERE WINTER STORMS & FLOODING
2013	4146	SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES

Year	Disaster Number	Description
2020	4487	COVID-19 PANDEMIC

G.4.3 Summary of Hazard Impacts Since Previous Plan

Since the approval of the previous Western Carolina University Pre-Hazard Mitigation Plan (June 30th, 2010), there have been 162 hazard events recorded for the planning area in the National Centers for Environmental Storm Event Database. It is important to take note of those hazard events and consider them in the *Hazard Identification* section to help ensure that the appropriate hazards are being considered in the risk assessment sections in the Mitigation Strategy. **Table G.6** documents the hazard events recorded.

TABLE G.6: SUMMARY OF HAZARD EVENTS SINCE PREVIOUS PLAN

Hazard Type*	Number of Reported Events in Jackson County
Cold/Wind Chill	15
Flash Flood	2
Flood	3
Hail	18
Heavy Snow	10
High Wind	1
Lightning	4
Strong Wind	0
Thunderstorm Wind	27
Tornado	1
Tropical Storm	0
Winter Storm	15
Winter Weather	66
TOTAL NUMBER OF REPORTED EVENTS	162

* The hazard type names that NCEI uses are different than the names of hazards used in this plan; however, one can still get an understanding of the types of hazards that impact the region as the hazard types are similar in name.

G.4.4 Hazard Evaluation

Table G.7 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 furthered 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 further evaluations and updates of the risk assessment if deemed necessary by the University Core Planning Team and the University Campus Core Committee during the plan update process.

TABLE G.7: 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?
NATURAL HAZARDS			
Avalanche	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of the NC State Hazard Mitigation Plan • Review of the previous Western Carolina University Pre-Disaster Mitigation Plan • Review of US Forest Service National Avalanche Center website	• The United States avalanche hazard is limited to mountainous western states including Alaska as well as some areas of low risk in New England. • Avalanche hazard was removed from the North Carolina State Hazard Mitigation Plan after determining the mountain elevation in Western North Carolina did have enough snow not to produce this hazard. • Avalanche is not included in the previous Western Carolina University Pre-Disaster Mitigation Plan.
Drought	**YES**	• Review of the NC State Hazard Mitigation Plan • Review of the North Carolina Drought Monitor website • Review of the previous Western Carolina University Pre-Disaster Mitigation Plan	• There are reports of drought conditions in eight out of the last ten years in Jackson County (2010-2019), according to the North Carolina Drought Monitor. • Droughts are discussed in NC State Hazard Mitigation Plan as a lesser hazard. • The NC State Hazard Mitigation Plan lists drought as a hazard.
Hailstorm	**YES (Assessed under Tornadoes/**	• Review of NC State Hazard Mitigation Plan	• Hailstorm events are discussed in the state plan under the Severe Thunderstorm hazard.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
	Thunderstorms)	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NOAA NCEI Storm Events Database • Review of the previous Western Carolina University Pre-Disaster Mitigation Plan	• NCEI reports 58 hailstorm events (0.75-inch size hail to 1.75 inches) for Jackson County between 1985 and 2018. For these events there was over $1 million (2018 dollars) in property damages. •
Excessive Heat	**YES**	• Review of NOAA NCEI Storm Events Database • Review of the North Carolina State Hazard Mitigation Plan • Review of the previous Western Carolina University Pre-Disaster Mitigation Plan	• NCEI did not report any excessive heat events for Jackson county. • The NC State Hazard Mitigation Plan does include Excessive Heat as hazard. • Excessive Heat was not addressed in the previous Western Carolina University Pre-Disaster Mitigation Plan.
Hurricane and Coastal Hazards	**YES**	• Review of NC State Hazard Mitigation Plan • Analysis of NOAA historical tropical cyclone tracks and National Hurricane Center Website • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations	• Hurricane and coastal hazard events are discussed in the state plan and are listed as a top hazard of concern. • NOAA historical records indicate 7 hurricane/coastal hazards have come within 25 miles of Jackson County since 1850. • Three out of eight disaster declarations in Jackson County are directly related to hurricane and costal hazard events.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
		• Review of the previous Western Carolina University Pre-Disaster Mitigation Plan	• Hurricane hazards were addressed in the previous Western Carolina University Pre-Disaster Mitigation Plan.
Lightning	**YES (Assessed under Tornadoes/ Thunderstorms)**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of NOAA NCEI Storm Events Database, NOAA lightning statistics • Review of the previous Western Carolina University Pre-Disaster Mitigation Plan	• Lightning events are discussed in the state plan as part of the severe thunderstorm hazard. • NCEI reports 15 lightning events for Jackson County since 1996. These events have resulted in \$2.64 million (2018 dollars) in property damage. •
Nor'easter	**NO**	• Review of NC State Hazard Mitigation Plan • Review of the previous Western Carolina University Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database	• Nor'easters are discussed in the state plan; however, they are not a hazard of concern for Jackson County. • NCEI does not report any nor'easter activity for Jackson County. However, nor'easters may have affected the County as severe winter storms. In this case, the activity would be reported under winter storm events. • Nor'easters were not addressed in the previous Western Carolina University Pre-Disaster Mitigation Plan.

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?
Tornadoes/Thunderstorm	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Western Carolina University Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations.	• Tornado events are discussed in the NC State Hazard Mitigation Plan. • NCEI reports 3 tornado events in Jackson County since 1989. These events have resulted in over $300 thousand (2018 dollars) in property damage with the most severe being an F2. • Tornado events were addressed in the previous Western Carolina University Pre-Disaster Mitigation Plan.
Severe Thunderstorm	**YES (Assessed under Tornadoes/Thunderstorms)**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Western Carolina University Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations.	• Severe thunderstorm events are discussed in the NC State Hazard Mitigation Plan. • NCEI reports 91 thunderstorm wind events in Jackson County since 1969. These events have resulted in $527 thousand (2018 dollars) in property damage. • Severe thunderstorm events were addressed in the previous Western Carolina University Pre-Disaster Mitigation Plan.
Severe Winter Weather	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan	• Severe winter weather events, including snow storms and ice storms, are discussed in the state plan. • NCEI reports that Jackson County has been affected by 242 snow and ice events since 1993.

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?
		• Review of the previous Western Carolina University Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations.	These were no deaths, injuries or damages reported with these events. • Three of the region's eight disaster declarations were directly related to winter storm events. • Winter storm events were addressed in the previous Western Carolina University Pre-Disaster Mitigation Plan.
Earthquakes	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Western Carolina University Pre-Disaster Mitigation Plan • Review of the National Geophysical Data Center USGS Earthquake Hazards Program website	• Earthquake events are discussed in the state plan and all of the participating counties in Western Carolina University are considered to be at moderate risk to an earthquake event (no counties are high risk). • Earthquakes were addressed in the previous Western Carolina University Pre-Disaster Mitigation Plan. 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. • 8 events are known to have occurred in the region according to the National Geophysical Data Center. The greatest MMI reported was a 7.

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?
			• According to USGS seismic hazard maps, the peak ground acceleration (PGA) with a 10% probability of exceedance in 50 years for the area is approximately 4%g. FEMA recommends that earthquakes be further evaluated for mitigation purposes in areas with a PGA of 3%g or more.
Expansive Soils	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Western Carolina University Pre-Disaster Mitigation Plan • Review of USDA Soil Conservation Service's Soil Survey	• Expansive soils are not identified in the state plan. • According to FEMA and USDA sources, Western Carolina University is located in an area that has a "little to no" clay swelling potential. • The previous Western Carolina University Pre-Disaster Mitigation Plan did not identify expansive soils as a potential hazard.
Geological (Landslides, Sinkholes, Erosion)	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Western Carolina University Pre-Disaster Mitigation Plan • Review of USGS Landslide Incidence and Susceptibility Hazard Map	• Landslide/debris flow events are discussed in the state plan. • USGS landslide hazard maps indicate "high to moderate landslide incidence" (more than 15% of the area is involved in land sliding) is found in Jackson County. • Data provided by NCGS indicate multiple landslide events in Jackson County.

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?
		• Review of the North Carolina Geological Survey database of historic landslides	• Geological hazards were addressed in the previous WCU Pre-Disaster Mitigation Plan.
Land Subsidence	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Western Carolina University Pre-Disaster Mitigation Plan	• The state plan delineates certain areas that are susceptible to land subsidence hazards in North Carolina; however, none of these areas are located in Jackson County. • The plan identifies Jackson County as having scored very low for the land subsidence hazard. • Land Subsidence was not addressed in the previous Western Carolina University Pre-Disaster Mitigation Plan.
Tsunami	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Western Carolina University Pre-Disaster Mitigation Plan • Review of FEMA "How-to" mitigation planning guidance (Publication 386-2, "Understanding Your Risks – Identifying Hazards and Estimating Losses).	• Tsunamis are discussed in the state plan. • Tsunamis were not addressed in the previous Western Carolina University Pre-Disaster Mitigation Plan. • No record exists of a catastrophic Atlantic basin tsunami impacting the mid-Atlantic coast of the United States. • Tsunami inundation zone maps are not available for communities located along the U.S. East Coast.

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?
			• 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.
Volcano	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of USGS Volcano Hazards Program website	• There are no active volcanoes in North Carolina. • There has not been a volcanic eruption in North Carolina in over 1 million years. • No volcanoes are located near Western Carolina University.
Dam Failure	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Western Carolina University Pre-Disaster Mitigation Plan • Review of North Carolina Division of Land Management website	• Dam failure is discussed in the state plan as a hazard of concern. • Of the 69 dams reported on the National Inventory of Dams for Jackson County, 28 are high hazard (40%), (High hazard is defined as "where failure or mis operation will probably cause loss of human life.") • Dam failure was not addressed in the previous Western Carolina University Pre-Disaster Mitigation Plan.
Erosion	**YES (Referenced in Geological Hazards)**	• Review of NC State Hazard Mitigation Plan • Review of the previous Western Carolina University Pre-Disaster Mitigation Plan	• Riverine erosion is addressed in the previous Western Carolina University Pre-Disaster Mitigation Plan. • Coastal erosion is discussed in the state plan but only for

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?
			coastal areas (there is no discussion of riverine erosion).
Flooding	**YES**	• Review of NC State Hazard Mitigation Plan • Review of historical disaster declarations • Review of NOAA NCEI Storm Events Database • Review of the previous Western Carolina University Pre-Disaster Mitigation Plan	• The flood hazard is thoroughly discussed in the state plan. • Six of the eight Presidential Disaster Declarations were directly associated with flooding • NCEI reports that Jackson County have been affected by 31 flood events since 1996. These events in total caused over $1.084 million (2018 dollars) in property damages. • Flooding was addressed in the previous Western Carolina University Pre-Disaster Mitigation Plan.
Storm Surge	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Western Carolina University Pre-Disaster Mitigation Plan • Review of NOAANCEI Storm Events Database	• Storm surge is discussed in the state plan under the hurricane hazard; however, Jackson County has zero vulnerability to storm surge. • Storm surge was not addressed in the previous Western Carolina University Pre-Disaster Mitigation Plan. • No historical events were reported by NCEI • Given the inland location of Western Carolina University, storm surge would not affect the area.

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?
OTHER HAZARDS			
Wildfires	**YES**	• Review of NC State Hazard Mitigation Plan • Review of the previous Western Carolina University Pre-Disaster Mitigation Plan • Review of Southern Wildfire Risk Assessment (SWRA) Data • Review of the NC Division of Forest Resources website	• Wildfires occur in virtually all parts of the United States. Wildfire hazard risk will increase as low-density development along the urban/wildland interface increases. • Wildfires were not addressed in the previous WCU Pre-Disaster Mitigation Plan. • According to the North Carolina Division of Forest Resources, Jackson County experiences an average of 188 fires each year which burn a combined 185 acres
Hazardous Substances	**YES**	• Review of the previous Western Carolina University Pre-Disaster Mitigation Plan	• Review of Pipeline and Hazardous Materials Safety Administration data indicates 55 HAZMAT incidents occurred in Jackson County. • EPA Toxic Release Inventory indicates 2 Toxic Release Inventory (TRI) facilities in Jackson County. • Jackson County identifies hazardous substances as a potential concern. • This update assesses hazardous materials, hazardous chemicals, and oil spills under this hazard.
Infectious Disease	**YES**	• Review of NC State Hazard Mitigation Plan	• Infectious Disease is identified as a hazard in the state plan.

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?
		• Review of the previous Western Carolina University Pre-Disaster Mitigation Plan. • .	• Although the previous Western Carolina University Pre-Disaster Mitigation Plan did not include infectious disease as a hazard, it is assessed in this update to maintain consistency with the NC State Hazard Mitigation Plan • Infectious Disease has caused one of the eight disaster declarations in Jackson County
TECHNOLOGICAL HAZARDS			
Terrorism	**YES**	• Review of NC State Hazard Mitigation Plan • Review of previous mitigation plans in Western Carolina University • Review of local official knowledge	• 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. • There is a fixed nuclear facility in the state. • This hazard will assess chemical, biological, radiological, nuclear, and explosive terrorism events.
Radiological Emergency – Fixed Nuclear Facilities	**NO**	• Review of NC State Hazard Mitigation Plan • Review of the previous Western Carolina University Pre-Disaster Mitigation Plan • Review of IAEA list of fixed nuclear power stations in the United States	• There were no identified nuclear facilities located within 50 miles of Western Carolina University or Jackson County. • Radiological emergencies are not identified in the previous plan

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?
		• Discussion with local officials about location of nuclear power stations	
Cyber	**YES**	• Review of NC State Hazard Mitigation Plan	• Changing future conditions encourage the assessment of the possibility of a cyber-attack with the increase in global technology
Electromagnetic Pulse	**YES**	• Review of NC State Hazard Mitigation Plan	• Changing future conditions encourage the assessment of the possibility of an electromagnetic pulse with the increase in global technology

G.5 Hazard Profiles, Analysis, and Vulnerability

G.5.1 OVERVIEW

This section includes detailed hazard profiles for each of the hazards identified in the Hazard Identification section as significant enough for further evaluation in the Western Carolina University Hazard Mitigation Plan. It contains the following subsections:

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

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

Natural Hazards

G.5.2 DROUGHT

G.5.2.1 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, 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. It is also notable that drought conditions typically do not cause significant damage to the built environment.

G.5.2.2 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 G.8.**

TABLE G.8: 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 NOAA, Jackson County has had drought occurrences in eight of the last ten years (2010-2019) (**Table G.9**). 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 G.9: SUMMARY OF DROUGHT OCCURRENCES IN JACKSON COUNTY (1995-2019)

Year	Months of Recorded Drought	Event Details
1998	3	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.
1999	3	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.
2000	4	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.
2001	7	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.
2002	1	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.
2007-2008	9	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.
2008	6	Another month of below normal rainfall resulted in a persistence of severe to exceptional drought conditions over much of western North Carolina through November. In fact, drought conditions actually worsened in some areas, with portions of the central North Carolina mountains deteriorating to exceptional drought conditions late in the month. Slight improvements in well water levels continued across the area. Most rivers and major streams continued to flow at less than 10 percent of normal. Voluntary water restrictions continued in most areas, with a few areas continuing to institute mandatory restrictions.
2016	2	Much needed rainfall, especially early in the month resulted in slight improvement of drought conditions across the North Carolina mountains in December. In fact, thanks

		to the rainfall, extreme drought conditions had once again retreated to southwest corner of the state. Nevertheless, monthly rainfall totals were still a little below normal, while final yearly totals were as much as 15 inches below normal in most locations. Levels were well below normal on all area streams, while some streams observed near-record low discharge rates. Reservoirs were several feet below target elevations and all communities continued to observe at least voluntary water restrictions, while some had instituted mandatory restrictions.

Source: NCEI Storm Event Database

G.5.2.3 Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of Jackson County, including the Western Carolina University campus, 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[1].

G.5.3 EXCESSIVE HEAT

G.5.3.1 Location and Spatial Extent

Excessive heat typically impacts a large area and cannot be confined to any geographic or political boundaries. The entire Western Carolina University campus is susceptible to extreme heat conditions.

G.5.3.2 Historical Occurrences

Data from the National Centers for Environmental Information showed that there have not been any historical excessive heat and heat wave events in Jackson County. Typical weather conditions in Cullowhee, North Carolina, where the campus is located, tend not to rise above 80 degrees Fahrenheit. **Table G.10** shows the average maximum temperatures from 2001 to 2019 for Franklin, NC which is the closest weather reporting station to WCU.

TABLE G.10: AVERAGE MAXIMUM TEMPERATURE IN FRANKLIN, NORTH CAROLINA

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
46°F	50°F	58°F	67°F	74°F	80°F	83°F	82°F	77°F	67°F	58°F	49°F

Source: State Climate Office of North Carolina

The highest temperature ever recorded in Franklin, was 101°F on July 29, 1952.[2]

[1] *U.S. Seasonal Drought Outlook. National Weather Service Climate Prediction Center. http://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php*

G.5.3.3 Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of Jackson County, including the Western Carolina University campus, has a probability level of possible (1 to 10 percent annual probability) for future extreme hat events to impact the region.

G.5.4 HURRICANE AND COASTAL HAZARDS

G.5.4.1 Location and Spatial Extent

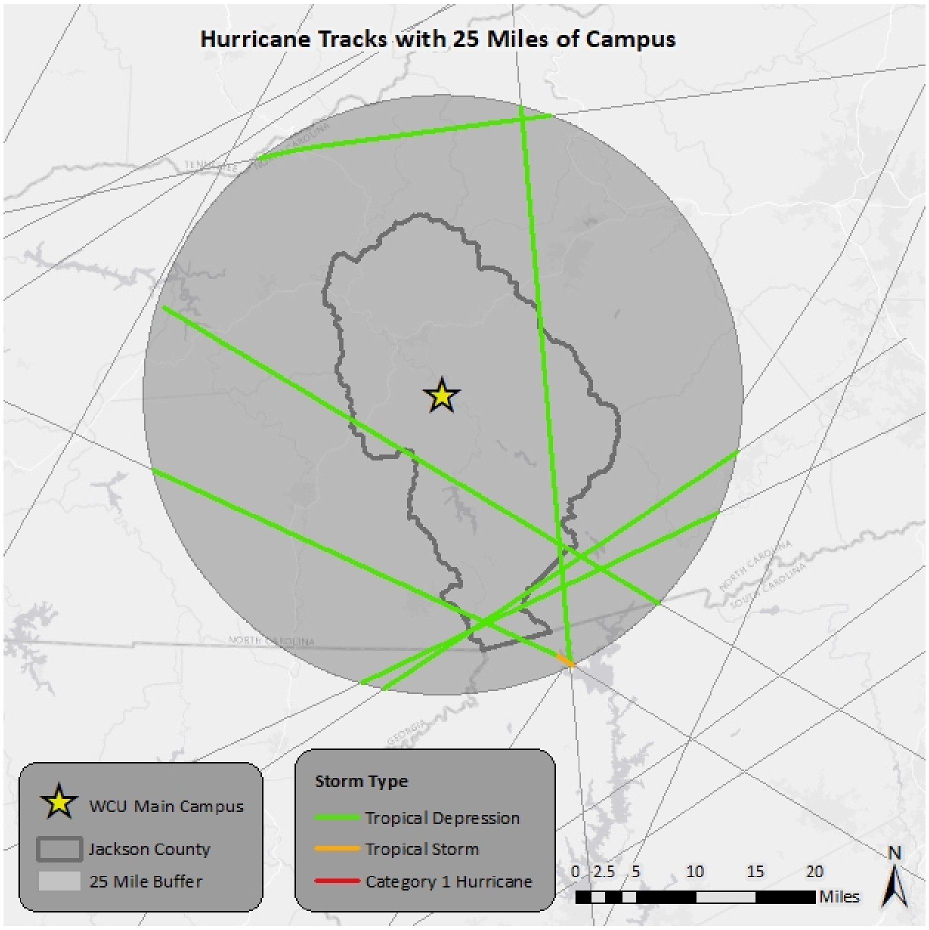
Hurricanes, coastal hazards, and tropical storms threaten the entire Atlantic and Gulf seaboard of the United States. While coastal areas are most directly exposed to the brunt of landfalling storms, their impact is often felt hundreds of miles inland and they can affect the Western Carolina University Campus.

G.5.4.2 Historical Occurrences

According to the National Hurricane Center's historical storm track records, 7 hurricane or tropical storm tracks have passed within 25 miles of WCU's campus since 1850[3]. This includes 5 tropical depressions, 1 tropical storm, and 1 category 1 hurricane. These storm events are shown in **Figure G.5.** Furthermore, **Table G.11** provides for each event the date of occurrence, name (if applicable), maximum wind speed (as recorded within 25 miles of Jackson County) and Category of the storm based on the Saffir-Simpson Scale.

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

FIGURE G.5: HISTORICAL HURRICANE STORM TRACKS WITHIN 25 MILES OF WESTERN CAROLINA UNIVERSITY



Source: National Oceanic and Atmospheric Administration; National Hurricane Center

TABLE G.11: HISTORICAL STORM TRACKS WITHIN 25 MILES OF WESTERN CAROLINA UNIVERSITY (1901–2018)

Year	Storm Name	Maximum Wind Speed (knots)	Storm Category
1901	UNNAMED	35	Tropical Depression
1952	UNNAMED	30	Tropical Depression
1959	GRACIE	45	Tropical Storm
1989	HUGO	85	Cat 1 Hurricane
2003	BILL	20	Tropical Depression
2004	IVAN	20	Tropical Depression
2005	CINDY	20	Tropical Depression

Source: National Hurricane Center

The National Centers for Environmental Information did not record any hurricane or tropical storm events in Jackson County between 1950 and 2019. Hurricane and tropical storm events have caused 2 presidential disaster declarations in Jackson County. While these were not recorded in the database, effects from these types of storms were likely still felt in other hazards, including thunderstorms and flooding. Flooding is generally the greatest hazard of concern with hurricane and tropical storm events in the area near Western Carolina University. However, hurricane remnant 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 or the Gulf of Mexico. 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.

G.5.4.3 Probability of Future Occurrences

Given the inland location of the campus, it is more likely to be affected by remnants of hurricane and tropical storm systems (as opposed to a major hurricane) which may result in flooding or high winds. The probability of being impacted is less than coastal areas, but still remains a real threat to Western Carolina University due to induced events like flooding and land sliding. Based on historical evidence, the probability level of future occurrence is possible (between 1 and 10 percent annual probability). However, when the area is impacted, the damage could be severe, threatening lives and property on campus.

G.5.5 TORNADOES/THUNDERSTORMS

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

G.5.5.1 Location and Spatial Extent

Tornadoes

Tornadoes occur throughout the state of North Carolina, and thus in the area surrounding Western Carolina University. 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 area surrounding the Western Carolina University campus 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 Western Carolina University typically experiences several straight-line wind events each year. These wind events can and have caused significant damage. It is assumed that the area surrounding the Western Carolina University campus 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 all of the area surrounding the Western Carolina University campus is uniformly exposed to severe thunderstorms; therefore, the campus itself is also 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 area surrounding the Western Carolina University campus is uniformly exposed to lightning.

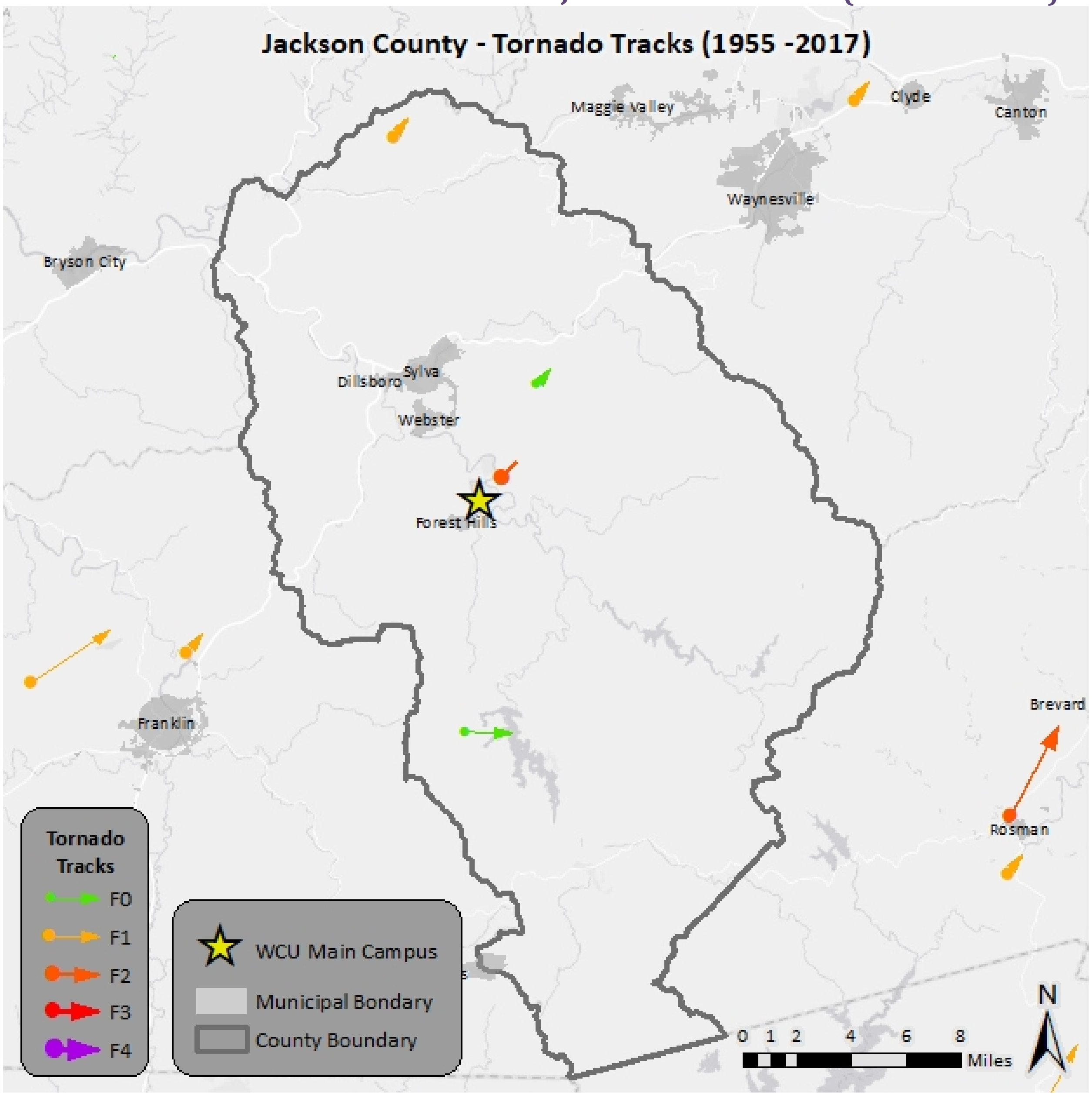
G.5.5.2 Historical Occurrences

Tornadoes

Tornadoes are a somewhat rare occurrence; however, they have and do occur in the area. According to the National Centers for Environmental Information, there have been 3 recorded tornado events in Jackson County since 1975 (**Table G.12**), resulting in over $300 thousand in property damages[4]. There have been no deaths or injuries reported with these events. The magnitude of these tornadoes ranged from F0 to F2 in intensity. The greatest extent for tornadoes is an EF5, however, that strong of a tornado is not likely in Jackson County. 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. **Figure G.6** shows a map of tornado impact in Jackson County.

[4] 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 Jackson County. As additional local data becomes available, this hazard profile will be amended.

FIGURE G.6: TORNADO TRACKS IN JACKSON COUNTY (1955 – 2017)



Source: National Centers for Environmental Information

TABLE G.12: HISTORICAL TORNADO IMPACTS IN JACKSON COUNTY

Location	Date	Magnitude	Deaths/ Injuries	Property Damage*	Details
Jackson County	3/12/1975	F0	0/0	$250	Tornado touched down for less than two minutes near Sylva. Damage was slight.
Jackson County	6/28/1976	F2	0/0	$250,000	No narrative provided.
Erastus	3/2/2012	EF0	0/0	$50,000	Two supercell thunderstorms entered the North Carolina mountains during the evening hours. One of the storms produced a strong tornado in the town of Murphy in Cherokee County. The supercell remained surprisingly strong as it crossed the southern mountains, producing large hail and eventually another weak tornado in Jackson County. An NWS storm survey found the path of a weak tornado in the Lake Glenville area. The tornado began along Pine Creek Rd about halfway between the Macon County line and the Lake. It traveled east southeast from there, crossing North Norton Rd and Woods Mountain Trail. Multiple trees were uprooted and snapped and a few homes and one church received minor roof damage. The tornado then crossed the lake and affected Glenshore Dr snapping and uprooting more trees and causing a tree to fall on a home, damaging the roof. The damage path ended there, at the shore of Lake Glenville.

Thunderstorms

According to NCEI, there have been 91 reported thunderstorm and high wind events since 1969 in Jackson County[5]. These events caused over $527 thousand (2019 dollars) in damages. There were reports of two injuries. **Table G.13** summarizes this information.

TABLE G.13: HISTORICAL THUNDERSTORM IMPACTS IN JACKSON COUNTY

Location	Date	Deaths/Injuries	Property Damage
Jackson County	6/23/1969	0/0	0
Jackson County	6/7/1971	0/0	0
Jackson County	7/11/1986	0/0	0
Jackson County	4/4/1989	0/0	0
Jackson County	5/27/1989	0/0	0
Jackson County	7/30/1991	0/0	0
Sylva	8/25/1993	0/0	0
Sylva/ Dillsboro	5/18/1995	0/0	$10,000
Jackson County	5/18/1995	0/1	$80,000
Sylva	9/10/1995	0/0	$30,000

[5] 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 Jackson County. As additional local data becomes available, this hazard profile will be amended.

Location	Date	Deaths/Injuries	Property Damage
Sylva	9/11/1995	0/0	$40,000
CASHIERS	4/20/1996	0/0	$25,000
CULLOWHEE	5/26/1996	0/0	0
CULLOWHEE	5/26/1996	0/0	0
COUNTYWIDE	1/5/1997	0/0	0
CULLOWHEE	6/14/1997	0/0	0
CASHIERS	7/4/1997	0/1	0
CASHIERS	7/28/1997	0/0	0
SYLVA	5/27/1998	0/0	0
COUNTYWIDE	6/2/1998	0/0	0
SYLVA	6/19/1998	0/0	0
CASHIERS	6/21/1998	0/0	0
BALSAM	5/6/1999	0/0	0
SAVANNAH	5/6/1999	0/0	0
CULLOWHEE	5/6/1999	0/0	$50,000
BALSAM	5/7/1999	0/0	0
WOLF MTN	7/6/1999	0/0	0
SYLVA	8/10/2000	0/0	0
SYLVA	6/22/2001	0/0	0
SYLVA	8/11/2001	0/0	0
CASHIERS	10/24/2001	0/0	0
SYLVA	10/25/2001	0/0	$100,000
CULLOWHEE	10/25/2001	0/0	$100,000
WEBSTER	3/17/2002	0/0	$10,000
SYLVA	5/2/2002	0/0	$3,000
COUNTYWIDE	5/13/2002	0/0	$3,000
CASHIERS	6/4/2002	0/0	0
CULLOWHEE	5/2/2003	0/0	$5,000
CASHIERS	7/5/2003	0/0	0
SYLVA	5/31/2004	0/0	$1,000
SYLVA	6/22/2004	0/0	0
SYLVA	7/5/2004	0/0	0
SYLVA	7/25/2004	0/0	0
CULLOWHEE	8/20/2004	0/0	0
SYLVA	4/3/2006	0/0	0
CULLOWHEE	5/20/2006	0/0	0
CASHIERS	5/20/2006	0/0	0
CASHIERS	6/23/2006	0/0	0
SYLVA	7/21/2006	0/0	0
CASHIERS	10/11/2006	0/0	0
SYLVA	4/3/2007	0/0	0
CULLOWHEE	8/24/2007	0/0	0
CULLOWHEE	1/30/2008	0/0	0
SYLVA	6/28/2008	0/0	0
WEBSTER	7/21/2008	0/0	0

Location	Date	Deaths/Injuries	Property Damage
CULLOWHEE	6/11/2009	0/0	0
SYLVA	6/17/2009	0/0	0
BETA	6/17/2009	0/0	0
GRIMESHAWES	6/17/2009	0/0	0
WEBSTER	6/18/2009	0/0	0
GAY	6/18/2009	0/0	0
DILLSBORO	5/28/2010	0/0	0
GRIMESHAWES	5/28/2010	0/0	0
SPEEDWELL	6/25/2010	0/0	0
SYLVA	9/22/2010	0/0	0
WILMOT	10/25/2010	0/0	0
NORTON	10/25/2010	0/0	0
CULLOWHEE	2/28/2011	0/0	0
WILMOT	4/4/2011	0/0	0
CASHIERS	4/27/2011	0/0	0
CASHIERS	4/27/2011	0/0	0
CULLOWHEE	6/8/2011	0/0	0
WILMOT	6/15/2011	0/0	0
NORTON	6/19/2011	0/0	0
DICKS CREEK	7/5/2012	0/0	0
WILMOT	1/30/2013	0/0	0
SYLVA	6/13/2013	0/0	0
SYLVA	2/21/2014	0/0	0
CULLOWHEE	4/28/2014	0/0	0
BALSAM	7/27/2014	0/0	0
CULLOWHEE	6/17/2015	0/0	$10,000
DICKS CREEK	6/24/2015	0/0	0
CULLOWHEE	8/14/2015	0/0	$10,000
GREENS CREEK	7/7/2016	0/0	0
WILMOT	7/8/2016	0/0	0
WILMOT	5/27/2017	0/0	0
GRIMESHAWES	9/20/2017	0/0	0
SAVANNAH	6/23/2018	0/0	0
WILMOT	6/25/2018	0/0	0
PUMPKINTOWN	6/21/2019	0/0	0
BARKERS CREEK	1/11/2020	0/0	$50,000

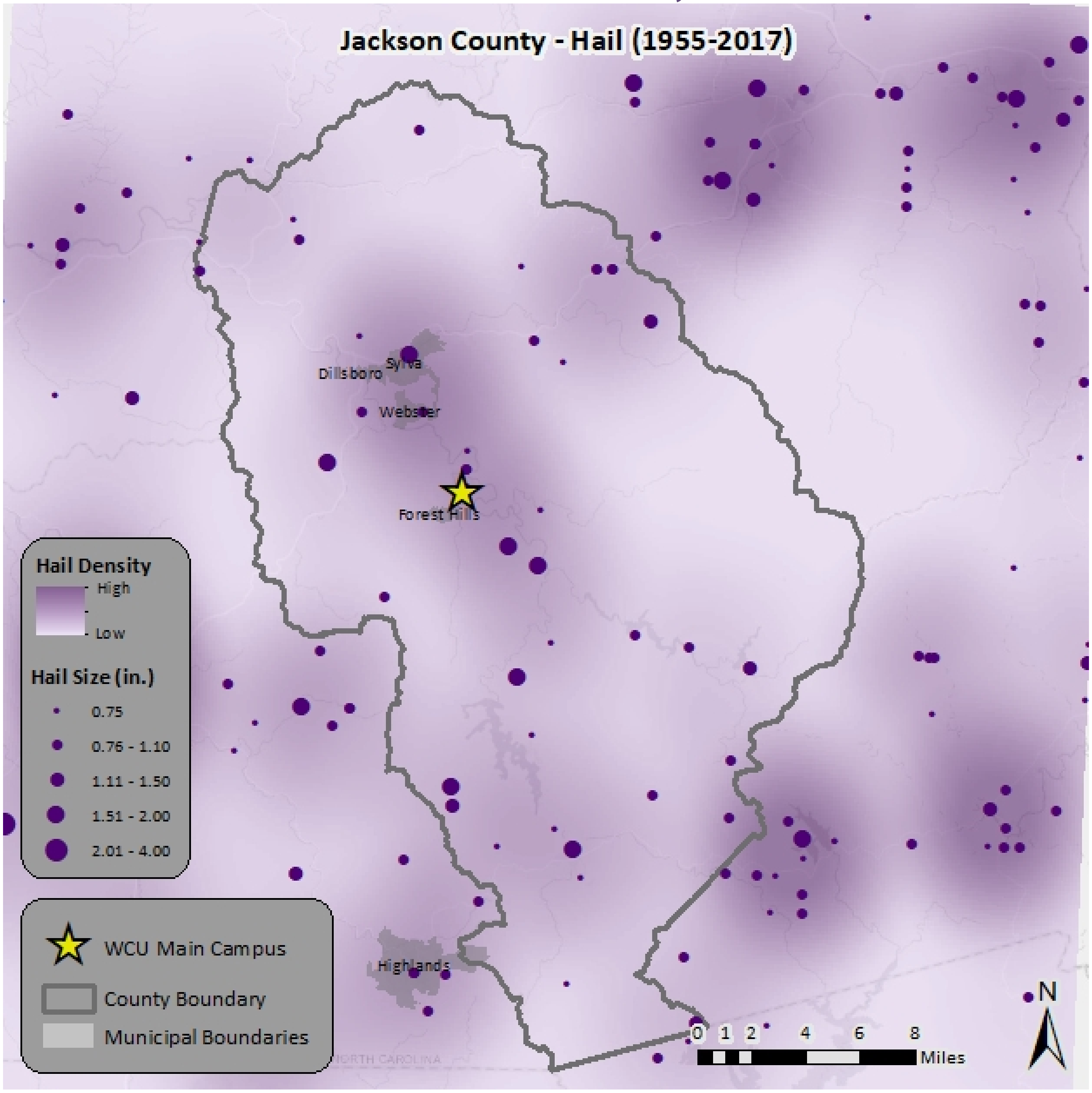
Hailstorms

According to the National Centers for Environmental Information, 58 recorded hailstorm events have affected Jackson County since 1985 summarized in **Table G.14.** [6] In all, hail occurrences resulted in over

[6] 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 Jackson County. 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.

$1,000,000 (2020 dollars) in property damages. Hail ranged in diameter from 0.75 inches to 1.75 inches. It should be noted that hail is notorious for causing substantial damage to cars, roofs, and other areas of the built environment that may not be reported to the National Centers for Environmental Information. **Figure G.7** shows a map of hailstorm occurrences in Jackson County.

FIGURE G.7: HAIL OCCURANCES IN JACKSON COUNTY



Source: National Centers for Environmental Information

TABLE G.14: HISTORICAL HAIL OCCURANCES IN JACKSON COUNTY

Location	Date	Magnitude	Deaths/Injuries	Property Damage*
Jackson County	6/7/1985	1	0/0	0
Jackson County	3/15/1989	0.75	0/0	0
Cashiers	3/31/1993	1.75	0/0	0
Sylva	4/15/1993	1	0/0	0
Sylva	8/25/1993	0.75	0/0	0
Jackson County	5/18/1995	1.75	0/0	0
SYLVA	5/24/1996	1.5	0/0	0
CULLOWHEE	5/24/1996	0.75	0/0	0
SAVANNAH	5/24/1996	1.75	0/0	0
SYLVA	5/24/1996	1.75	0/0	$1,000,000
CULLOWHEE	5/26/1996	1.5	0/0	0
BALSAM	4/16/1998	1	0/0	0
SYLVA	5/27/1998	1	0/0	0
CULLOWHEE	5/6/1999	0.75	0/0	0
SYLVA	12/16/2000	0.88	0/0	0
BALSAM	6/4/2002	1	0/0	0
GLENVILLE	7/1/2002	0.75	0/0	0
SYLVA	4/30/2003	0.75	0/0	0
SYLVA	8/26/2003	0.75	0/0	0
TUCKASEGEE	5/8/2004	1.75	0/0	0
CULLOWHEE	5/8/2004	1	0/0	0
CASHIERS	3/27/2005	0.88	0/0	0
SYLVA	4/12/2005	0.88	0/0	0
CULLOWHEE	6/20/2005	0.75	0/0	0
WOLF MTN	4/3/2006	1	0/0	0
SYLVA	4/8/2006	0.75	0/0	0
CULLOWHEE	4/19/2006	1	0/0	0
CULLOWHEE	4/19/2006	1.75	0/0	0
CASHIERS	4/20/2006	0.75	0/0	0
WOLF MTN	5/20/2006	1	0/0	0
SYLVA	5/30/2006	0.75	0/0	0
CULLOWHEE	6/12/2007	0.75	0/0	0
CASHIERS	6/22/2008	0.75	0/0	0
CASHIERS	6/22/2008	0.75	0/0	0
CASHIERS	7/21/2008	0.75	0/0	0
WILMOT	5/8/2009	0.75	0/0	0
DICKS CREEK	5/8/2009	1	0/0	0

Location	Date	Magnitude	Deaths/Injuries	Property Damage*
BALSAM	5/8/2009	1.5	0/0	0
DILLSBORO	5/16/2009	0.75	0/0	0
BIG RIDGE	6/2/2009	0.88	0/0	0
BALSAM	5/11/2011	0.88	0/0	0
WOLF MTN	6/1/2011	1.25	0/0	0
CULLOWHEE	6/6/2011	1	0/0	0
PUMPKINTOWN	6/6/2011	0.88	0/0	0
CULLOWHEE	6/8/2011	0.75	0/0	0
WEBSTER	6/8/2011	1	0/0	0
ROCK BRIDGE	6/9/2011	1	0/0	0
GLENVILLE	3/2/2012	1.75	0/0	0
TUCKASEGEE	4/3/2012	0.75	0/0	0
TUCKASEGEE	4/3/2012	1	0/0	0
BESSIE	4/26/2012	1.75	0/0	0
BESSIE	4/26/2012	1.5	0/0	0
CASHIERS	7/1/2012	1	0/0	0
WILLITS	7/5/2012	1	0/0	0
BALSAM	6/19/2014	0.88	0/0	0
WILMOT	7/8/2016	0.88	0/0	0
WEBSTER	7/8/2016	1	0/0	0
GRIMESHAWES	9/20/2017	1.25	0/0	0

Lightning

According to the National Centers for Environmental Information, there have been a total of 15 recorded lightning events in Jackson County since 1997[7]. These events resulted in nearly $2.64 million (2020 dollars) in damages, as listed in summary **Table G.15**. Furthermore, lightning caused one death and ten injuries in the County.

It is certain that more than 15 events have impacted the County. Lightning occurs with almost every spring and summer thunderstorm that impacts the County; however, 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.

[7] 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 Jackson County. The State Fire Marshall's office was also contacted for additional information but none could be provided. As additional local data becomes available, this hazard profile will be amended.

TABLE G.15: HISTORICAL LIGHTNING IMPACTS IN JACKSON COUNTY

Location	Date	Deaths/ Injuries	Property Damage*	Details
CASHIERS	6/14/1997	0/0	0	Two houses were struck by lightning during the early morning of the 14th. Both houses suffered total losses.
BIG RIDGE	7/3/1999	0/7	0	A lightning strike caused injuries to 7 people at a campground, including burns to 3 people.
CASHIERS	8/8/1999	1/2	0	Lightning struck 3 people hiking at Whiteside Cliffs near the Macon county line and South Carolina state line, and at an elevation of 4900 feet. A teenage boy died and the two others were injured.
CASHIERS	7/3/2001	0/0	$100,000	
CASHIERS	7/2/2002	0/1	0	
CULLOWHEE	5/8/2004	0/0	0	
SYLVA	6/27/2005	0/0	$5,000	
CASHIERS	6/27/2005	0/0	$200,000	
CULLOWHEE	5/6/2009	0/0	$50,000	Thunderstorms developed along a stationary front, producing a few reports of large hail over the western Piedmont of North Carolina.
SYLVA	5/16/2009	0/0	$25,000	Slow moving thunderstorms produced a few areas of flash flooding for a third straight day over western North Carolina. A couple reports of large hail were also received.
GRIMESHAWES	5/15/2010	0/0	$150,000	Thunderstorms developed over western North Carolina along a stationary front. A few of the storms produced large hail.
BIG RIDGE	4/25/2011	0/0	$900,000	Lightning struck a house in the Glenridge area, igniting a fire that completely destroyed the home.
BESSIE	4/27/2011	0/0	$1,000,000	An historic tornado outbreak affected areas from the Deep South to the Mid-Atlantic states April 27-28. A strong tornado touched down in Rabun County late on the 27th, with additional tornadoes affecting the North Carolina foothills during the early morning hours of the 28th. At least three supercell thunderstorms crossed the western Carolinas and northeast Georgia during this time. A greater number of supercells and tornadoes affected areas to the west of the

Location	Date	Deaths/ Injuries	Property Damage*	Details
				Appalachians. Scattered areas of straight line wind damage and large hail also accompanied the storms.
BESSIE	6/19/2011	0/0	$200,000	The northern end of a line of thunderstorms moved across the southwest mountains of North Carolina during the overnight hours, producing areas of wind damage.
DILLSBORO	12/21/2011	0/0	$10,000	Lightning struck a propane tank at a water treatment plant, igniting a fire that destroyed some equipment.

Source: National Centers for Environmental Information

G.5.5.3 Probability of Future Occurrences

Tornadoes

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

Thunderstorms

Given the high number of previous events, it is certain that thunderstorms will occur in the future. This results in a probability level of highly likely (100 percent annual probability) for future wind events for Western Carolina University.

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 Western Carolina University 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 Jackson County 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), Western Carolina University is located in an area of the country that experienced an average of 3 to 6 lightning flashes per square kilometer per year between 2008 and 2017. 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 could cause minor property damages at WCU.

G.5.6 SEVERE WINTER WEATHER

G.5.6.1 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. Western Carolina University 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 campus has uniform exposure to a winter storm.

G.5.6.2 Historical Occurrences

Winter weather has resulted in three disaster declarations Jackson County. This includes the Blizzard of 1996, one previous winter storm in 1993, and a winter storm in 2009. According to the National Centers for Environmental Information, there have been a total of 160 days of severe winter weather or storms in Jackson County since 1996 (**Table G.16**)[8]. There were no deaths, injuries or damages reported with these events.

[8] These ice and winter storm events are only inclusive of those reported by the National Centers for Environmental Information (NCEI). It is likely that additional winter storm conditions have affected Jackson County.

TABLE G.16: WINTER STORM EVENTS IN JACKSON COUNTY

Year	Winter Weather Events Reported	Days of Winter Weather Reported
1996	8	4
1997	4	3
1998	8	5
1999	10	6
2000	6	3
2002	6	4
2003	19	11
2004	17	10
2005	19	13
2006	11	7
2007	7	5
2008	16	9
2009	17	11
2010	14	10
2011	11	8
2012	7	4
2013	14	11
2014	13	9
2015	9	6
2016	4	2
2017	8	5
2018	4	3
2019	2	2
2020	8	6
TOTAL	**242**	**160**

Source: National Centers for Environmental Information

There have been several severe winter weather events to impact Western Carolina University. The text below describes some of the major events.

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.

2014 Winter Weather – February 10, 2014

Light to moderate snow developed across the central and northern mountains during late morning and continued off and on through the afternoon. While most locations saw an inch or less, a small band of moderate to heavy snow developed during the afternoon from the high elevations of northern Jackson County, through central Haywood, and central and southern Buncombe Counties, where two to four-inch amounts were common. Some high elevation areas saw as much as 5 inches in this area. Several accidents in the Balsam area resulted in major traffic problems on Highway 74 near the Haywood/Jackson line.

2017 Winter Weather – December 8-9, 2017
As moisture associated with developing and strengthening low pressure over the northeast Gulf of Mexico overspread the western Carolinas, snow developed over the mountains of southwest North Carolina around daybreak on the 8th and quickly accumulated. By late morning, heavy snowfall accumulations were reported across the Smoky Mountains and Balsams and vicinity. Total accumulations generally ranged from 8-12 inches, with locally higher amounts well over a foot reported in the higher elevations, and lower amounts reported in the low valleys along the Tennessee border. While occasional flurries and light snow showers produced locally light additional accumulations into the early daylight hours of the 9th, the accumulating snow ended in most areas shortly after midnight.

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.

G.5.6.3 Probability of Future Occurrences

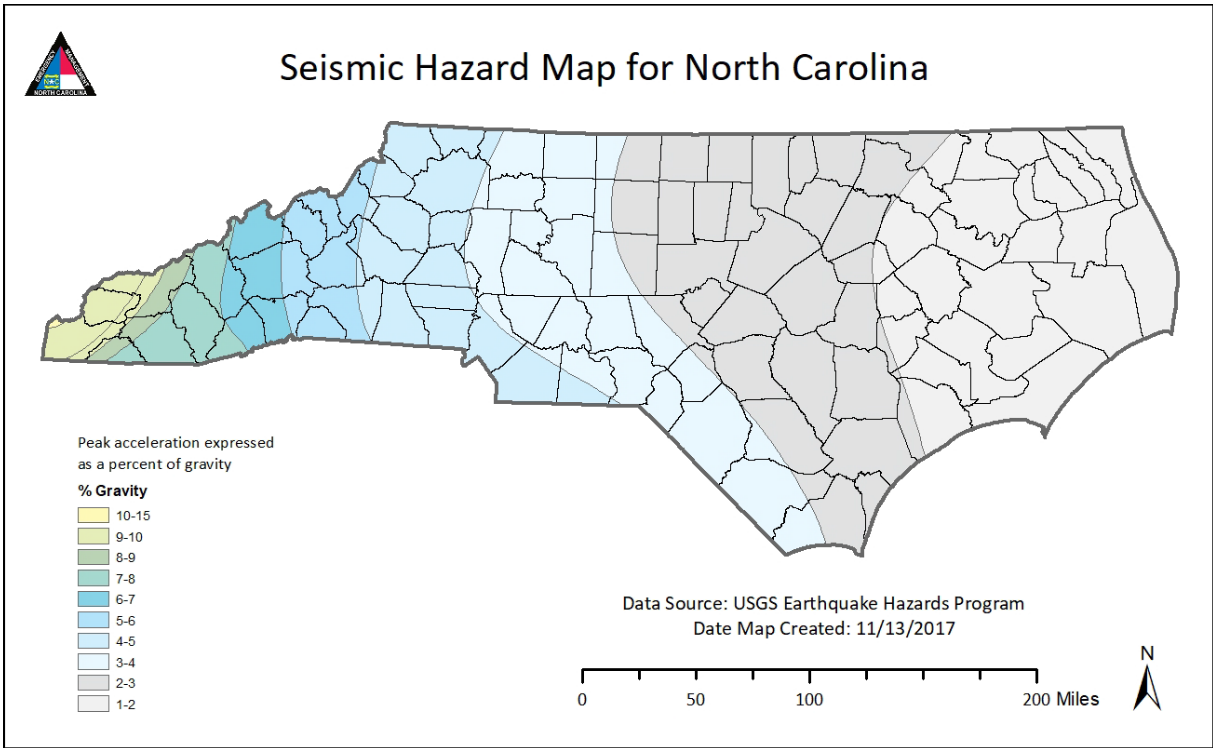
Winter storm events will remain a regular occurrence for Western Carolina University due to its location in the western part of the state. According to historical information the University often experiences several winter storms events each year. Therefore, the annual probability is likely (10 to 100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

G.5.7 EARTHQUAKES

G.5.7.1 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 G.8** is a map showing geological and seismic information for North Carolina.

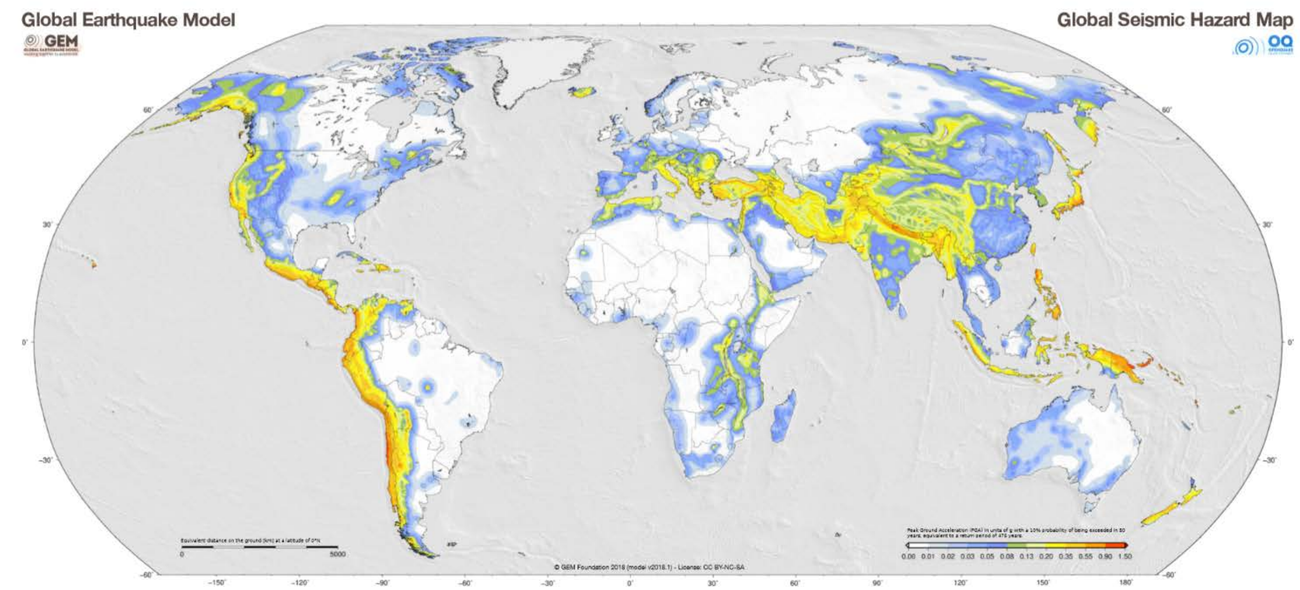
FIGURE G.8: GEOLOGICAL AND SEISMIC INFORMATION FOR NORTH CAROLINA



Source: North Carolina Geological Survey

Figure G.9 shows the intensity level associated with the world 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 campus as a whole exists within an area of moderate seismic risk.

FIGURE G.9: PEAK ACCELERATION WITH 10 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS



Source: Global Earthquake Model, 2018

G.5.7.2 Historical Occurrences

Since 1852 there have been 8 earthquakes, greater than 4.5 magnitude to occur in the area around WCU. The strongest of these measured a 5.2 on the Richter Scale. **Table G.17** provides a summary of earthquake events reported by the United States Geological Survey.

TABLE G.17: EARTHQUAKES IMPACTING JACKSON COUNTY

Location	Date	Magnitude
Southwestern Virginia	4/29/1852	*4.8*
Near Wilkesboro, NC	8/31/1852	*5.0*
Virginia/NC border	11/25/1898	*4.5*
Virginia/NC border	2/13/1899	*4.5*
South Carolina	1/1/1913	4.8
North Carolina	2/21/1916	*5.2*
Eastern Tennessee	11/3/1928	*4.5*
Eastern Tennessee	11/30/1973	4.7

A list of earthquakes that have caused damage throughout North Carolina is presented below in **Table G.18.**

TABLE G.18: EARTHQUAKES WHICH HAVE CAUSED DAMAGE IN NC

Date	Location	Richter Scale (Magnitude)	MMI (Intensity)	MMI in North Carolina
12/16/1811 - 1	NE Arkansas	8.5	XI	VI
12/16/1811 - 2	NE Arkansas	8.0	X	VI
12/18/1811 - 3	NE Arkansas	8.0	X	VI
01/23/1812	New Madrid, MO	8.4	XI	VI
02/071812	New Madrid, MO	8.7	XII	VI
04/29/1852	Wytheville, VA	5.0	VI	VI
08/31/1861	Wilkesboro, NC	5.1	VII	VII
12/23/1875	Central Virginia	5.0	VII	VI
08/31/1886	Charleston, SC	7.3	X	VII
05/31/1897	Giles County, VA	5.8	VIII	VI
01/01/1913*	Union County, SC	4.8	VII	VI
02/21/1916*	Asheville, NC	5.5	VII	VII
07/08/1926	Mitchell County, NC	5.2	VII	VII
11/03/1928*	Newport, TN	4.5	VI	VI
05/13/1957*	McDowell County, NC	4.1	VI	VI
07/02/1957	Buncombe County, NC	3.7	VI	VI
11/24/1957	Jackson County, NC	4.0	VI	VI
10/27/1959 **	Chesterfield, SC	4.0	VI	VI
07/13/1971	Newry, SC	3.8	VI	VI
11/30/1973*	Alcoa, TN	4.6	VI	VI
11/13/1976	Southwest Virginia	4.1	VI	VI
05/05/1981	Henderson County, NC	3.5	VI	VI
2020	Sparta, NC			

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).

G.5.7.3 Probability of Future Occurrences

The probability of significant, damaging earthquake events affecting the area surrounding Western Carolina University 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 campus. The annual probability level for the campus 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, and for Jackson County the likelihood was 4 - 5%

G.5.8 GEOLOGICAL

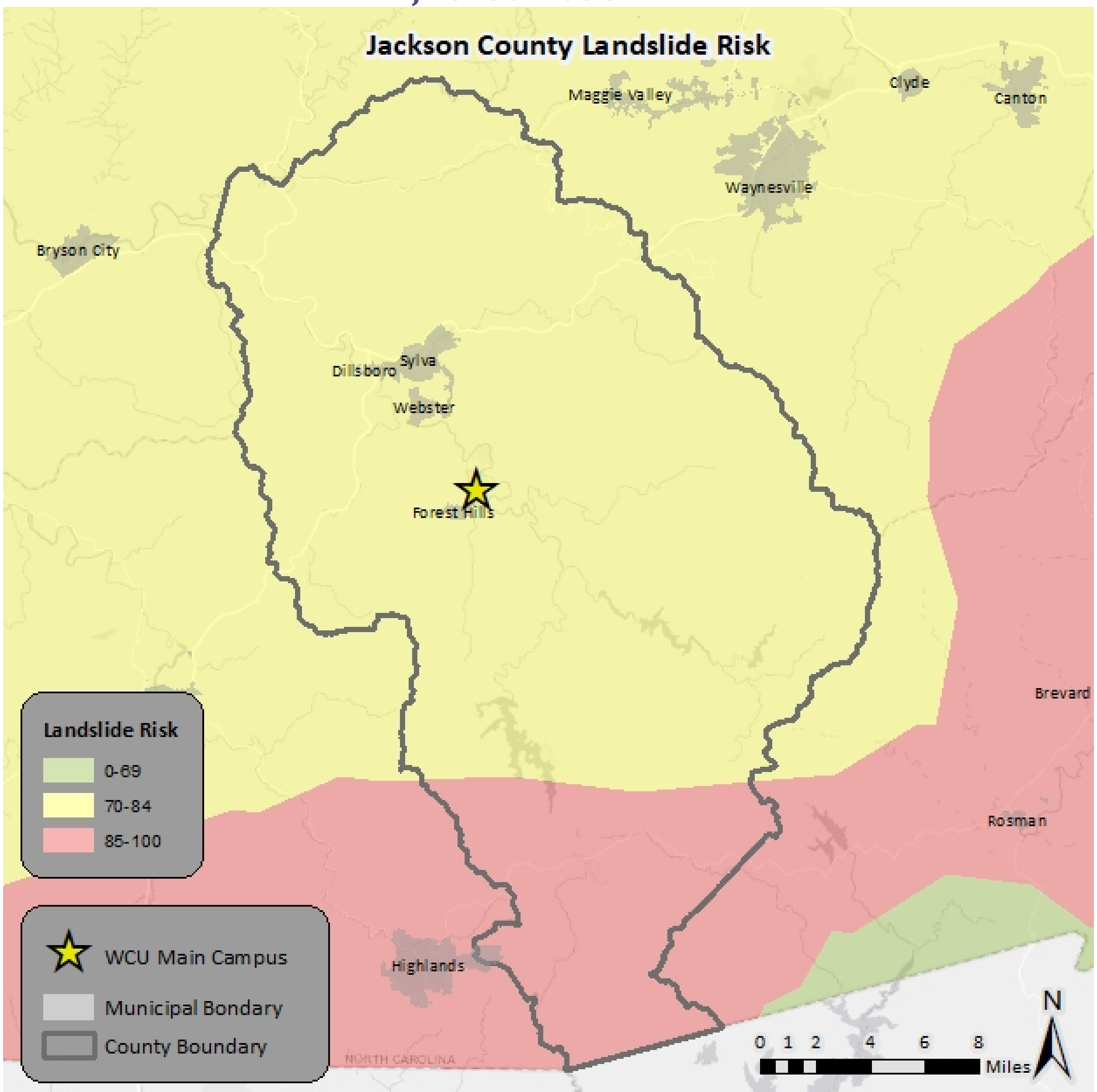
G.5.8.1 Location and Spatial Extent

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 Blue Ridge Mountains, making areas near Western Carolina University susceptible to them as well.

According to **Figure G.10** below, much of Jackson County, has moderate to high risk to landslides.

FIGURE G.10: LANDSLIDE SUSCEPTIBILITY AND INCIDENCE MAP OF JACKSON COUNTY



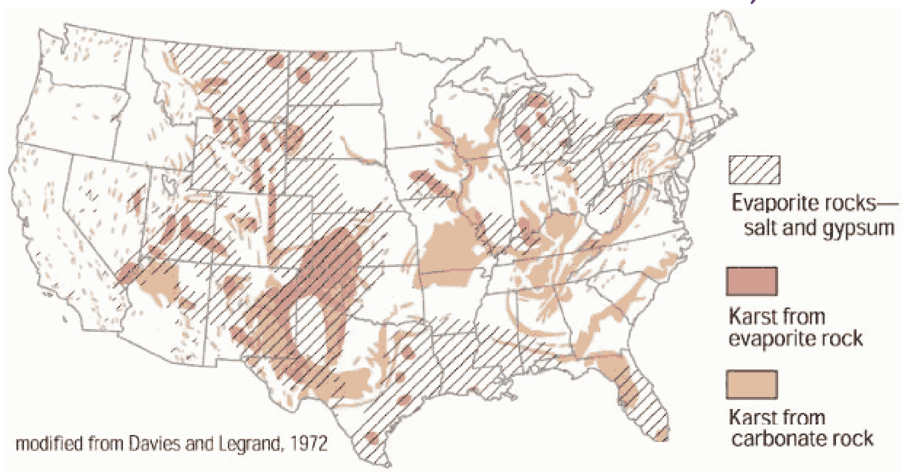
Source: United States Geological Survey

Sinkholes

Figure G.11 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 G.11: UNITED STATES GEOLOGICAL SURVEY OF KARST MODIFIED FROM DAVIES AND LEGRAND, 1972



Erosion

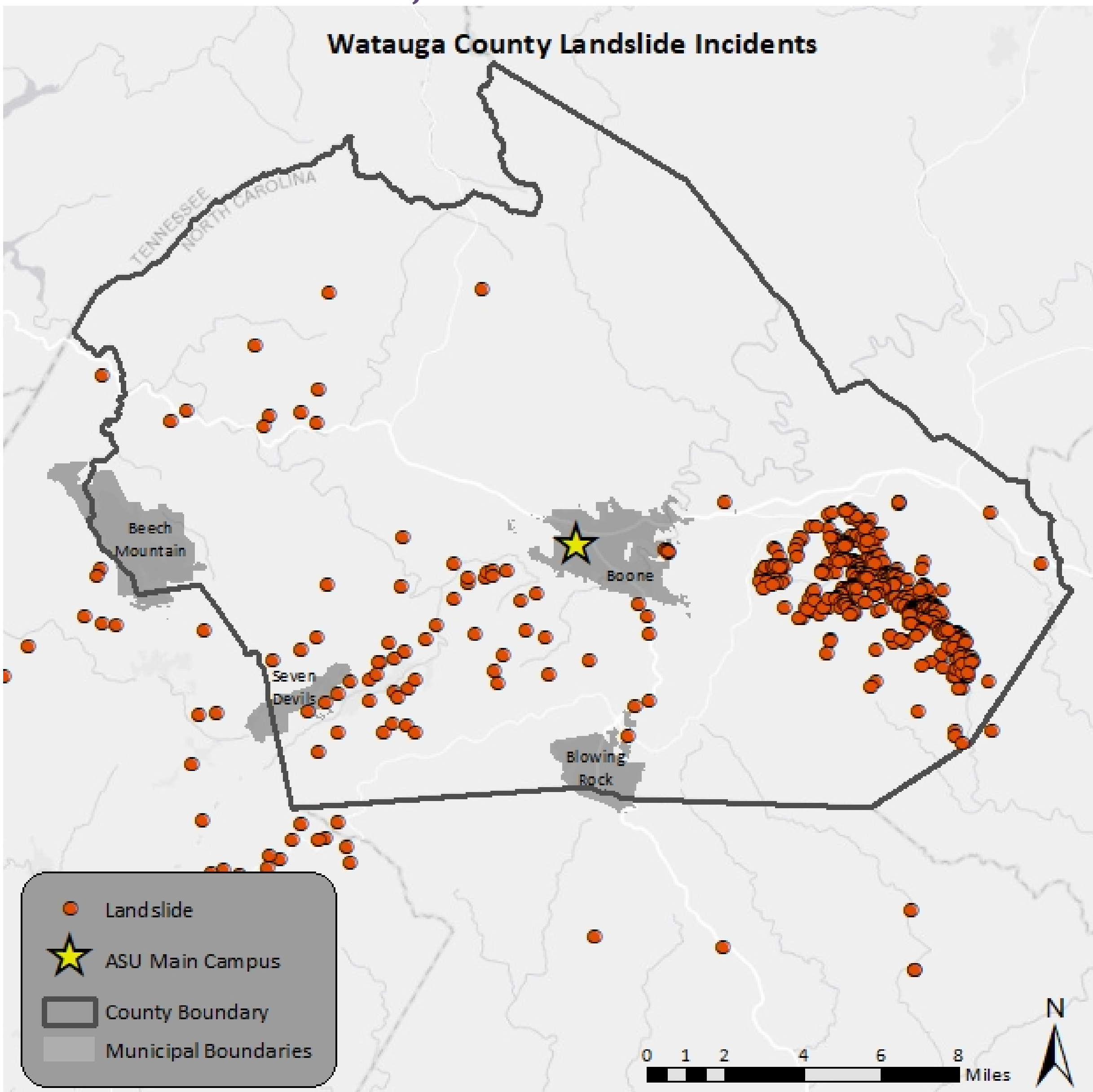
Erosion on the Western Carolina University campus is typically caused by flash flooding events. Unlike coastal areas, where the soil is mainly composed of fine-grained particles such as sand, Jackson County soils have much greater organic matter content. Furthermore, vegetation also helps to prevent erosion in the area. Erosion occurs on the Western Carolina University campus, particularly along the banks of rivers and streams, but it is not an extreme threat to any of the buildings on campus. No areas of concern were reported by the Campus Hazard Mitigation Planning Team.

G.5.8.2 Historical Occurrences

Landslides

Steep topography in the area surrounding Western Carolina University 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 around Western Carolina University as provided by the North Carolina Slope Movement-Slope Movement Deposit Database (NCSM_SMD database) are presented in **Figure G.12.** While some incidence mapping has been completed throughout the western portion of North Carolina, it is not complete; therefore, it should be noted that many more incidents than what is reported are likely to have occurred in the area.

FIGURE G.12: LOCATION OF PREVIOUS LANDSLIDE OCCURRENCES IN JACKSON COUNTY



Source: North Carolina Geological Survey

Sinkholes

In North Carolina, most sinkholes occur in the southern coastal plain due to the high concentration of limestone. They are fairly uncommon in the western part of the state and in Jackson County.

Erosion

Most historical occurrences of erosion are seen near the coast of North Carolina, but Western Carolina University is still susceptible to the hazard. Several sources were vetted to identify areas of erosion at Western Carolina University. This includes searching local newspapers, interviewing local officials, and reviewing previous hazard mitigation plans. Jackson County have previous mitigation actions that address erosion including bank stabilization and meeting erosion control requirements. Such actions will continue to be implemented as necessary throughout the region. Erosion was referenced in the previous Western Carolina University 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.

G.5.8.3 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 steep slopes and heavy rain, for example. This would increase the likelihood of occurrence. It should also be noted that some areas of the Western Carolina University campus 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 in Jackson County. While many sinkholes have been relatively small, it is still unlikely (between 1 and 33.3 percent annual probability) that the campus will continue to be affected in the future.

Erosion

Erosion remains a natural, dynamic, and continuous process for Western Carolina University, 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*.

G.5.9 DAM FAILURE

G.5.9.1 Location and Spatial Extent

The North Carolina Division of Energy, Mineral and 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 G.19** explains these classifications.

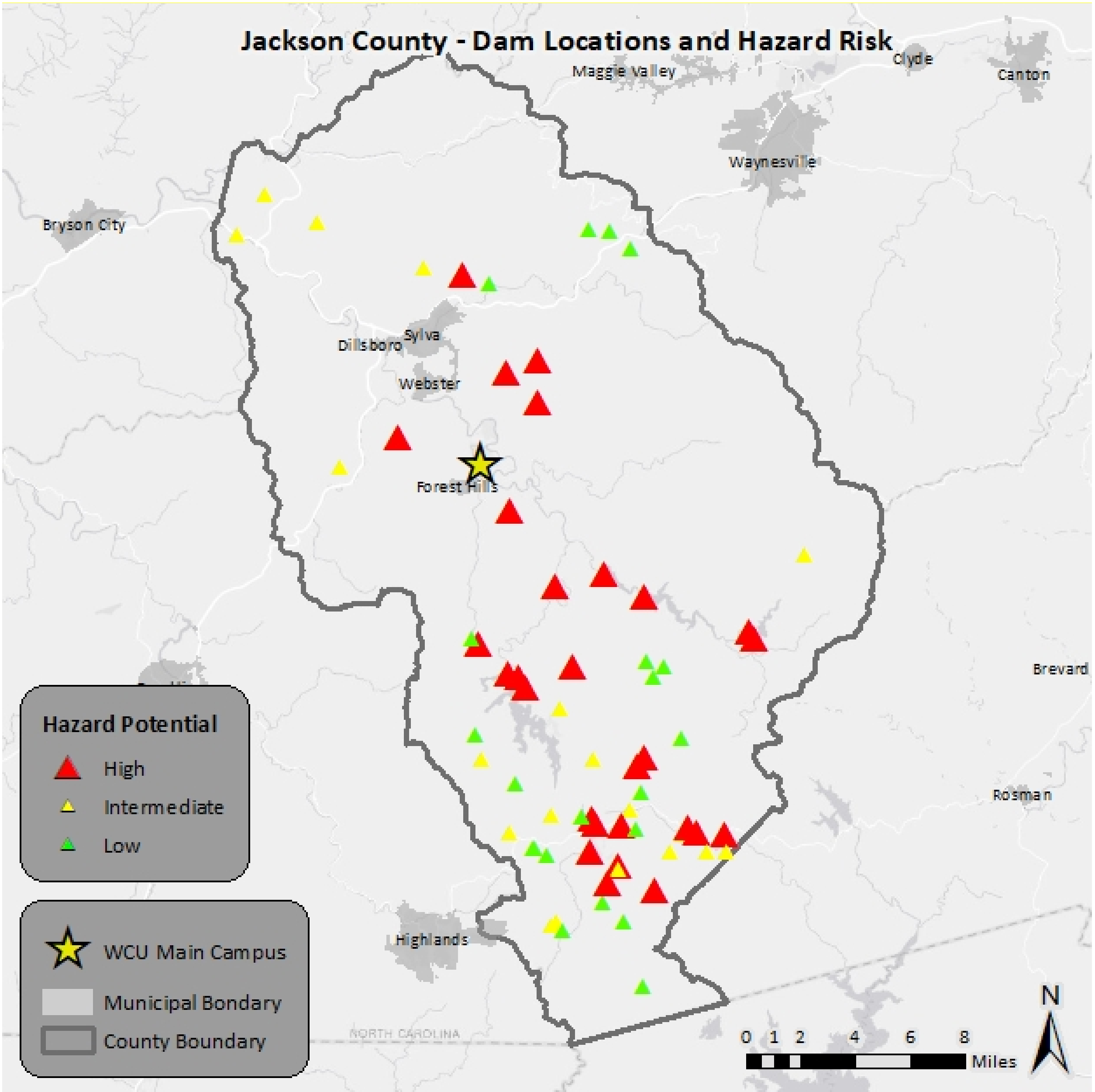
TABLE G.19: NORTH CAROLINA DAM HAZARD CLASSIFICATIONS

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 Management, there are 69 dams in Jackson County. **Figure G.13** shows the dam location and the corresponding hazard ranking for each. Of these dams, 28 are classified as high hazard potential. These high hazard dams are listed in **Table G.20**. The two high hazard dams that are located closest to WCU are the McGuire Lake Dam and the Hefner Dam. According to a consensus of the Campus Hazard Mitigation Planning Team, there is an extremely low possibility that any of these state-recognized dams would cause any damage whatsoever to Western Carolina University should a dam breach or failure occur, despite the hazard classifications assigned to these dams by the state.

FIGURE G.13: JACKSON COUNTY DAM LOCATION AND HAZARD RANKING



Source: North Carolina Division of Land Resources

TABLE G.20: JACKSON COUNTY HIGH HAZARD DAMS

Dam Name	Hazard Potential	Surface Area (acres)	Max Capacity (Ac-ft)
Jackson County			
Cashiers Lake Dam	High	24.8	379
Hampton Lake Dam	High	14.7	280
Hogback Dam	High	23.0	391
Trout Lake Dam	High	7.5	82
Tuckasegee Lake Dam	High		183
Wolf Creek Lake Dam	High		14,361
East Fork Dam	High		906
Bear Creek Dam	High		34,711
Cedar Cliff Dam	High		7,000
Thorpe Lake Dam #1	High		70,800
Thorpe Lake Dam #2	High		70,800
Frady Cove Estates	High	2.3	31
Hodge Dam	High	0.6	5
Sapphire Valley Golf Course Dam	High	1.7	15
Laurel Lake Dam	High	3.5	50
Wolf Lake	High	3.0	37
Mcguire Lake Dam	High	2.6	45
Hefner Dam	High		0
Lancewood Dam	High	2.5	20
Fairfield Lake Dam	High	183.0	3,015
Connelly Dam	High		0
Hanks Dam	High	15.0	125
Stigler Dam	High	1.2	0
Silver Springs Dam	High	7.4	65
Breedlove Dam	High	1.0	8
Pine Creek Dam	High	1.0	8
Moody Bridge Partners Dam	High		
Town of Sylva Water Supply	High	1.5	17

Source: North Carolina Division of Land Resources

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

G.5.9.2 Historical Occurrences

According to information from the North Carolina Division of Energy, Mineral and Land Resources, there have been no dam breaches in Jackson County.

G.5.9.3 Probability of Future Occurrence

Given the current dam inventory and historic data, a dam breech is possible (between 1 and 10 percent annual probability) in the future. However, with regular monitoring, these events can be prevented as has been demonstrated in the past.

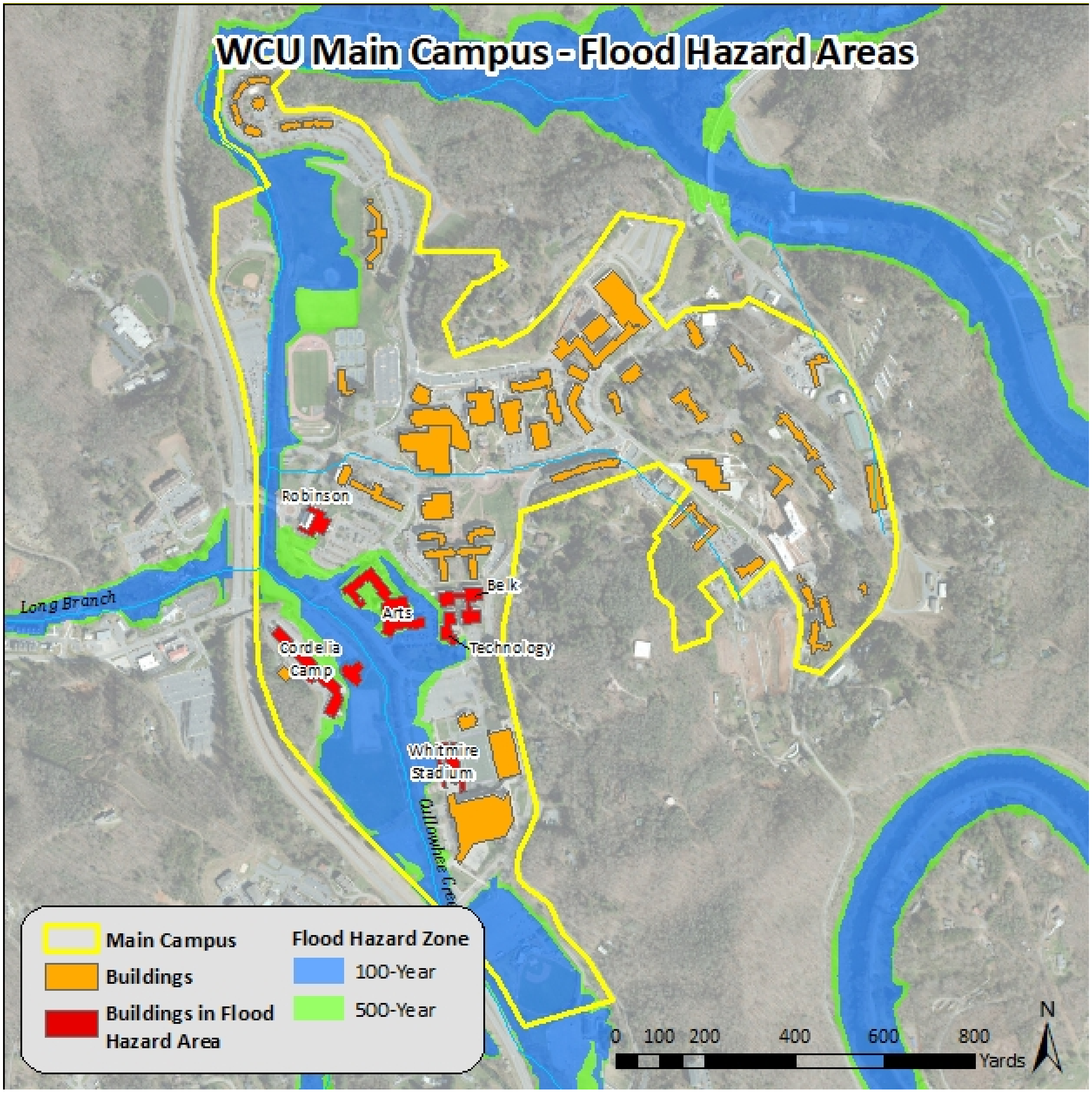
Inventories of statewide dam inundation data is an area that NCEM-RM is currently working hard to improve. At this time, there is geospatial data in final quality control review for 19 dams in North Carolina and that number is expected to increase significantly over the next several years. Additionally, NCEM is currently working with the USACE to acquire inundation data for 9 dams under the Corps' management. As this data becomes available, detailed assessments can be run to better determine vulnerability to dam failures. The 2025 update of this plan may include a much more robust analysis of dam failure vulnerability at the County level.

G.5.10 FLOODING

G.5.10.1 Location and Spatial Extent

There are areas on the Western Carolina University campus that are susceptible to flooding from Cullowhee Creek. Special flood hazard areas on the Western Carolina University campus were mapped using Geographic Information System (GIS) and FEMA Digital Flood Insurance Rate Maps (DFIRM). This includes the 1-percent annual chance floodplain (100-year), and the 0.2-percent annual chance floodplain (500-year). **Figure G.14** illustrates the location and extent of currently mapped special flood hazard areas for the campus based on best available FEMA DFIRM data from April 2010. 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 G.14: SPECIAL FLOOD HAZARD AREAS ON THE WESTERN CAROLINA UNIVERSITY CAMPUS



Source: Federal Emergency Management Agency

Seven of the buildings on campus were found to lie in a special flood hazard area. A list of these buildings can be seen in **Table G.21.**

TABLE G.21: WCU BUILDINGS IN THE FLOODPLAIN

Building Name	Building Type	100-Year	500-Year
Robinson			X
Whitmire Stadium – West Stands		X	X
Center for Applied Technology			X
Belk			X
Fine and Performing Arts		X	X
Cordelia Camp			X
Cordelia Camp Gymnasium		X	X
Total Number of Buildings:		**3**	**7**

G.5.10.2 Historical Occurrences

The National Centers for Environmental Information reported a total of 39 events throughout Jackson County since 1996[9]. A summary of these events is presented in **Table G.22**. These events accounted for $1.078 million in property damage throughout the county.

TABLE G.22: MAJOR FLOOD OCCURRENCES IN JACKSON COUNTY

Area	Date	Type	Property Damage	Crop Damage	Description
NORTHERN JACKSON (ZONE)	1/18/1996	Flood	$0	$0	An extremely strong cold front, preceded by heavy rain all day, moved through the mountains, foothills and piedmont during the night. Heavy rain and flooding accompanied the storm system. Several inches of rain fell across the mountains during the day. At Rosman, the French Broad River flooded causing some evacuations in the downtown area.
NORTHERN JACKSON (ZONE)	1/26/1996	Flood	$0	$0	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.
SYLVA	4/29/1996	Flash Flood	$0	$0	Heavy rain caused small streams to flood and caused mud slides.
PUMPKINTOWN	6/19/1996	Flash Flood	$0	$0	A few trees were blown down at Statesville. A sudden flash flood in Jackson county caused creeks to overflow and caused mudslides.
NORTHERN JACKSON (ZONE)	9/28/1996	Flood	$0	$0	

[9] These events are only inclusive of those reported by NCEI. It is likely that additional occurrences have occurred and have gone unreported.

SYLVA	2/28/1997	Flash Flood	$0	$0	
EAST OF SYLVA	2/28/1997	Flash Flood	$0	$0	Jonathan, Cove and Scott creeks and other small streams flooded quickly after thunderstorms dumped heavy rainfall on saturated ground. No serious property damage was reported although some roads were closed.
CASHIERS	7/23/1997	Flash Flood	$0	$0	A private dam overflowed in response to heavy rain as the remnants of Hurricane Danny moved across.
SOUTH PORTION	6/21/1998	Flash Flood	$0	$0	A few storms became severe as they moved east across the southern mountains during the early afternoon. A tree fell on a car and others were blocking a road in Macon county. In addition to downed trees in Cashiers, excessive rain in a short period of time caused flash flooding across the southern part of Jackson county that resulted in a bridge on Hwy 281 being washed out.
SYLVA	8/7/2001	Flash Flood	$0	$0	
SOUTHERN JACKSON (ZONE)	5/6/2003	Flood	$0	$0	An extended period of heavy rainfall resulted in gradual rises, mainly along small creeks and streams. Flooding developed during the early morning hours of the 6th across southern and western portions of the counties.
NORTHERN JACKSON (ZONE)	5/6/2003	Flood	$0	$0	An extended period of heavy rainfall resulted in gradual rises, mainly along small creeks and streams. Flooding developed during the early morning hours of the 6th across southern and western portions of the counties.
NORTH PORTION	5/6/2003	Flash Flood	$50,000	$0	Numerous thunderstorms producing very heavy rainfall resulted in rapid rises and flash flooding along creeks and streams in area in and around the Cherokee Indian Reservation. Most creeks around the reservation flooded. The high water caused damage to numerous homes. Many bridges and campgrounds were washed away. Several rock slides and mudslides resulted in closure of major highways as well as side roads.
NORTH PORTION	5/7/2003	Flash Flood	$100,000	$0	
NORTHERN JACKSON (ZONE)	5/7/2003	Flood	$0	$0	Although flash flooding abated by noon across the southern mountains, many creeks and streams remained above flood stage through the afternoon hours.
SOUTHERN JACKSON (ZONE)	5/7/2003	Flood	$0	$0	Although flash flooding abated by noon across the southern mountains, many creeks and streams remained above flood stage through the afternoon hours.
CASHIERS	9/1/2003	Flash Flood	$0	$0	
SOUTHERN JACKSON (ZONE)	11/19/2003	Flood	$0	$0	
CULLOWHEE	5/8/2004	Flash Flood	$0	$0	
CASHIERS	5/22/2004	Flash Flood	$20,000	$0	
SYLVA	7/25/2004	Flash Flood	$100,000	$0	

NORTHERN JACKSON (ZONE)	9/7/2004	Flood	$100,000	$7,000	Flooding developed in the early evening in areas near the Blue Ridge, from Highlands to Cashiers, then quickly spread to include locations such as Cullowhee, Bryson City, and Cherokee. Jackson and southern Macon counties were the hardest hit, as numerous creeks and streams flooded, including the Little Tennessee River. Several homes and businesses were damaged and a few private dams were breached or damaged in Macon County. Several sections of highway 281 were washed out in Jackson County. By early morning of the 8th, flood gates were open on all Jackson County dams, and numerous rescues and evacuations were underway.
SOUTHERN JACKSON (ZONE)	9/7/2004	Flood	$100,000	$7,000	Flooding developed in the early evening in areas near the Blue Ridge, from Highlands to Cashiers, then quickly spread to include locations such as Cullowhee, Bryson City, and Cherokee. Jackson and southern Macon counties were the hardest hit, as numerous creeks and streams flooded, including the Little Tennessee River. Several homes and businesses were damaged and a few private dams were breached or damaged in Macon County. Several sections of highway 281 were washed out in Jackson County. By early morning of the 8th, flood gates were open on all Jackson County dams, and numerous rescues and evacuations were underway.
NORTHERN JACKSON (ZONE)	9/16/2004	Flood	$250,000	$0	After an extended period of moderate to heavy rainfall, flooding began in Jackson County during the late evening. Cope Creek was the first stream to flood, and evacuations became necessary along the creek. Evacuations also occurred along the Tuckasegee River, as flooding became quite severe overnight, exceeding the magnitude of the flood associated with Frances only 9 days earlier. Severe flooding also occurred along Scotts Creek, Caney Fork, and Cullowhee Creek. Scotts Creek covered Front Street in Dillsboro with 3 to 4 feet of water. Several landslides occurred, one of which destroyed several storage units at Lake Glenville. Large sections of some roads were washed out by slides or flood water, including portions of highways 19A, 281, 64, and 107, all of which were closed for long periods.
SOUTHERN JACKSON (ZONE)	9/16/2004	Flood	$250,000	$0	After an extended period of moderate to heavy rainfall, flooding began in Jackson County during the late evening. Cope Creek was the first stream to flood, and evacuations became necessary along the creek. Evacuations also occurred along the Tuckaseegee River, as flooding became quite severe overnight, exceeding the magnitude of the flood associated with Frances only 9 days earlier. Severe flooding also occurred along Scotts Creek, Caney Fork, and Cullowhee Creek. Scotts Creek covered Front Street in Dillsboro with 3 to 4 feet of water. Several landslides occurred, one of which destroyed several storage units at Lake Glenville. Large sections of some roads were washed out by slides or flood water, including portions of highways 19A, 281, 64, and 107, all of which were closed for long periods.
NORTHERN JACKSON (ZONE)	6/12/2005	Flood	$0	$0	
SOUTHERN JACKSON (ZONE)	6/12/2005	Flood	$0	$0	

CULLOWHEE	6/20/2005	Flash Flood	$0	$0	
TUCKASEGEE	7/20/2005	Flash Flood	$0	$0	
SYLVA	8/22/2005	Flash Flood	$0	$0	
SYLVA	7/26/2007	Flash Flood	$50,000	$0	Stationary thunderstorms produced localized flash flooding over the North Carolina mountains during the late afternoon and evening hours.
EAST LAPORT	8/26/2008	Flash Flood	$0	$0	The remnants of Tropical Storm Fay stalled just west of the Appalachian Mountains, resulting in a prolonged, moist south to southeasterly flow over western North Carolina. During the early morning hours of Wed, August 27th, rainfall became especially heavy over the western North Carolina Piedmont as the southerly winds were lifted over a weak stationary front. Storm total rainfall in this area averaged 8 to 10 inches, with locally higher amounts, resulting in significant urban and stream flooding.
SYLVA	5/16/2009	Flash Flood	$5,000	$0	Slow moving thunderstorms produced a few areas of flash flooding for a third straight day over western North Carolina. A couple reports of large hail were also received.
ADDIE	9/21/2009	Flood	$0	$0	A third round of heavy rain in two days over the southern North Carolina Mountains caused the French Broad River to go into flood west of Hendersonville. The prolonged heavy rain also caused many streams to flood, closing several roads across the southern mountains.
WILMOT	1/15/2013	Flood	$0	$0	
DILLSBORO	1/15/2013	Flood	$0	$0	A deep long wave trough developed over the western states around January 10th. . Heavy rain periodically fell from late on the 13th through the evening hours of the 17th. The trough eventually filled, but not before a trailing southern stream upper low brought a last shot of heavy rain to the region during the overnight hours over the 17th. The rain changed to snow in some areas before ending. The prolonged heavy rain resulted is several landslides across the North Carolina mountains. Roads and homes were damaged by these debris flows. While several instances of stream and main-stem river flooding were reported, the prolonged nature of the rainfall kept the flooding from becoming more extensive or damaging than it otherwise would have been.
BARKERS CREEK	12/24/2015	Flash Flood	$2,000	$0	After a couple of days of moderate rain acted to saturate the soil across the mountains, foothills, and western Piedmont of North Carolina, a round of heavier rain on the 24th resulted in flooding and flash flooding.
TUCKASEGEE	12/29/2015	Flood	$50,000	$0	Heavy rain developed during the late evening and early morning hours across the mountains and foothills along and ahead of a cold front. Two to four inch rainfall amounts occurred in just a few hours across portions of the southern mountains and foothills. This amount of rainfall combined with wet soils and elevated stream levels caused by multiple recent rain events to produce localized flash flooding and flooding across the area.

SYLVA	4/19/2019	Flash Flood	$1,000	$0	A large area of moderate to heavy rain showers, along with embedded clusters of strong to severe thunderstorms moved slowly across western North Carolina throughout the morning and into the afternoon of the 19th ahead of a slow-moving cold front. Some of the storms produced a couple of isolated, weak tornadoes and locally damaging winds. However, the larger impact was from flash flooding resulting from a swath of 4 to 7 inches of rain that fell across portions of the mountains.

Source: National Centers for Environmental Information

TABLE G.23: SUMMARY OF FLOOD OCCURRENCES

Location	Number of Occurrences	Deaths / Injuries	Property Damage (2020)
Dillsboro	1	0/0	$0
Sylva	8	0/0	$0
Webster	0	0/0	$0
Forest Hills	0	0/0	$0
Unincorporated Areas	30	0/0	$1,078,000
Jackson County Total	**39**	**0/0**	**$1,078,000**

Source: National Centers for Environmental Information

G.5.10.3 Probability of Future Occurrences

Flood events will remain a threat to Western Carolina University, and the probability of future occurrences will remain possible (between 1 and 10 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).

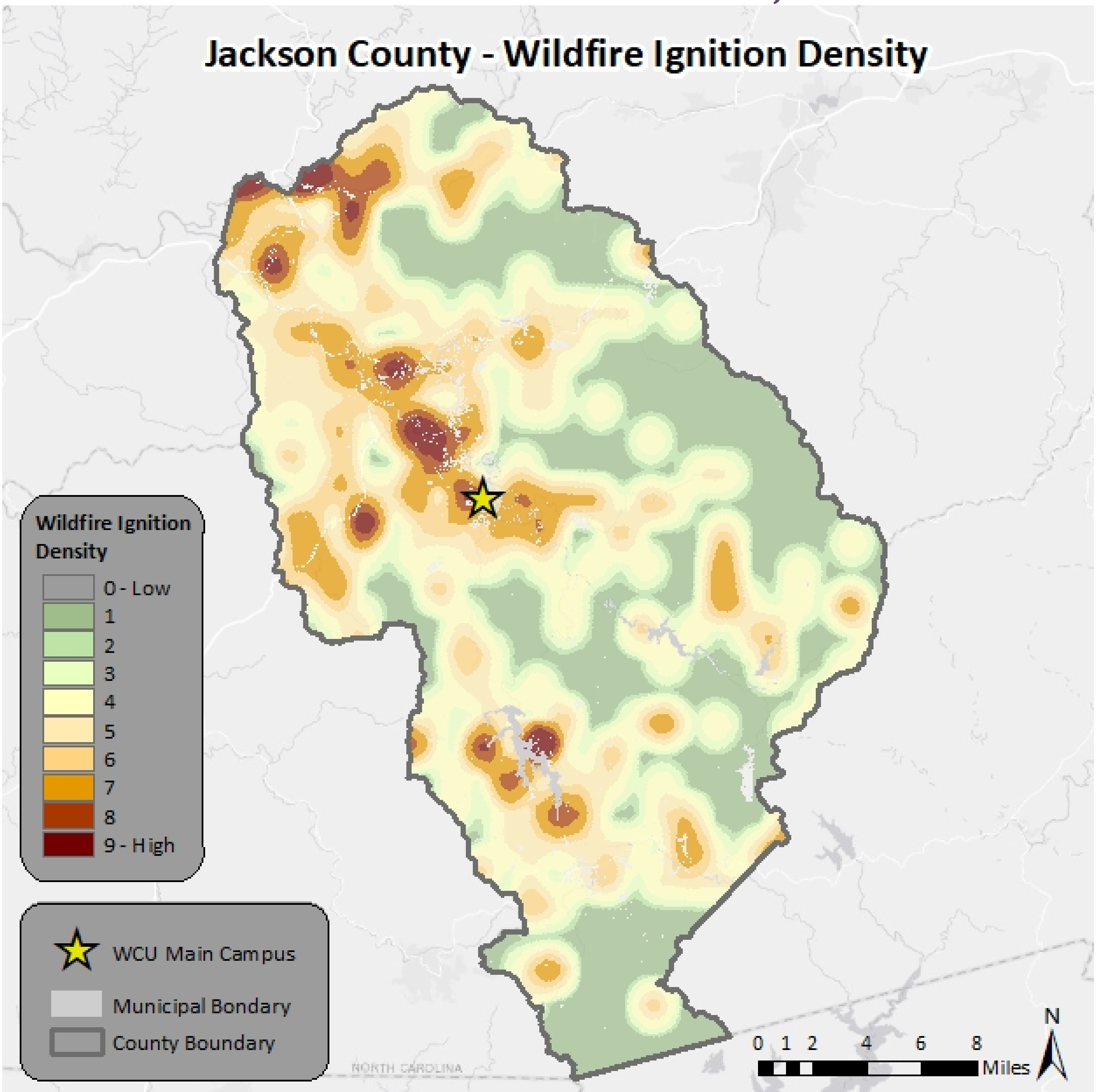
G.5.11 WILDFIRES

G.5.11.1 Location and Spatial Extent

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

Figure G.15 shows the Wildfire Ignition Density for Jackson County 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.

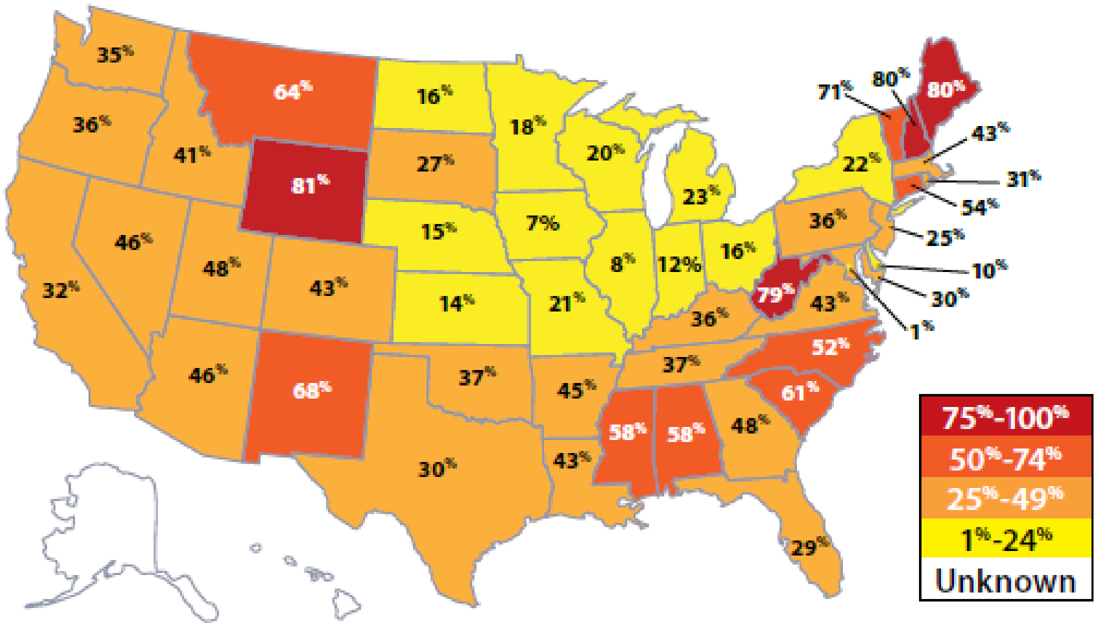
FIGURE G.15: WILDFIRE IGNITION DENSITY IN JACKSON COUNTY



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 G.16** 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.

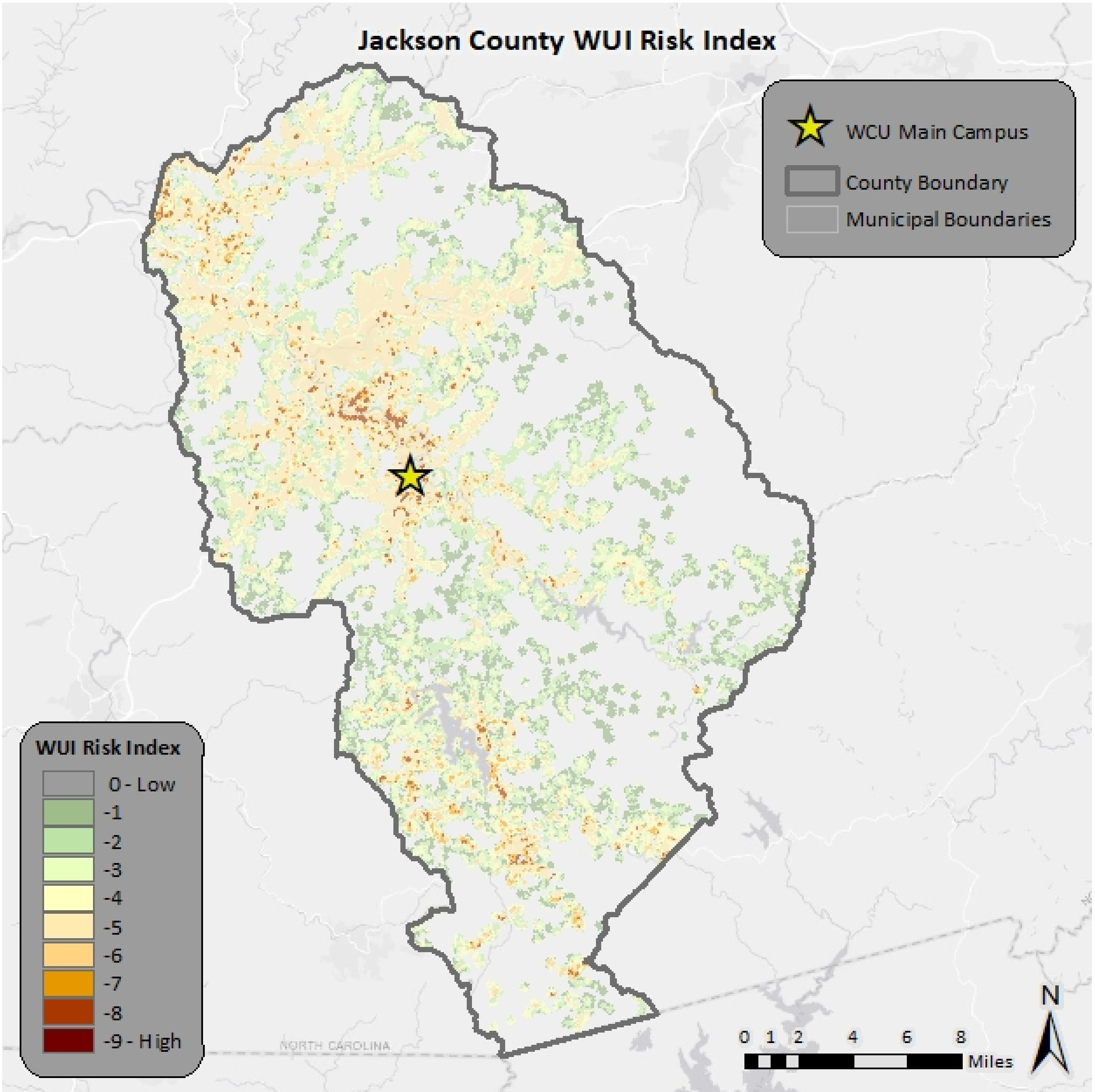
FIGURE G.16: % OF HOMES IN THE WILDLAND URBAN INTERFACE



Source: US Department of Agriculture

Below, **Figure G.17** displays the WUI Risk Index specifically for Jackson County.

FIGURE G.17: WCU WUI RISK INDEX



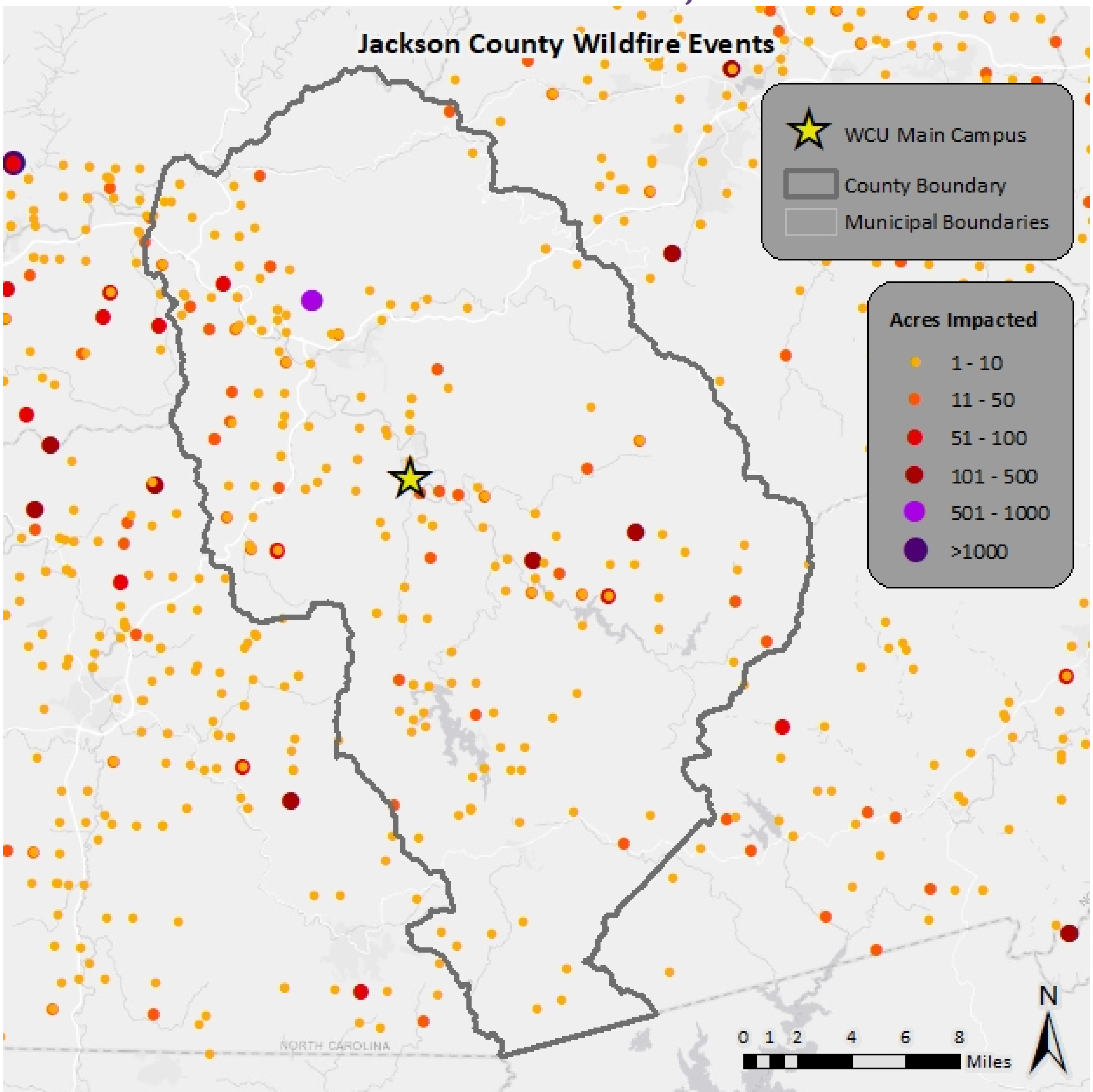
Source: Southern Wildfire Risk Assessment

G.5.11.2 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 # events that impacted an area greater than 1 acre have occurred throughout Jackson County[10]. **Figure G.18** displays wildfire events in Jackson County.

[10] These events are only inclusive of those reported by NASFI. It is likely that additional events have occurred and have gone unreported.

FIGURE G.18: WILDFIRE EVENTS IN JACKSON COUNTY



Source: NASFI

Based on data from the North Carolina Division of Forest Resources from 2003 to 2018, the Western Carolina University 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.

There is one incident of wildfire in the National Centers for Environmental Information database for Jackson County. The event occurred on February 14, 2011 and was caused by a fallen tree onto an electrical line which caused a wildfire to break out in the Green Briar/ Rocky Knob area of Jackson County. The winds, gusting as high as 62 mph at the Cullowhee airport (KNTB), combined with low relative humidity to fan the fire. About 60 to 100 acres were burned but no homes were damaged. High winds and falling humidity behind a cold front were blamed for either causing or aggravating wildfires that broke out in several North Carolina counties.

G.5.11.3 Probability of Future Occurrences

Wildfire events will be an ongoing occurrence in Jackson County and for Western Carolina University. 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 Western Carolina University for future wildfire events are likely (10 to 100 percent annual probability).

G.5.12 INFECTIOUS DISEASE

G.5.12.1 Location and Spatial Extent

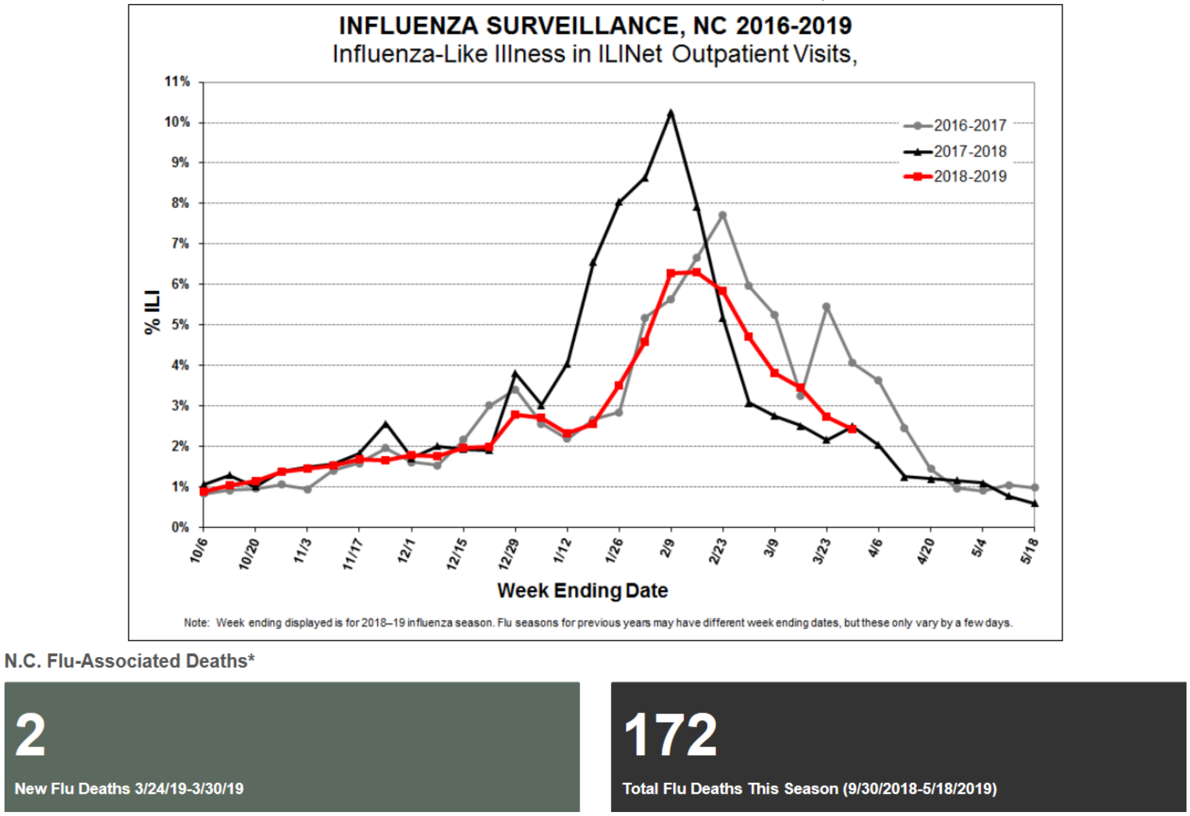
Extent is difficult to measure for an infectious disease event as the extent is largely dependent on the type of disease and on the effect that it has on the population. Extent can be somewhat defined by the number of people impacted, which depending on the type of disease could number in the tens of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

G.5.12.2 Historical Occurrences

Infectious Disease

Influenza is historically the most common infectious disease that has occurred in Jackson County. Cases of the flu tend to occur in the late fall to early winter months. In recent years, cases of the influenza and influenza-like illnesses have been reported in hospitals. As seen in **Figure G.19** below, 172 people throughout North Carolina died from the flu between 2018 and 2019.

FIGURE G.19: INFLUENZA SURVEILLANCE, NC 2016-2019



Source: NC Department of Health and Human Services

Starting in 2020, the COVID-19 infectious disease pandemic began to impact North Carolina and Jackson County. The NC Department of Health and Human Services has been actively monitoring and tracking cases since the first case arrived in the State. A Presidential disaster declaration was declared for North Carolina on March 24, 2020 for the COVID-19 pandemic. **Table F.24** provides a summary of confirmed cases of COVID–19 in Jackson County as of the date of the final version of this plan in 2021. The COVID-19 pandemic is still evolving even though vaccines have been created that are slowing the spread. The pandemic unfolded as this plan was being developed, so the information below presents only a small sample of the pandemic's impacts on Jackson County. On April 27, 2020, the UNC System made the decision to postpone in-person classes for the remainder of the school year. As a result, WCU and all other universities in North Carolina, shifted to online courses. Due to Executive Order 135, which extended the existing statewide stay-at-home order through May 8, 2020; college campuses were asked to vacate any on-campus university housing.

TABLE G.24: SUMMARY OF CONFIRMED COVID – 19 CASES IN JACKSON COUNTY

Location	Number of Cases	Number of Deaths*
Jackson County	**3601**	**56**

Source: North Carolina Department of Health and Human Services as of 5/14/21

** Deaths reflect deaths in persons with laboratory-confirmed COVID-19 reported by local health departments to the 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[11].

G.5.12.3 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 Western Carolina University will experience an outbreak of infectious diseases in the future.

TECHNOLOGICAL HAZARDS

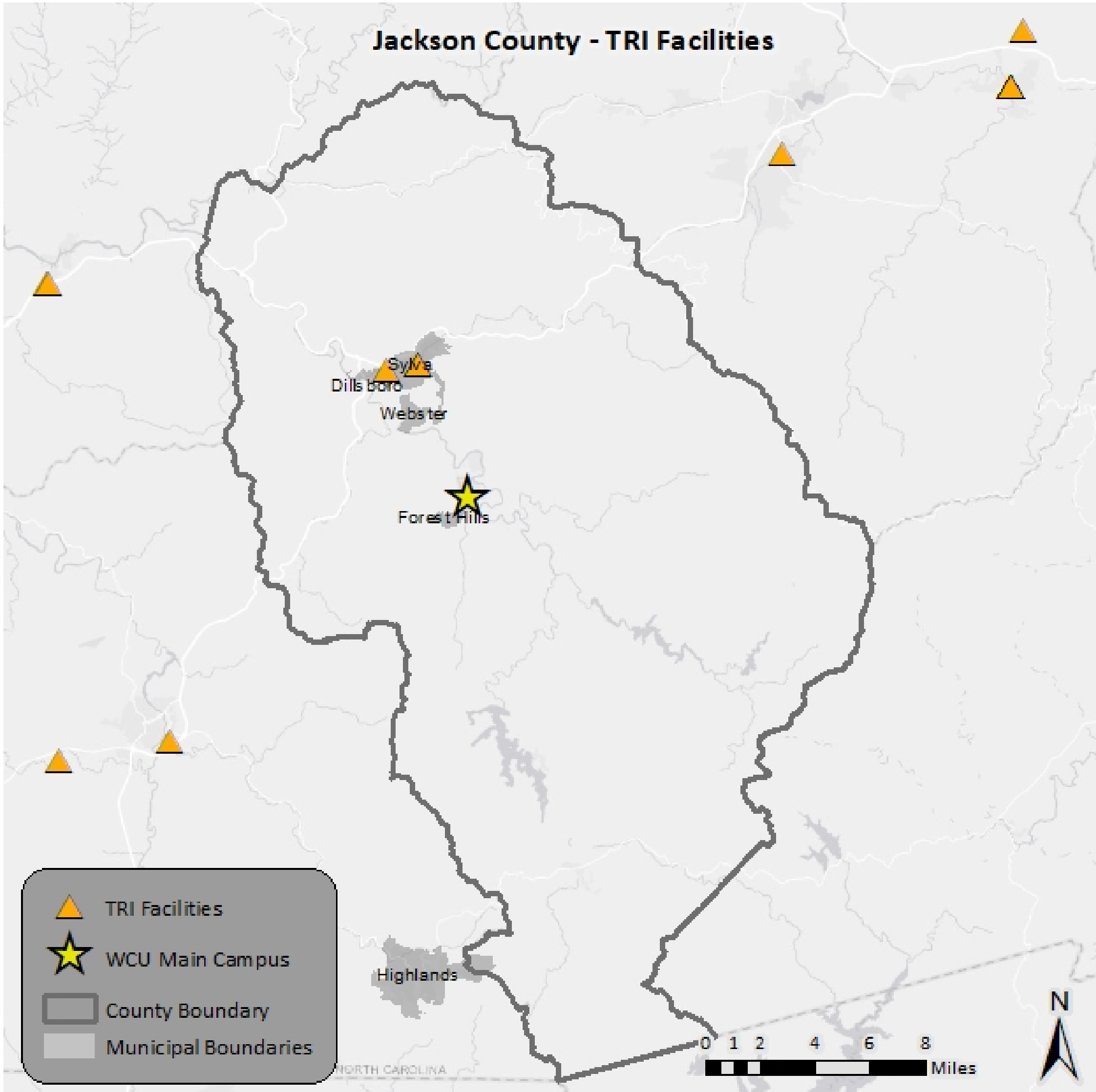
G.5.13 HAZARDOUS SUBSTANCES

G.5.13.1 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 collection information from industrial facilities on the releases and transfers of certain toxic agents. This information is then reported in the Toxic Release Inventory (TRI). TRI sites indicate where such activity is occurring. A map for Jackson County TRI Facilities is shown in **Figure G.20.**

[11] https://www.ncdhhs.gov/news/press-releases/nc-prepared-zika-virus-risk-local-virus-carrying-mosquitoes-low

FIGURE G.20: TOXIC RELEASE INVENTORY (TRI) SITES



Source: EPA

G.5.13.2 Historical Occurrences

The U.S. Department of Transportation Pipeline and Hazard 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.

The Pipeline and Hazardous Materials Safety Administration (PHMSA) is an agency of the United States Department of Transportation that was established in 2004. The PHMSA maintains a database of hazardous materials incidents for communities across the United States. Summary results of their data for events that have occurred in Jackson County can be found in **Table G.25.**

TABLE G.25: SUMMARY OF HAZMAT INCIDENTS IN JACKSON COUNTY

Location	Incidents Reported	Injuries	Fatalities	Type	Costs
Dillsboro	0	0	0	N/A	$0
Sylva	6	0	0	Highway	$0
Webster	0	0	0	N/A	$0
Forest Hills	0	0	0	N/A	$0
Unincorporated Areas	2	0	0	Highway	$2,115
Jackson County	**8**	**0**	**0**		**$2,115**

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

G.5.13.3 Probability of Future Occurrence

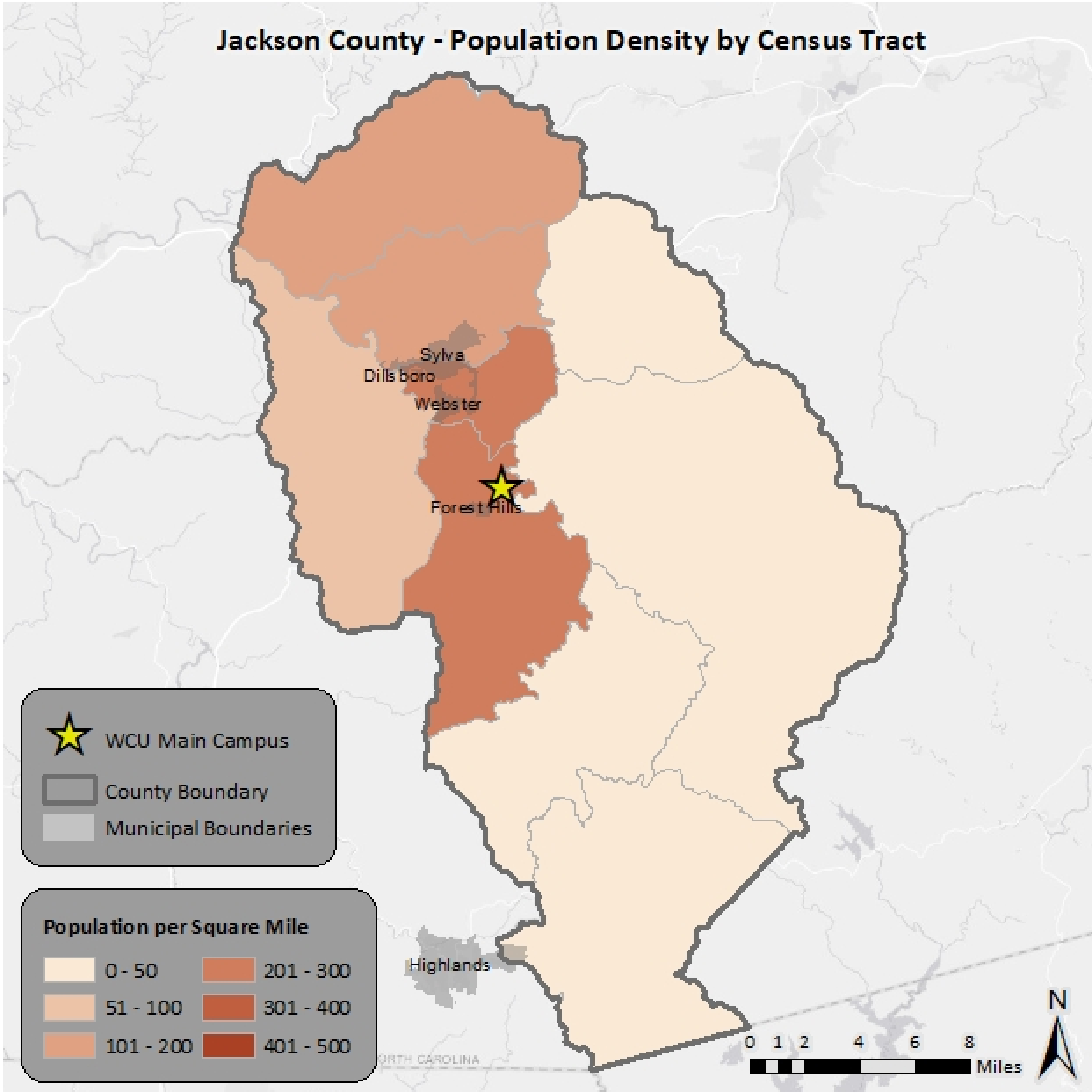
Given the location of toxic release inventory sites in Jackson County, it is possible that a hazardous material incident may occur. University officials are mindful of this possibility and take precautions to prevent such an event from occurring.

G.5.14 TERRORISM

G.5.14.1 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 G.21** displays the population density in Jackson County using census tract levels.

FIGURE G.21: POPULATION DENSITY



Source: US Census Bureau

Furthermore, the most recent population counts of each participating county and jurisdictions can be seen in **Table G.26** below.

TABLE G.26: 2018 POPULATION ESTIMATES FOR JACKSON COUNTY

Location	2018 Population Estimate
Dillsboro	248
Sylva	2,738
Webster	387
Forest Hills	374
Unincorporated Area	39,580
Jackson County Total	**43,327**

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

G.5.14.2 Historical Occurrences

No extreme cases of terror attacks have previously affected Jackson County or Western Carolina University. However, as the population in the area continues to increase, so does the chance of an attack. There is an ongoing concern on college campuses about active shooter events. Information from the National Center on Safe and Supportive Learning Environments, a recent study found between the 2001-2002 and 2015-2016 school years, 437 people were shot in 190 college campus shooting incidents.

G.5.14.3 Probability of Future Occurrence

Neither Jackson County nor Western Carolina University have experienced a 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.

G.5.15 CYBER

G.5.15.1 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. Western Carolina University is susceptible to cyber-attacks.

G.5.15.2 Historical Occurrences

In North Carolina, 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. **Table G.27** displays the North Carolina Cybercrimes and Victim Counts in 2018.

TABLE G.27: NORTH CAROLINA CYBERCRIMES AND VICTIM COUNTS IN 2018

Crime Type by Victim Count			
Crime Type	*Victim Count*	*Crime Type*	*Victim Count*
Advanced Fee	436	Identity Theft	330
BEC/EAC	430	Investment	47
Charity	11	Lottery/Sweepstakes/Inheritance	213
Civil Matter	15	Malware/Scareware/Virus	49
Confidence Fraud/Romance	432	Misrepresentation	148
Corporate Data Breach	39	No Lead Value	246
Credit Card Fraud	306	Non-payment/Non-Delivery	1,647
Crimes Against Children	28	Other	172
Denial of Service/TDos	28	Overpayment	406
Employment	391	Personal Data Breach	1,125
Extortion	1,219	Phishing/Vishing/Smishing/Pharming	947
Gambling	4	Ransomware	29
Government Impersonation	255	Re-shipping	31
Hacktivist	2	Real Estate/Rental	286
Harassment/Threats of Violence	330	Spoofing	430
Health Care Related	9	Tech Support	361
IPR/Copyright and Counterfeit	30	Terrorism	2
Descriptors*			
Social Media	902	Virtual Currency	790

Source: FBI Internet Crime Compliant Center, 2018

Although Western Carolina University has not reported any major catastrophic cyberattacks, the potential to experience one is unpredictable and can happen at any time.

G.5.15.3 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 at Western Carolina University, and it is considered likely (between 10 and 100 percent annual probability) to experience one in the near future.

G.5.16 ELECTROMAGNETIC PULSE

G.5.16.1 Location and Spatial Extent

An EMP can happen in any location, and they are relatively unpredictable. Due to advancing technologies, densely populated areas may be more prone to damages from an EMP. Therefore, Cullowhee and the Western Carolina University campus may be more susceptible.

G.5.16.2 Historical Occurrences

There have been no reports of EMP occurrences at Western Carolina University.

G.5.16.3 Probability of Future Occurrences

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

G.5.17 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.

G.5.17.1 Hazard Extent

Table G.28 describes the extent of each natural hazard identified for Western Carolina University. The extent of a hazard is defined as its severity or magnitude, as it relates to the planning area.

TABLE G.28 EXTENT OF WESTERN CAROLINA UNIVERSITY 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. According to the North Carolina Drought Monitor Classifications, the most severe drought condition is Exceptional. Jackson County has received this ranking (three times) over the nineteen-year reporting period. According to the NOAA, Jackson County has had drought occurrences in six of the last twenty-five years (1995-2019).
Excessive Heat	The extent of excessive heat can be defined by the maximum temperature reached. The highest temperature recorded in Jackson County is 101 degrees Fahrenheit (reported on July 28, 1940).
Hurricane and Coastal Hazards	Hurricane extent is defined by the Saffir-Simpson Scale which classifies hurricanes into Category 1 through Category 5. The greatest classification of hurricane to traverse directly through Jackson County was Hurricane Hugo in 1989 which carried tropical force winds of 85 miles per hour upon arrival.
Tornadoes /Thunderstorms	<u>Tornadoes</u>: Tornado hazard extent is measured by tornado occurrences in the US provided by FEMA as well as the Fujita/Enhanced Fujita Scale. The greatest magnitude reported in Jackson County was an F1 (reported in 1996). <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 Centers for Environmental Information, the strongest recorded wind event in Jackson County was reported on June 22, 2001 at 100 knots (approximately 115 mph). It should be noted that future events may exceed these historical occurrences. <u>Lightning</u>: According to the Vaisala flash density map, Western Carolina University 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.

	Hailstorms: Hail extent can be defined by the size of the hail stone. The largest hail stone reported in Jackson County was 4.0 inches (reported on June 2, 1998). It should be noted that future events may exceed this.
Severe Winter Weather	The extent of winter storms can be measured by the amount of snowfall received (in inches). The greatest 24-hour snowfall was reported in Jackson County was 25 inches reported on January 26, 1920.
Earthquakes	Earthquake extent can be measured by the Richter Scale and the Modified Mercalli Intensity (MMI) scale and the distance of the epicenter to Jackson County. According to data provided by the National Geophysical Data Center, the greatest MMI to impact Jackson County 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.
Geological	Landslide: As noted above in the landslide profile, the landslide data provided by the North Carolina Geological survey is incomplete. This provides a challenge when trying to determine an accurate extent for the landslide hazard. However, when using the USGS landslide susceptibility index, extent can be measured with incidence, which is high throughout most of Jackson County. There is also at least moderate susceptibility throughout a majority of the region. Sinkhole: The western part of North Carolina and Western Carolina University are susceptible to sinkholes; however, there are no historical records of sinkholes in Jackson County. Erosion: The extent of erosion can be defined by the measurable rate of erosion that occurs. There are no erosion rate records available for Jackson County or Western Carolina University.
Dam Failure	Dam failure extent is defined using the North Carolina Division of Land Resources criteria. Of the 30 dams in Jackson County, 18 are classified as high-hazard.
Flooding	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 7 percent of the total land area for Western Carolina University. Flood depth and velocity are recorded via United States Geological Survey stream gages throughout the region. While a gauge does not exist on Western Carolina University's campus, there is one at or near many areas. The greatest peak discharge recorded for the area was reported in July 1916. Water reached a discharge of 28,000 cubic feet per second and the stream gage height was recorded at 22.1 feet. Peak discharge for the gage on the Jackson River near Sugar Grove, NC is in the table below.

	<table><tr><th>Location/Jurisdiction</th><th>Date</th><th>Peak Discharge (cfs)</th><th>Gage Height (ft)</th></tr><tr><td>**Jackson County**</td><td></td><td></td><td></td></tr><tr><td>Jackson River near Sugar Grove, NC</td><td>Jul-16</td><td>28,000</td><td>22.1</td></tr></table>
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 Jackson County. • The greatest number of fires to occur in any year was 25 in 2001. • The greatest number of acres to burn in a single year occurred in 2016 when 1,394 acres were burned. • The largest acres burned in a single incidence occurred in 2016 when 1,379 acres were burned. Although this data lists the extent that has occurred, larger and more frequent wildfires are possible throughout Jackson County.
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 Western Carolina University is susceptible to infectious diseases such as the flu, which kills hundreds of people annually. As of November 1, 2020, the number of COVID-19 cases in Jackson County was 12,027 and the number of deaths related to COVID-19 was 210. On April 27, 2020, the UNC System made the decision to postpone in-person classes for the remainder of the school year. As a result, WCU and all other universities in North Carolina, shifted on online classes. There is no tangible way of determining dollar losses due to the pandemic in Jackson County.
Technological Hazards	
Hazardous Materials Incident	According to USDOT PHMSA, the largest hazardous materials incident reported in Jackson County is 120 LGA released on the highway on January 14, 2016. It should be noted that larger events are possible.
Terrorism	Although no severe terrorism attacks have been reported at Western Carolina University, the entire campus 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 for Western Carolina University. Technology usage, however, is increasing. A cyber-attack could potentially devastate the campus and could have lasting negative impacts.
Electromagnetic Pulse	Electromagnetic Pulse (EMP) occurrences have not taken place at Western Carolina University, 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.

G.5.17.2 Priority Risk Index

In order to draw some meaningful planning conclusions on hazard risk for Western Carolina University, the results of the hazard profiling process were used to generate hazard classifications according to a "Priority Risk Index" (PRI). The purpose of the PRI is to categorize and prioritize all potential hazards for Western Carolina University 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 Western Carolina University to consider as part of their proposed mitigation strategy.

The prioritization and categorization of identified hazards for Western Carolina University 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 Western Carolina University Campus Hazard Mitigation Planning Team in gaining consensus on the determination of those hazards that pose the most significant threat to the campus 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 at Western Carolina University 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[12], as summarized in **Table G.29**. 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:

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

According to the weighting scheme and point system applied, the highest possible value for any hazard is 4.0. When the scheme is applied for Western Carolina University, the highest PRI value is 3.3 (Severe Winter Weather). Prior to being finalized, PRI values for each identified hazard were reviewed

[12] The Campus 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.

and accepted by the members of the Western Carolina University Campus Hazard Mitigation Planning Team.

TABLE G.29: PRIORITY RISK INDEX FOR THE WESTERN CAROLINA UNIVERSITY

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	

PRI Category	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
	Large	Between 50 and 100% of area affected	4	
Warning Time	More than 24 hours	Self-explanatory	1	10%
	12 to 24 hours	Self-explanatory	2	
	6 to 12 hours	Self-explanatory	3	
	Less than 6 hours	Self-explanatory	4	
Duration	Less than 6 hours	Self-explanatory	1	10%
	Less than 24 hours	Self-explanatory	2	
	Less than one week	Self-explanatory	3	
	More than one week	Self-explanatory	4	

G.5.17.3 Priority Risk Index Results

Table G.30 summarizes the degree of risk assigned to each category for all initially identified hazards based on the application of the PRI. Assigned risk levels were based on the detailed hazard profiles developed for this section, as well as input from the Campus Hazard Mitigation Planning Team. The results were then used in calculating PRI values and making final determinations for the risk assessment.

TABLE G.30: SUMMARY OF PRI RESULTS FOR THE WESTERN CAROLINA UNIVERSITY

Hazard	Sub hazard(s) Assessed	Category/Degree of Risk					
		Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Natural Hazards							
Drought		Likely	Minor	Moderate	More than 24 hours	More than 1 week	2.3
Excessive Heat		Unlikely	Minor	Large	More than 24 hours	Less than 1 week	1.8
Hurricane and Coastal Hazards		Possible	Limited	Large	More than 24 hours	Less than 24 hours	2.3
Tornadoes/ Thunderstorms	Hailstorm, Lightning	Highly Likely	Critical	Large	12 to 24 hours	Less than 6 hours	3.0
Severe Winter Weather		High Likely	Critical	Large	More than 24 hours	Less than one week	3.3
Earthquakes		Possible	Minor	Moderate	Less than 6 hours	Less than 6 hours	2.3
Geological	Landslide, Sinkholes, Erosion	Possible	Limited	Small	Less than 6 hours	Less than 6 hours	2.3

Hazard	Sub hazard(s) Assessed	Category/Degree of Risk					
		Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Dam Failure		Unlikely	Critical	Moderate	More than 24 hours	Less than 6 hours	2.0
Flooding		Likely	Limited	Moderate	6 to 12 hours	Less than 24 hours	2.6
Other Hazards							
Wildfires		Likely	Limited	Small	Less than 6 hours	Less than 1 week	2.6
Infectious Disease		Unlikely	Minor	Small	More than 24 hours	More than 1 week	1.6
Technological Hazards							
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

G.5.18 FINAL DETERMINATIONS

The conclusions drawn from the hazard profiling process for Western Carolina University, including the PRI results and input from the Campus 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 at Western Carolina University. It should be noted that although some hazards are classified below as posing low risk, their occurrence of varying or unprecedented magnitudes is still possible in some cases and their assigned classification will continue to be evaluated during future plan updates.

Table G.31 ranks the hazards that were assessed in the update that were renamed to be consistent with the State of North Carolina Hazard Mitigation Plan. These conclusions were based on the PRI calculations and input from the Western Carolina University Campus Hazard Mitigation Planning Team.

TABLE G.31: 2021 CONCLUSIONS ON HAZARD RISK FOR WESTERN CAROLINA UNIVERSITY

HIGH RISK	Severe Winter Storm Tornadoes/Thunderstorms Flooding Wildfires Geological Hazards (Landslides)
MODERATE RISK	Hurricanes and Coastal Hazards Earthquakes Drought Terror Threat
LOW RISK	Hazardous Substances Dam Failure Geological Hazards (Erosion and Sinkholes) Radiological Emergency Electromagnetic Pulse Infectious Disease Cyber

G.6 Capability Assessment

The purpose of conducting a capability assessment for an institution of higher learning is to determine the ability of the institution to implement a comprehensive mitigation strategy and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs, or projects[13]. 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 the university's regulatory framework, level of administrative and technical support, access to fiscal resources, and current political climate.

A capability assessment is generally based upon two primary components: 1) an inventory of the university's relevant plans, programs and policies already in place and 2) an analysis of the university's capacity to carry them out. Careful examination of campus capabilities will detect any existing gaps, shortfalls, or weaknesses with ongoing 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 university, which should continue to be supported and enhanced through future mitigation efforts.

The capability assessment completed for WCU 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.

Capability Assessment Findings and Conclusion

Collectively, WCU's administrative, technical and fiscal capabilities are high. WCU's high capability will help ensure that the Mitigation Strategy is effectively carried out and that hazard risk reduction for the campus is an attainable goal. 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 Campus Hazard Mitigation Planning Committee considered not only their level of hazard risk, but also their existing capability to minimize or eliminate that risk.

[13] While the Final Rule for implementing the Disaster Mitigation Act of 2000 does not require a local capability assessment to be completed for hazard mitigation plans, it is a critical step in developing a mitigation strategy that meets the needs of the campus while taking into account their own unique abilities. The Rule does state that a 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)).

G.7 Mitigation Action Plan

The Mitigation Action Plan, or MAP, provides a functional plan of action for each building at the Western Carolina University. It is designed to achieve the mitigation goals established in Section 4: Mitigation Strategy of the main plan and will be maintained on a regular basis according to the plan maintenance procedures established in Section 5: Plan Maintenance of the main plan.

Each proposed mitigation action has been identified as an effective measure (policy or project) to reduce hazard risk to the buildings on WCU's campus. 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's 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. 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.

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 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.
- Relative Cost
- Identification of University Department Responsible for each action
- Implementation Schedule—Date by which the action should be completed. More information is provided when possible.
- Implementation Status (2021)—Indication of completion, progress, deferment, or no change since the previous plan. If the action is new, that will be noted here.

All of the mitigation actions in this section have been assigned to Emergency Management and Facilities staff to ensure their implementation. Other University Departments will be consulted for input on an as-needed basis.

For the update of this plan, the WCU Campus Hazard Mitigation Planning Team participated in three activities related to the mitigation strategy for the university. Those activities included the following:

1. Review and reapproval of previous mitigation goals for the UNC Western Campuses. All eight of the campuses in the Western region decided to leave the previous mitigation goals in place and unchanged.
2. Review and update of existing mitigation actions. The Campus Hazard Mitigation Planning Team reviewed each existing action to determine if it was still relevant, if the prioritization of the action remained the same and to provide an update on the status of implementation for the actions.
3. Identification of any new mitigation actions as determined necessary. The Campus Hazard Mitigation Team identified several new actions for inclusion in the plan. New mitigation actions for this update are marked as such in the Mitigation Action Plan.

The Mitigation Action Plan for WCU is found on the following pages.

Campus-Wide Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
	Property Protection						
CW-PP-1	As feasible and as funding is available, install generators/back-up power, for critical facilities campus wide	All Hazards	Moderate	$25,000-$100,000 per generator	Emergency Services and Facilities Management	2026	New action for the 2021 update.

Bird and Natural Sciences Building Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
	Prevention						
BNS-P-1	Replace the roof of the Bird Building.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Low	>$100,000	Emergency Services and Facilities Management	2026	No action; Identified as #2 campus roofing priority; Requires non-appropriated funding approval.
BNS-P-2	Replace the roof of the Natural Sciences Building.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Low	>$100,000	Emergency Services and Facilities Management	Action to be deleted	Not required; Natural Science Building scheduled for demolition 3rd quarter of 2021.

Camp Annex Building – Police Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
	Prevention						
CAB-P-1	The facility should receive a new roof with enhanced drainage (to include scuppers or overflows).	Flood	High	$25,000-$100,000	Emergency Services and Facilities Management	2022	Funding identified; Roof replacement to be performed as part of building interior partial renovation schedule for FY 2021-22
CAB-P-2	Trees that are located adjacent to the facility should be regularly pruned or removed to prevent they and/or their limbs from falling and damaging the facility during ice and high wind events.	Severe Winter Weather	Moderate	<$5,000	Emergency Services and Facilities Management	Completed:	Completed. Pruning performed regularly; Select trees removed in FY 2020-21
CAB-P-3	State DOT should be asked to verify that the bridge is in acceptable condition with respect to corrosion and that connections are sufficient to prevent a washout in the event of a flood.	Flood	Moderate	$5,000-$25,000	Emergency Services and Facilities Management	2026	Last NCDOT bridge inspection performed 02/21/2018; Maintenance and repair of bridge under NCDOT purview and funding
CAB-P-4	Prior to impending severe weather events, campus police assets should be staged on main campus to prevent them from becoming trapped at the Camp Annex by falling trees or high water.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	<$5,000	Emergency Services and Facilities Management	2026	Guidance will be provided to shift supervisors when adverse weather is expected instructing them to stage vehicles and personnel in key locations to avoid assets becoming trapped at the police department.
	Property Protection						
CAB-PP-1	The dispatch/911 call center should receive supplemental HVAC to improve climate control for radios and equipment. Emergency HVAC equipment should be capable of operating on generator power.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	High	$25,000-$100,000	Emergency Services and Facilities Management	Completed	Action complete.

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
CAB-PP-2	Radio repeaters at the water tank facility should have a generator or supplemental batteries added.	Earthquake, Wildfire	High	$25,000-$100,000	Emergency Services and Facilities Management	Completed	Action complete

Facilities Management and Grounds Shop Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
	Prevention						
FMGS-P-1	Facilities Management and the Grounds Shop should each receive a new emergency generator capable of fully powering the facilities during emergencies.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	>$100,000	Emergency Services and Facilities Management	Completed	Completed. Full emergency generator backup power in place at Facilities Management (and was at time report developed)
FMGS-P-2	The roofing on both buildings should be replaced with adequate sloping and drain implementation.	Severe Winter Weather, Flood	Moderate	>$100,000	Emergency Services and Facilities Management	2026	Partially completed; Full roof rehabilitation of Grounds Shop roof complete; As of last roof inspection, Facilities Management built-up roof shows no problems noted (Priority #17 for campus roof replacement)
FMGS-P-3	The Grounds Shop should have a fire alarm system installed.	Earthquake, Wildfire	Moderate	$25,000-$100,000	Emergency Services and Facilities Management	2026	Short-term plans (next 2-3 years) have Ground Shop relocating to new facilities on campus; Before re-occupation of existing building, renovations will be performed to bring up to code, including fire and other safety measures.
FMGS-P-4	The overhead telephone lines should not rest against the roof deck and loose cables should be secured.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	$5,000-$25,000	Emergency Services and Facilities Management	Completed	Action complete
	Property Protection						
FMGS-PP-1	Trees adjacent to the facilities should be routinely pruned or removed to prevent storm related damage	Severe Winter Weather, Flood	Moderate	$5,000-$25,000	Emergency Services and Facilities Management		Pruning performed regularly; Select trees have been removed
FMGS-PP-2	Mechanical equipment should be anchored to a foundation.	Earthquake, Geological, Flood	Moderate	<$5,000	Emergency Services and		Action completed

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
					Facilities Management		
PMGS-PP-3	Provide bollards to protect fuel pumps from accidental vehicle impacts.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	$5,000-$25,000	Emergency Services and Facilities Management		Curbing added; Bollards to be installed as part of re-paving project in Summer of 2021
FMGS-PP-4	The antenna on the roof of the Grounds Shop should be properly affixed to the roof.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	N/A	<$5,000	Emergency Services and Facilities Management	Complete	Complete. The antenna has been removed and the action is no longer needed.
FMGS-PP-5	Trees that are leaning towards the Grounds Shop should be pruned back or removed to protect the facility from falling limbs/trees during a high wind or ice event.	Severe Winter Weather	Moderate	$5,000-$25,000	Emergency Services and Facilities Management		Pruning performed regularly; Select trees removed as needed
	Natural Resource Protection						
FMGS-NRP-1	A slope stability analysis on the Grounds Shop should be conducted to ensure the integrity of the slope and remedial action should be taken as prescribed by the investigator.	Earthquake, Geological, Flood	Moderate	$25,000-$100,000	Emergency Services and Facilities Management		Not a needed action

Forsyth Building and Telecommunications System Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Prevention							
FBTS-P-1	Provide backup power to the telecom equipment connecting the campus network to DukeNet.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	$5,000-$25,000	Emergency Services and Facilities Management		Internet connections now provided by MCNC. All Internet connection equipment on backup power.
FBTS-P-2	Install redundant Internet connection serviced by Verizon.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	$5,000-$25,000	Emergency Services and Facilities Management		WCU has 2 primary connections to the Internet via (HHS and Forsyth). WCU also has a tertiary Internet connection via ERC as a backup for VoIP services if the 2 primary connections fail.
FBTS-P-3	The room housing the telephone PBX should have non-water based fire suppression.	Wildfire	Moderate	$25,000-$100,000	Emergency Services and Facilities Management		Campus transitioned to VoIP and retired the on-campus PBX. Both Data Centers protected by non-water-based fire suppression.
FBTS-P-4	The mechanical equipment supporting the PBX should be properly anchored to their foundations.	Earthquake, Geological, Flood	Moderate	$25,000-$100,000	Emergency Services and Facilities Management		Campus transitioned to VoIP and retired the on-campus PBX.
Property Protection							
FBTS-PP-1	Where available, fiber optic lines should be buried in cable duct banks for protection.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	$25,000-$100,000	Emergency Services and Facilities Management		Complete
FBTS-PP-2	Trees growing around the fiber optic line connecting Cordellia Camp to Forsyth should be removed.	Severe Winter Weather, Wildfire, Flood	Moderate	<$5,000	Emergency Services and Facilities Management		Not required.

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
	Install a new roof on the Forsyth building.	Severe Winter Weather, Flood	Moderate	>$100,000	Emergency Services and Facilities Management	Completed	Completed in 2017
FBTS-PP-3	Install additional column base plate anchors in cooling tower supports.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	<$5,000	Emergency Services and Facilities Management	2026	To be reviewed for applicability.

H.F. Robinson Administration Building Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
	Prevention						
HFR-P-1	An emergency generator should be installed capable of powering the executive command center, the call center, the auditorium, and supporting mechanical equipment.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	>$100,000	Emergency Services and Facilities Management	Complete	Action complete
HFR-P-2	The emergency generator and propane tank should be anchored to their foundations.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	<$5,000	Emergency Services and Facilities Management	Complete	Action complete
	Property Protection						
HFR-PP-1	The chiller should be bolted to its foundation or supported on properly anchored vibration isolators.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	<$5,000	Emergency Services and Facilities Management	2026	Action to be further reviewed for applicability.
HFR-PP-2	The anchorage of the cooling tower should be brought into compliance with code.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	<$5,000	Emergency Services and Facilities Management	2026	Action to be further reviewed for applicability.

Ramsey Center Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
	Prevention						
RC-P-1	The building should have adequate emergency generator power to run infrastructure required to use the facility as an emergency shelter. This could be through a fixed generator or providing disconnects for mobile generators.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	>$100,000	Emergency Services and Facilities Management	2026	Deferred, pending staff time and funding
RC-P-2	The emergency generator, chillers, and all other mechanical equipment should be anchored to their foundations.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	<$5,000	Emergency Services and Facilities Management	2026	Action to be further reviewed for applicability.
RC-P-3	The leak near electrical switchgear should be repaired to prevent water damage.	Severe Winter Weather, Flood	Moderate	<$5,000	Emergency Services and Facilities Management	Completed	Completed in 2016
RC-P-4	The waterproofing at the northwest patio should be replaced to prevent further water intrusion and damage to occupied spaces below	Severe Winter Weather, Flood	Moderate	$25,000-$100,000	Emergency Services and Facilities Management	Completed	Completed in 2016
	Property Protection						
RC-PP-1	The window seals should be replaced throughout the facility.	Earthquake, Severe Winter Weather, Wildfire, Flood	Moderate	>$100,000	Emergency Services and Facilities Management	2021	Under construction for completion 3rd quarter 2021
RC-PP-2	The beams of the cooling tower should be spot welded to replace lost bolt capacity.	Earthquake, Geological, Severe Winter	Moderate	<$5,000	Emergency Services and	2026	Action to be further reviewed for applicability.

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
		Weather, Wildfire, Flood			Facilities Management		
RC-PP-3	Replace the roof of the facility to prevent further water damage.	Severe Winter Weather Flood	Moderate	>$100,000	Emergency Services and Facilities Management	Completed	Completed in 2016
	Structural Projects						
RC-SP-1	The façade windows should be reinforced using a laminate film to prevent the dispersion of glass onto walkways and potential bystanders below.	Earthquake, Wildfire	Moderate	>$100,000	Emergency Services and Facilities Management	2021	Under construction for completion 3rd quarter 2021

Scott Hall Student Housing Department Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
	Prevention						
SH-P-1	A generator should be installed that is capable of powering the entire west wing of the first floor and selected mechanical systems to permit Housing Department operations during an emergency.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	>$100,000	Emergency Services and Facilities Management	NA	Scott Hall removed 2020
SH-P-2	Caulk joints should be repaired to prevent water intrusion.	Severe Winter Weather, Flood	Moderate	$25,000-$100,000	Emergency Services and Facilities Management	NA	Scott Hall removed 2020
SH-P-3	The building should be reroofed to prevent damage from water intrusion.	Severe Winter Weather, Flood	Moderate	>$100,000	Emergency Services and Facilities Management	NA	Scott Hall removed 2020
SH-P-4	Shower pans and waterproofing should be repaired or replaced in the bathroom areas.	Severe Winter Weather, Flood	Moderate	>$100,000	Emergency Services and Facilities Management	NA	Scott Hall removed 2020
	Property Protection						
SH-PP-1	Drainage features should be regularly serviced and personnel should have access to emergency pumping equipment in the event of failure.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	<$5,000	Emergency Services and Facilities Management	NA	Scott Hall removed 2020
SH-PP-2	Mechanical equipment should be attached to their foundations.	Earthquake, Geological	Moderate	<$5,000	Emergency Services and Facilities Management	NA	Scott Hall removed 2020

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
SH-PP-3	A non-water based fire suppression system should be used in the PBX room.	Wildfire	Moderate	$25,000-$100,000	Emergency Services and Facilities Management	NA	Scott Hall removed 2020
	Emergency Services						
SH-PP-ES	Trees should be routinely pruned and inspected by an arborist to prevent storm related damage.	Severe Winter Weather, Flood	Moderate	<$5,000	Emergency Services and Facilities Management	NA	Scott Hall removed 2020

Steam Plant Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
	Prevention						
SP-P-1	The failing boiler should be replaced to provide redundancy to the steam supply.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	>$100,000	Emergency Services and Facilities Management	2022	New Steam Plant currently under construction; Scheduled for 2022 delivery
SP-P-2	Add a redundant connection for makeup water.	Earthquake, Geological, Severe Winter, Wildfire, Flood	Moderate	$25,000-$100,000	Emergency Services and Facilities Management	Completed	Action completed
SP-P-3	Replace the existing emergency generator and install a new automatic transfer switch. This should be done immediately.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	>$100,000	Emergency Services and Facilities Management	Completed	Complete; Also new Steam Plant currently under construction; Scheduled for 2022 delivery
SP-P-4	The large tree adjacent to the facility should be routinely pruned and checked by an arborist.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	<$5,000	Emergency Services and Facilities Management	Completed	Action completed: tree removed
SP-P-5	Mechanical equipment should be anchored to a foundation.	Earthquake, Geological	Moderate	$5,000-$25,000	Emergency Services and Facilities Management	2022	New Steam Plant currently under construction; Scheduled for 2022 delivery

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
SP-P-5	It would be cost prohibitive to retrofit or upgrade the steam plant structure to comply with updated seismic requirements. A structural engineer should be periodically contracted to inspect the steam plant and associated infrastructure for deterioration and make recommendations until a new facility can be built.	Earthquake, Geological	Moderate	<$5,000	Emergency Services and Facilities Management	2022	New Steam Plant currently under construction; Scheduled for 2022 delivery

Substation and Electrical Distribution Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
	Property Protection						
SED-PP-1	The conductor between the main switchgear and switch #15 should be upgrade to 500 mcm to permit back feeding other circuits.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	>$100,000	Emergency Services and Facilities Management	2026	Project still included as part of capital plans; Currently, the 250 mcm conductoring has capacity for required back feed
SED-PP-2	The campus should maintain spare breakers for the switches, particularly for the older Westinghouse for which replacement parts are difficult to obtain.	Earthquake, Geological, Severe Winter Weather, Flood	Moderate	>$100,000	Emergency Services and Facilities Management	2026	Substation inspection performed every two years; Spare parts, as can be obtained, kept in inventory
SED-PP-3	The overhead line serving Facilities Management and the water plant should be buried or the surrounding trees pruned back significantly.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	>$100,000	Emergency Services and Facilities Management	Completed	Action completed
SED-PP-4	The soil bank behind the substation should be reinforced or a retaining wall installed. Runoff control features should be installed in the parking lot above the substation.	Earthquake, Geological, Severe Winter Weather, Flood	Moderate	$25,000-$100,000	Emergency Services and Facilities Management	Completed	Action completed
SED-PP-5	The pipe from the drainage outfall should be extended to prevent accidental discharge of water onto the switches.	Severe Winter Weather, Flood	Moderate	<$5,000	Emergency Services and Facilities Management	2026	Action to be further reviewed for applicability.

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
SED-PP-6	Trees near the substation should be routinely pruned or removed to prevent damage from falling limbs.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	<$5,000	Emergency Services and Facilities Management	Completed	Pruning performed regularly; Select trees have been removed

Water Treatment and Distribution Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
	Property Protection						
WTD-PP-1	A manual transfer switch should be installed at river pump station to permit the use of mobile emergency power in the event of an outage. The bank around the pump station should be re-graded to reduce flooding at the site.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	$5,000-$25,000	Emergency Services and Facilities Management	2026	Pending staff time and funding. No status change.
WTD-PP-2	The deteriorating concrete of the water storage tanks should be repaired to reduce the opportunity for contamination.	Earthquake, Geological, Flood	Moderate	$5,000-$25,000	Emergency Services and Facilities Management	Completed	Action completed.
WTD-PP-3	The emergency generator at the treatment plant should be properly bolted to its foundation.	Earthquake, Geological, Severe Winter Weather, Flood	Moderate	<$5,000	Emergency Services and Facilities Management	2026	To be reviewed for applicability.
WTD-PP-4	A full engineering evaluation of the dam should be performed to identify any structural issues and identify remedial measures for damage to abutments.	Earthquake, Flood	Moderate	>$100,000	Emergency Services and Facilities Management	Completed	Action completed.
WTD-PP-5	Trees surrounding overhead power lines should be routinely pruned. The lines should be buried if possible.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Moderate	>$100,000	Emergency Services and Facilities Management	Completed.	Action completed. Pruning performed regularly, select trees removed as necessary

Annex H Winston Salem State University

This section provides planning process, campus profile, hazard risk, vulnerability, capability, and mitigation action information specific to Winston Salem State University (WSSU). This section contains the following subsections:

- H.1 Planning Process Details
- H.2 Campus Profile
- H.3 Asset Inventory
- H.4 Hazard Identification
- H.5 Hazard Profiles, Analysis, and Vulnerability
- H.6 Capability Assessment
- H.7 Mitigation Strategy

H.1 Planning Process Details

The update of the campus hazard mitigation plan was conducted by a Campus Hazard Mitigation Planning Committee comprised of university staff and faculty. The committee followed a planning process prescribed by FEMA and participated in a series of meetings to update the plan. Details about the meetings help by the committee are provided below.

TABLE H.1: WINSTON-SALEM STATE UNIVERSITY CAMPUS HAZARD MITIGATION PLANNING COMMITTEE

LAST NAME	FIRST NAME	TITLE	ATTENDED FIRST MEETING	ATTENDED SECOND MEETING
Banks	Jamar	Dean of Students	X	
Berry	Carolyn	Associate Provost - Academic Affairs		X
Bouchereau	Chantal	Director Housing and Residence Life	X	X
Brown	Bobby	Police Chief	X	
Conner	Shanoya	AD of Housing and Residence Life		X
Dubose	James	Associate Athletic Director		X
Fair-Reese	Kimberly	Exec Director for University Donor Events		X
Graves	Cornelius	Director of External Relations		X
Henry	Amir	Deputy Chief	X	X
Holloway	Calvin	Interim AVC HR	X	

LAST NAME	FIRST NAME	TITLE	ATTENDED FIRST MEETING	ATTENDED SECOND MEETING
Ingram	Frank	Associate Dean STEM Research and Academic Initiatives		X
Isom	Sarah	University Program Specialist		X
Jones	Darryl	Director of Systems Operations		X
Lea	Kizzy	AVC Business Services	X	
Leach	Camille Klutze	Chief of Staff	X	
Lee	Joel	Asst VC Enrollment Services		X
Lord	Frank	Controller	X	
McMullen	Timothy	AVC - Facilities Management	X	X
Norwood	Jimmy	Director of Design and Construction		X
Rusere	Wilbourne	Associate Vice Chancellor for Finance and Admin		X
Steelman	Eric	EH&S Manager	X	X
Stogner*	Jason	EM Director	X	X
Thomas	Etienne	Director of Athletics		X
Thompson-Williams	Karen	Director of Student Health Services		X
Tilford	Terri	Director of Counseling		X
White	Kelly	Deputy Director Public Safety		X
Wiley	Latoya	Director of Budget and Analysis		X
Wymbs	Mary	IT Director	X	

* Primary Point of Contact

December 4, 2019 – Project Kickoff Meeting

ESP Associates' Project Manager, Nathan Slaughter, 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 Campus Hazard Mitigation Planning Team and began by having attendees introduce themselves. The 12 attendees included faculty and staff from various departments at the University. 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 was managing the planning effort and had assigned ESP Associates, Inc. to manage the update.

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 on campus (buildings, infrastructure 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 a discussion about various mitigation techniques. He briefly explained the six different categories of mitigation techniques: emergency services, prevention, natural resource protection, structural projects, public education and awareness, and property protection. The attendees were then asked what types of mitigation projects would be needed the most at WSSU if FEMA funding was available. This helped demonstrate how priorities in mitigation actions should be considered for the plan.

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

- Coordinate between the eight participating campuses to update the existing plan,
- Update the plan to demonstrate progress and reflect current conditions,
- Complete the update in a timely manner because the existing plan expired in October of 2017,
- Increase public awareness and education,
- Maintain grant eligibility for participating campuses, and
- Maintain compliance with State and Federal requirements.

Mr. Slaughter reviewed the list of participating campuses with the group. He also explained the project tasks to be accomplished. These included the planning process, risk assessment, capability assessment, mitigation strategy, mitigation action plan, and plain maintenance procedures.

He explained that the project as being managed by a Campus Hazard Mitigation Steering Committee that had one representative from each of the eight campuses. For WSSU, that representative is Jason Stogner, Director of Emergency Management. He explained that the group currently in the room would be known as the Campus Hazard Mitigation Planning Team.

Mr. Slaughter explained that this update would expand the scope of the plan to not only address natural hazards, as was previously done for the existing plan, but that it would also address manmade/technological hazards as well. This was done to ensure alignment with the State of North Carolina's Hazard Mitigation Plan.

Mr. Slaughter explained that the plan would address campus vulnerability, where feasible, to identify specific types and numbers of campus assets that are at risk to the identified hazards. He said that an attempt would be made to address other types of vulnerability as well to include social, economic and environmental vulnerabilities.

He then discussed the capability assessment and how the plan would include a discussion on the University's capability to address their hazard vulnerability through mitigation. Next, he discussed the mitigation strategy and explained how that section of the plan would be reviewed and updated as required by FEMA.

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

Mr. Slaughter then reviewed the roles and responsibilities of ESP Associates, Inc, the campus leads and stakeholders. The presentation concluded with a discussion of the next steps to be taken in the project development. He explained that a Hazard Mitigation Public Survey was being developed and that it would be distributed soon. The next campus HMPT meeting was discussed and would be held sometime in the Spring or Summer of 2020. The purpose of the second meeting would be to discuss the findings of the risk and capability assessments and to begin updating existing mitigation actions and identify new goals.

October 27, 2020 – Mitigation Strategy Meeting – Zoom Meeting

Following a hiatus in the planning process caused by the onset, response and initial recovery from the COVID 19 pandemic, the WSSU Campus Hazard Mitigation Planning Team held an online Mitigation Strategy Meeting on October 27, 2020.

Mr. Slaughter began the meeting with brief introductions and an overview of the agenda for the day. He provided a brief refresher on the definition of mitigation and a recap of the Disaster Mitigation Act of 2000, the key objectives of the project and the project schedule (which remained somewhat delayed because of the COVID-19 pandemic, but still on track for completion of the final plan).

He then began providing more detailed information about the hazards that impact the University. He started by recapping the number of hazard events experienced since the previous plan and discussed the presidential disaster declarations that have been experienced since the previous update. These included two declarations, one for Tropical Storm Michael and one for the COVID-19 pandemic. He provided summary stats and slides for the following hazards: drought, hail, hurricanes and tropical storms, lightning, severe thunderstorms, tornadoes, flood, wildfire, winter storms and freeze, dam failure, earthquake, landslides, excessive heat, hazardous materials incident, public health hazards/infectious disease, cyber nuclear power plants, electromagnetic pulse and terrorism.

Mr. Slaughter provided an overview of the Priority Risk Index. The PRI is a quantitative scoring of hazards which is used to focus in on the hazards of greatest concern for the University. Using the PRI, the following hazards were considered the be highest risk for the University: severe winter weather, severe thunderstorms, flooding and hurricanes and coastal hazards.

Following the hazard identification and PRI review, Mr. Slaughter reviewed the listing of key assets from the prior plan and discussed the need to update that ranking. He also mentioned that social vulnerability would be included in the plan to some extent and he presented slides on social vulnerability for Forsyth County.

There was also a brief discussion about the capability assessment that would be included in the plan for the University. He mentioned how that assessment would be conducted and what it would try to capture (administrative, technical, fiscal, and political capabilities of the University).

The remainder of the meeting was spent discussing the Mitigation Strategy. Mr. Slaughter gave an overview of the process for updating the Mitigation Strategy and presented the existing mitigation goals for the UNC Western Campuses regional plan. He asked the WSSU Campus Hazard Mitigation Planning Team to review the goals to determine whether or not they still reflect current vulnerabilities and current mitigation priorities. The committee members agreed that the goals were no longer relevant and new goals and associated objectives were developed, voted upon and accepted. It should be noted that these goals and objectives also align with those found in the UNC Eastern Campuses Hazard Mitigation Plan.

Mr. Slaughter then indicated that Campus Hazard Mitigation Planning Team would need to provide a status update for their existing mitigation actions (completed, deleted, or deferred) and a brief discussion of how that determination was made. Mr. Slaughter also discussed the Mitigation Action Worksheets to be completed for any new mitigation actions. Mr. Slaughter then presented sample mitigation actions for the committee members to consider to include in their plan update.

Mr. Slaughter mentioned the need to conduct public outreach measures to meet FEMA requirements and indicated that a public survey would be sent out soon and an online public meeting for the entire UNC Western Campuses region would be conducted before the plan was finalized.

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

Involving the Public

Because this plan update was developed during the COVID-19 pandemic, the planning teams had to get creative in order to solicit feedback from the public about the plan and their thoughts on hazard mitigation. A public survey instrument was developed to provide an opportunity for the public to provide comment on their concerns about hazard impacts on the campuses and their thoughts on how mitigation could help reduce vulnerability. The public survey was distributed by each campus through different means to outreach to faculty, staff and students.

For WSSU, 11 public survey responses were received and the results from those surveys were shared with the Campus Hazard Mitigation Planning Team. Feedback from the surveys was reviewed and considered for inclusion in this plan, as applicable, where determined to be relevant. A summary of the responses can be found in **Appendix B** and detailed survey responses can be obtained through North Carolina Emergency Management, Hazard Mitigation Planning staff.

H.2 Campus Profile

This section of the plan provides a general overview of the Winston-Salem State University Campus and surrounding area.

H.2.1 Geography and the Environment

Winston-Salem State University is located 1.5 miles outside of downtown Winston-Salem, North Carolina. Winston-Salem is the county seat and largest city of Forsyth County and the fifth- largest city in the state. Winston-Salem is a prominent municipality in the Piedmont Triad region. According to the United States Census Bureau, the city has a total area of 109.6 square miles. Today, the campus has approximately 1.6 million gross square feet of space on approximately 140 acres. The university is bound on the north by a Norfolk Southern railroad track, on the east by a Brushy Fork, on the south by the Bowman Gray Stadium and on the west by the US 52 highway. Salem Creeks runs through the southern part of the campus. Salem Creek is fed directly out of the Salem Lake dam. An orientation map of the Winston-Salem State University can be seen in **Figure H.1** and a map of the main-campus can be seen in **Figure H.2**.

FIGURE H.1: WINSTON SALEM STATE UNIVERSITY LOCATOR MAP

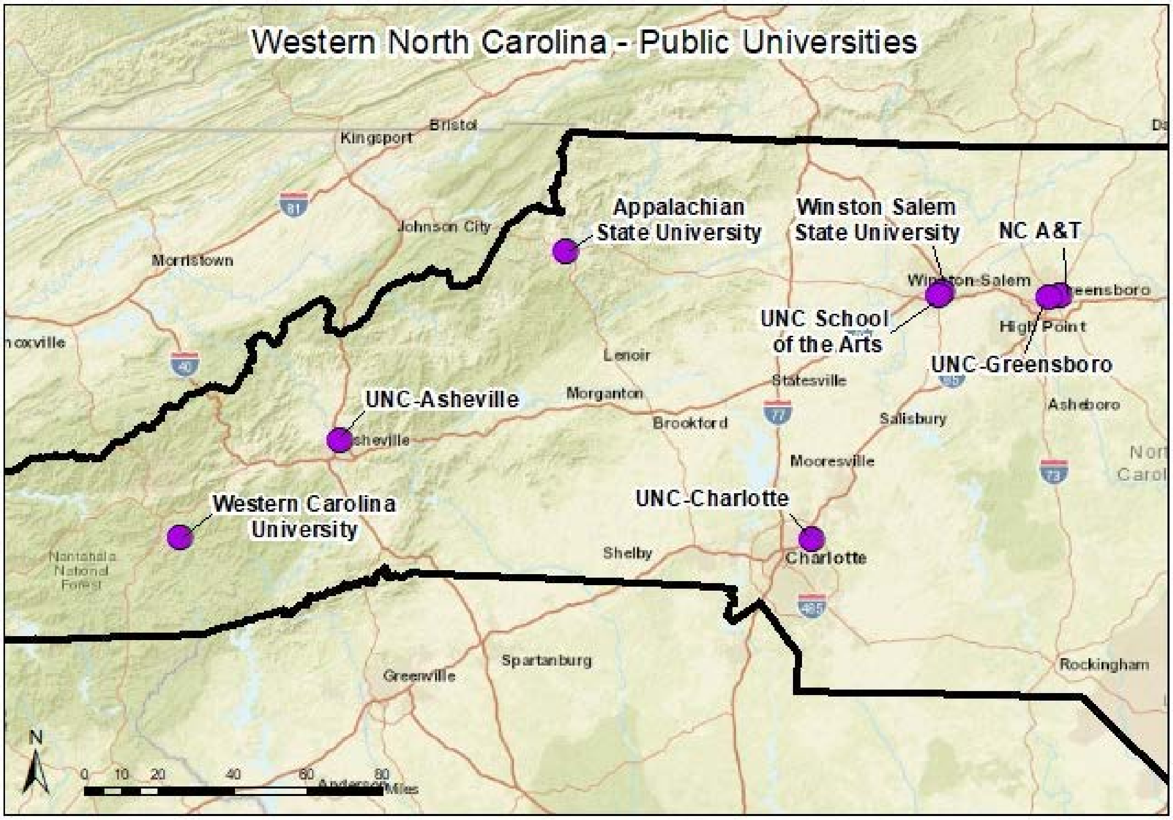
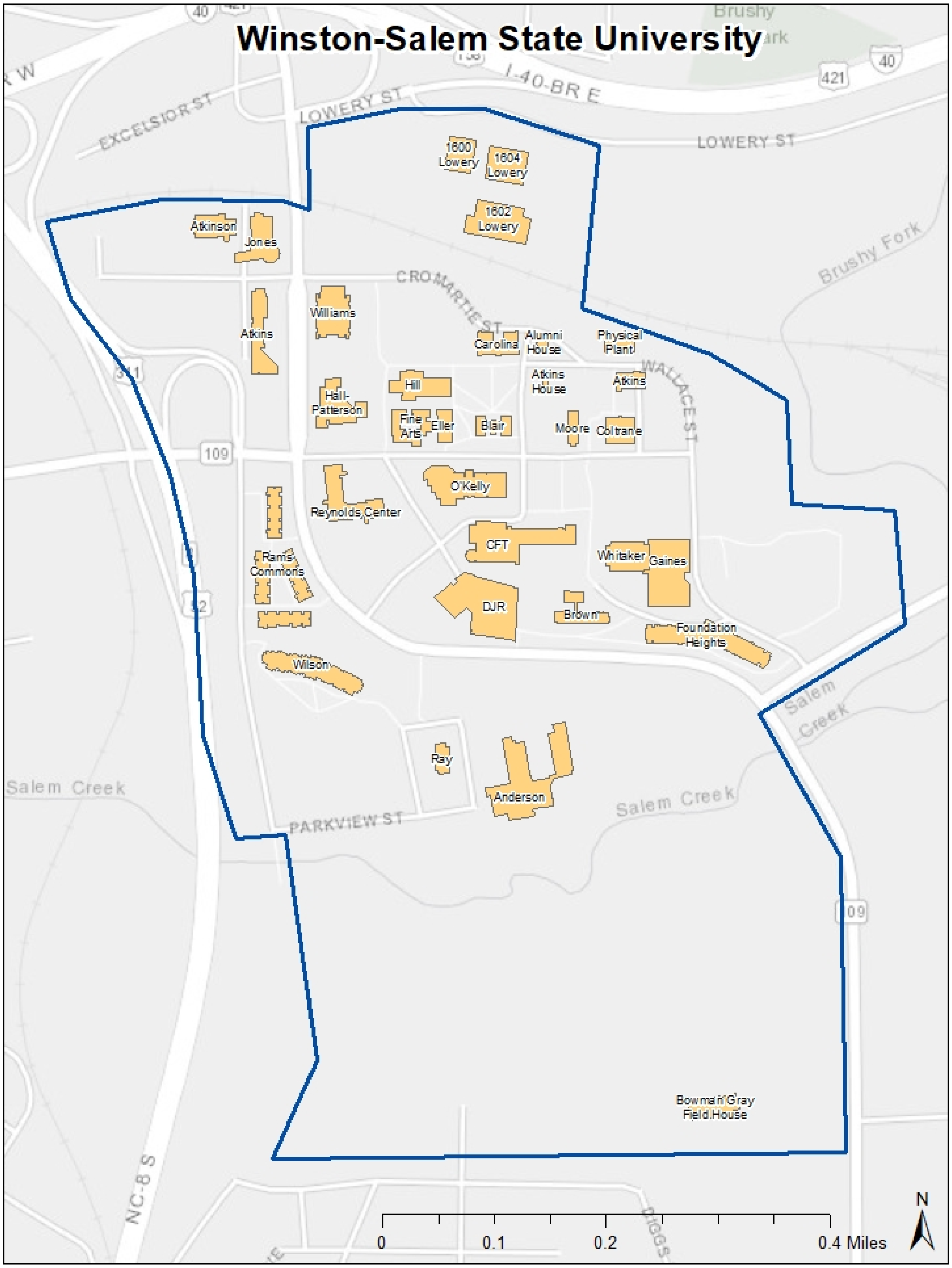


FIGURE H.2 WSSU MAIN CAMPUS MAP



The weather is usually around 30- or 40-degrees Fahrenheit during the day in the winter months, but can venture into the teens at night. During the summer months, the temperatures are typically in the 80's or 90's during the day, but near the 60's at night. Rain is never very frequent, but ice storms are a concern during the colder seasons. Temperatures begin warming in March with temperatures climbing until mid to late September. November often requires a sweater or light jacket. Light snow and ice are common from December to February.

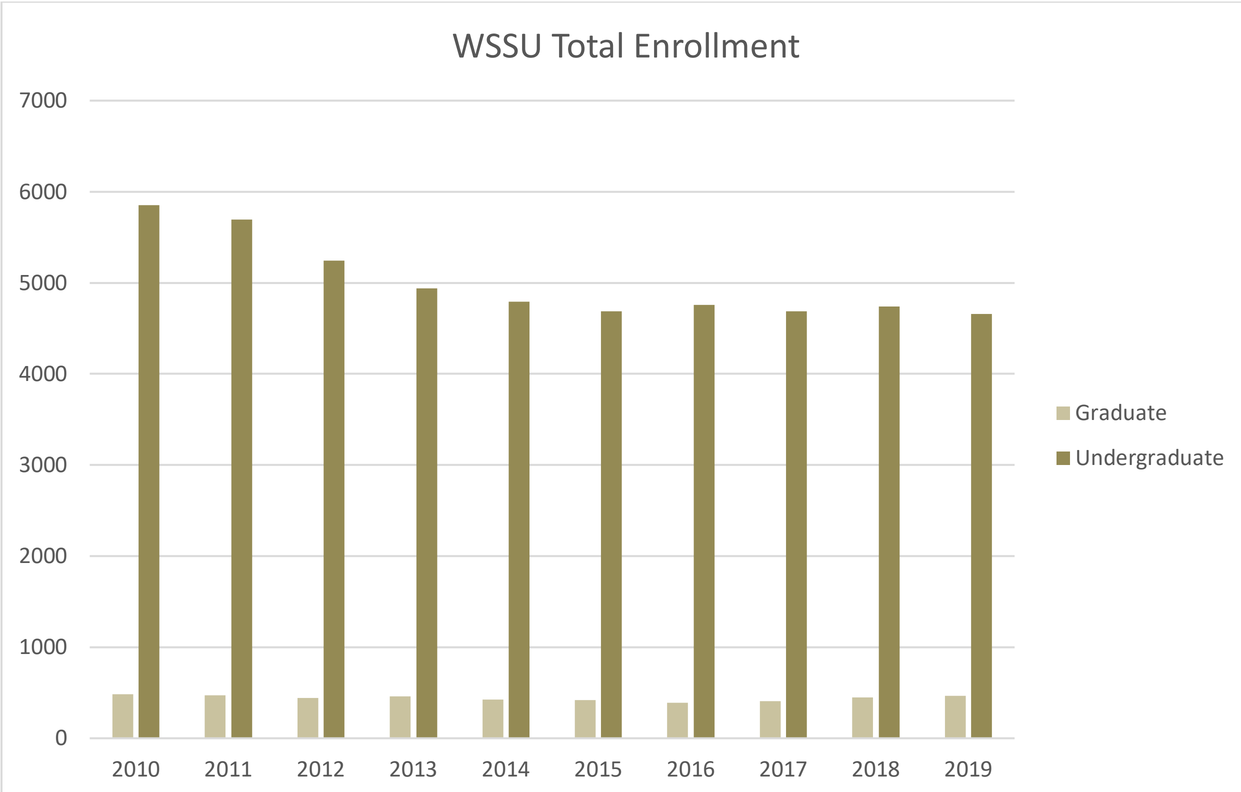
TABLE H.2 MONTHLY AVERAGES FOR WINSTON-SALEM, NORTH CAROLINA

Month	Average High	Average Low	Average Precipitation
January	49°F	30°F	3.61 in
February	53°F	33°F	3.19 in
March	61°F	40°F	4.04 in
April	71°F	48°F	3.70 in
May	78°F	56°F	3.87 in
June	85°F	65°F	4.20 in
July	89°F	69°F	5.00 in
August	86°F	68°F	4.87 in
September	80°F	61°F	4.19 in
October	71°F	50°F	3.41 in
November	62°F	40°F	3.35 in
December	62°F	33°F	3.47 in

H.2.2 Population and Demographics

Winston Salem State University has grown steadily over the years, and has been an established university since 1892. WSSU has seen an increase in enrollment of 1.8% from 2017 and is reporting its highest overall enrollment since 2014. University officials are expecting to see an enrollment of 6,000 by the year 2022. The majority of students attending this university are Black representing almost 75% of the student population, with the second most prevalent ethnicity being White representing nearly 17%. Native Hawaiian's make up the least represented group for this University consisting of less than .1% of the total student population. The enrollment trends over the past ten years can be seen in **Figure H.3.**

FIGURE H.3: ENROLLMENT TOTALS



Source: UNC System – Interactive Data Dashboards

For a breakdown of enrollment demographics please see **Table H.3** below.

TABLE H.3 ENROLLMENT DEMOGRAPHICS (2019)

Race/Ethnicity	Enrollment (Fall 2018)	Percentage
White	647	12.63%
Hispanic or Latino	188	3.67%
Black or African American	3,834	74.86%
Two or More Races	195	3.80%
Asian	56	1.09%
Nonresident Alien	83	1.62%
American Indian or Alaska Native	18	0.35%
Native Hawaiian or Other Pacific Islander	1	0.01%
Unknown	99	1.93%

Source: UNC System – Interactive Data Dashboards

H.3 Asset Inventory

An inventory of assets was compiled to identify the total count and value of property exposure on the WSSU campus. This asset inventory serves as the basis for evaluating exposure and vulnerability by hazard. Assets for analysis include buildings, critical facilities, and critical infrastructure.

H.3.1 Building Inventory

This section provides total building exposure for the campus, which was estimated by summarizing building footprints provided by North Carolina Emergency Management and property values derived from 2020 insurance assessment data. According to that data, there are 48 buildings associated with WSSU totaling a value of $473,844,666 (building and contents).

H.3.2 Critical Buildings and Infrastructure Exposure

Of significant concern with respect to any disaster event is the location of critical facilities and infrastructure in the planning area. Critical facilities are those essential services and lifelines that, if damaged during and emergency event, would disrupt campus continuity of operations or result in severe consequences to public health, safety, and welfare.

Critical buildings are a subset of the total building exposure and were identified by WSSU's HMPC representatives. The WSSU HMPC updated the list of critical facilities from the previous DRU plan and ranked each facility on a set of standardized criteria designed to evaluate all critical buildings in the UNC System DRU plans. Factors considered for this ranking included:

- the building's use for emergency response,
- the building's use for essential campus operations
- the building's use as an emergency shelter or for essential sheltering services,
- the presence of a generator or generator hook-ups,
- the building's use for provision of energy, chilled water or HVAC for sensitive or essential systems,
- the storage of hazardous materials,
- the building's use for sensitive research functions,
- the building's cultural or historical significance, and
- building-specific hazard vulnerabilities

Figure H.4 below shows the scoring sheet that the WSSU Campus Mitigation Planning Team used to rate critical buildings on campus. All of the campuses in the UNC system used to same scoring methodology for consistency.

FIGURE H.4: CRITICAL BUILDING SCORING WORKSHEET

Critical Building Scoring Worksheet

Campus:
Facility Name:

		Score
1	Does the facility serve as the campus Emergency Operations Center (EOC)? Yes, Primary EOC = 6 pts Yes, Secondary EOC = 3 pts No = 0 pts	0
2	Does the facility house functions essential to campus operations? Main Telecommunication Center = 3 pts Computer Network Hub = 3 pts Adminstrative Operations = 1 pts Maintenance = 1 pt Public Safety = 1 pt	0
3	Is the facility equiped with a generator or hook-ups? Generator = 3 pts Hook-ups = 1 pt Neither = 0 pts	0
4	Does the facility serve as a pre or post disaster shelter? Both pre and post disaster shelter = 6 pts Either pre or post disaster shelter = 3 pts Neither = 0 pts	0
5	Does the facility provide services essential to sheltering? Resident Housing = 1 pt Assesmbly Space = 1 pt Food Preperation Facility = 1 pt Shower Facilities = 1 pt	0
6	Does the facility provide chilled water distribution or contain HVAC systems necessary to sensitive or essential systems? Yes = 3 pts No = 0 pts	0
7	Are there hazardous materials on-site? (greater than 25 gallons) Yes = 3 pts No = 0 pts	0
8	Does the facility house research functions that have a low level of tolerance for disruption? Yes = 2 pts No = 0 pts	0
9	Does the facility serve as storage for rare or unique collections (art, artifacts, letters, etc) or is it a historically or culturally significant building? Yes = 2 pts No = 0 pts	0
10	Does the facility have hazard specific vulnerabilities (basement susceptible to flood, etc.) Yes = 3 pts No = 0 pts	0
Notes/ Comments		

Total Score:	0
Total Possible Score:	42

The identified critical facilities for WSSU, as scored by the WSSU Campus Hazard Mitigation Planning Team are listed below:

- Anderson Center (23)
- Campus Police (22)
- Cleon F. Thompson Student Services Building (20)
- A. H. Ray Student Wellness Center (18)
- C.G. O'Kelly Library (17)
- Elva J. Jones Computer Science Building (17)
- Donald J. Reaves (DJR) Student Activities Center (13)
- Hill Hall (12)
- Physical Plant (10)
- Blair Hall (1)

H.4 Hazard Identification

This section describes how the Campus Hazard Mitigation Planning Team identified the hazards to be included this plan

H.4.1 Hazard Identification

Upon a review of the full range of natural hazards suggested under FEMA planning guidance, the Campus Hazard Mitigation Planning Team identified a number of hazards that are to be addressed in its Hazard Mitigation Plan. These hazards were identified through a process that utilized input from the Campus Hazard Mitigation Planning Team, research of past disaster declarations in the surrounding county, and review of the previous WSSU Pre-Disaster Mitigation Plan. To maintain consistency, the Multi-Campus Hazard Mitigation Steering Committee and the Campus Hazard Mitigation Planning Teams voted to assess the same hazards that were identified in the most recent update of the North Carolina State Hazard Mitigation Plan. Therefore, since the development of the previous plan, the hazard identified and included in the plan have changed. A list of all previous hazards covered in the previous WSSU Pre-Disaster Mitigation Plans are viewable in **Table H.4**, 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.

TABLE H.4: 2021 WINSTON-SALEM STATE UNIVERSITY HAZARDS UPDATE

2010 Winston-Salem State University Identified Hazards		2021 Winston-Salem State University Identified Hazards		Description of hazards covered in 2021 Plan and Explanations
Atmospheric Hazards	Drought	Drought	Natural Hazards	Agricultural Drought, Hydrological Drought
	Driving Rain			
		Hailstorm		Assessed under "Tornadoes/Thunderstorms"
	Other High Wind events			

		Excessive Heat		
	Hurricane	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
	Electrical Storm	Severe Thunderstorm		Assessed under "Tornadoes/Thunderstorms"
	Severe Winter Weather, including ice or snow events	Severe Winter Weather		Freezing Rain, Snowstorms, Blizzards, Wind Chill, Extreme Cold
Hydrologic Hazards		Dam Failures		
		Erosion		Assessed under "Geological"
	Flood	Flooding		
Geologic Hazards	Earthquake	Earthquakes		
	Landslide, Rockslide, and other Geologic	Geological		Landslides, Sinkholes, Erosion
Other Hazards	Wildfire or Building Fire	Wildfires	**Other Hazards**	
	Animal borne and other Infectious Diseases	Infectious Disease		
	Accidental Explosion		**Technological Hazards**	
		Hazardous Substances		Hazardous Materials, Hazardous Chemicals, Oil Spill
		Terrorism		
		Cyber		
		Electromagnetic Pulse		

H.4.2 Disaster Declarations

Disaster declarations provide insight into the hazards that may impact WSSU. **Table H.5** shows every declared presidential disaster to impact Forsyth County since 1977. There have been ten total disaster declarations in Forsyth County since 1977.

TABLE H.5: FORSYTH COUNTY DISASTER DECLARATIONS

Year	Disaster Number	Description
1989	844	HURRICANE HUGO
1989	827	TORNADOES
1996	1087	BLIZZARD OF '96
1996	1103	WINTER STORM
1999	1292	HURRICANE FLOYD
2002	1448	SEVERE ICE STORM
2003	1457	ICE STORM
2004	1553	HURRICANE IVAN
2019	4412	TROPICAL STORM MICHAEL
2020	4487	COVID-19 PANDEMIC

H.4.3 Summary of Hazard Impacts Since Previous Plan

Since the approval of the previous UNC School of the Arts Pre-Hazard Mitigation Plan (June 30th, 2010), there have been 218 hazard events recorded for the planning area in the National Centers for Environmental Storm Event Database. It is important to take note of those hazard events and consider them in the *Hazard Identification* section to help ensure that the appropriate hazards are being considered in the risk assessment sections in the Mitigation Strategy. **Table H.6** documents the hazard events recorded.

TABLE H.6: SUMMARY OF HAZARD EVENTS SINCE PREVIOUS PLAN

Hazard Type*	Number of Reported Events in Forsyth County
Cold/Wind Chill	0
Flash Flood	21
Flood	0
Hail	25
Heavy Snow	0
High Wind	0
Lightning	0
Strong Wind	8
Thunderstorm Wind	132
Tornado	0
Tropical Storm	2
Winter Storm	14
Winter Weather	16

TOTAL NUMBER OF REPORTED EVENTS	218

* The hazard type names that NCEI uses are different than the names of hazards used in this plan; however, one can still get an understanding of the types of hazards that impact the region as the hazard types are similar in name.

H.4.4 Hazard Evaluation

Table H.7 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 furthered 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 further evaluations and updates of the risk assessment if deemed necessary by the University Core Planning Team and the University Campus Core Committee during the plan update process.

TABLE H.7: 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?
NATURAL HAZARDS			
Avalanche	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of the NC State Hazard Mitigation Plan • Review of the previous Winston Salem State University Pre-Disaster Mitigation Plan • Review of US Forest Service National Avalanche Center website	• The United States avalanche hazard is limited to mountainous western states including Alaska as well as some areas of low risk in New England. • Avalanche hazard was removed from the North Carolina State Hazard Mitigation Plan after determining the mountain elevation in Western North Carolina did have enough snow not to produce this hazard. • Avalanche is not included in the previous Winston Salem State University Pre-Disaster Mitigation Plan.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Drought	**YES**	• Review of the NC State Hazard Mitigation Plan • Review of the North Carolina Drought Monitor website • Review of the previous Winston Salem State University Pre-Disaster Mitigation Plan	• There are reports of drought conditions in nineteen out of the last nineteen years in Forsyth County, according to the North Carolina Drought Monitor. • Droughts are discussed in NC State Hazard Mitigation Plan.
Hailstorm	**YES (Assessed under Tornadoes/ Thunderstorms)**	• Review of NC State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NOAA NCEI Storm Events Database • Review of the previous Winston Salem State University Pre-Disaster Mitigation Plan	• Hailstorm events are discussed in the state plan under the Severe Thunderstorm hazard. • NCEI reports 100 hailstorm events (0.75-inch size hail to 2.75 inches) for Forsyth County between 1970 and 2019. There was no property or crop damages reported by NCEI for these events.
Excessive Heat	**YES**	• Review of NOAA NCEI Storm Events Database • Review of the North Carolina State Hazard Mitigation Plan • Review of the previous Winston Salem State University Pre-Disaster Mitigation Plan	• The NC State Hazard Mitigation Plan includes Excessive Heat. • Extreme Heat was not addressed in the previous Winston Salem State University Pre-Disaster Mitigation Plan.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Hurricane and Coastal Hazards	**YES**	• Review of NC State Hazard Mitigation Plan • Analysis of NOAA historical tropical cyclone tracks and National Hurricane Center Website • Review of NOAA • NCEI Storm Events Database • Review of historical presidential disaster declarations • Review of the previous Winston Salem State University Pre-Disaster Mitigation Plan	• Hurricane and coastal hazard events are discussed in the state plan and are listed as a top hazard. • NOAA historical records indicate 14 hurricane/coastal hazards have come within 25 miles of Forsyth County since 1850. • Four out of ten disaster declarations in Forsyth County are directly related to hurricane and costal hazard events. • Hurricane hazards were addressed in the previous Winston Salem State University Pre-Disaster Mitigation Plan.
Lightning	**YES (Assessed under Tornadoes/ Thunderstorms)**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of NOAA NCEI Storm Events Database, NOAA lightning statistics • Review of the previous Winston Salem State University Pre-Disaster Mitigation Plan	• Lightning events are discussed in the state plan as part of the severe thunderstorm hazard. • NCEI reports 3 lightning events for Forsyth County since 1996. These events have resulted in $225 thousand (2020 dollars) in property damage.
Nor'easter	**NO**	• Review of NC State Hazard Mitigation Plan	• Nor'easters are discussed in the state plan.

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?
		• Review of the previous Winston Salem State University Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database	• NCEI does not report any nor'easter activity for Forsyth County. However, nor'easters may have affected the County as severe winter storms. In this case, the activity would be reported under winter storm events. • Nor'easters were not addressed in the previous Winston Salem State University Pre-Disaster Mitigation Plan.
Tornadoes/Thunderstorm	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Winston Salem State University Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations.	• Tornado events are discussed in the NC State Hazard Mitigation Plan. • NCEI reports 16 tornado events in Forsyth County since 1973. These events have resulted in 56 injuries and over $85.8 million (2020 dollars) in property damage with the most severe being an F3. • Tornado events were addressed in the previous Winston Salem State University Pre-Disaster Mitigation Plan.
Severe Thunderstorm	**YES (Assessed under Tornadoes/Thunderstorms)**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Winston Salem State	• Severe thunderstorm events are discussed in the NC State Hazard Mitigation Plan. • NCEI reports 272 thunderstorm wind events in Forsyth County since 1958. These events have resulted in $1.07 million (2020 dollars) in property damage.

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?
		University Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations.	• Severe thunderstorm events were addressed in the previous Winston Salem State University Pre-Disaster Mitigation Plan.
Severe Winter Weather	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Winston Salem State University Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database • Review of historical presidential disaster declarations.	• Severe winter weather events, including snow storms and ice storms, are discussed in the state plan. T • NCEI reports that Forsyth County has been affected by 67 snow and ice events since 1996. These events resulted in over $70,000 (2020 dollars) in damages. • Six of the region's ten disaster declarations were directly related to winter storm events. • Severe winter weather events were addressed in the previous Winston Salem State University Pre-Disaster Mitigation Plan.
Earthquakes	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Winston Salem State University Pre-Disaster Mitigation Plan	• Earthquake events are discussed in the state plan and the Winston Salem State University is considered to be at moderate risk to an earthquake event (Forsyth County as a whole is considered to be at a moderate risk to an earthquake). • Earthquakes were addressed in the previous Winston Salem State University Pre-Disaster

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?
		• Review of the National Geophysical Data Center USGS Earthquake Hazards Program website	Mitigation Plan. 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. • 9 events are known to have occurred in the region according to the National Geophysical Data Center. The greatest MMI reported was a 5. • According to USGS seismic hazard maps, the peak ground acceleration (PGA) with a 10% probability of exceedance in 50 years for the area is approximately 4%g. FEMA recommends that earthquakes be further evaluated for mitigation purposes in areas with a PGA of 3%g or more.
Expansive Soils	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Winston Salem State University Pre-Disaster Mitigation Plan • Review of USDA Soil Conservation Service's Soil Survey	• Expansive soils are not identified in the state plan. • According to FEMA and USDA sources, Winston Salem State University is located in an area that has a "little to no" clay swelling potential. • The previous Winston Salem State University Pre-Disaster Mitigation Plan did not identify expansive soils as a potential hazard.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Geological (Landslides, Sinkholes, Erosion)	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Winston Salem State University Pre-Disaster Mitigation Plan • Review of USGS Landslide Incidence and Susceptibility Hazard Map • Review of the North Carolina Geological Survey database of historic landslides	• Landslide/debris flow events are discussed in the state plan. • USGS landslide hazard maps indicate "low landslide incidence" (more than 15% of the area is involved in land sliding) is found in Forsyth County. • Data provided by NCGS indicate no recorded landslide events in the Winston Salem State University or Forsyth County. • Geological hazards were addressed in the previous Winston Salem State University Pre-Disaster Mitigation Plan.
Land Subsidence	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Winston Salem State University Pre-Disaster Mitigation Plan	• The state plan delineates certain areas that are susceptible to land subsidence hazards in North Carolina; however, none of these areas are located in Forsyth County. • The plan identifies Forsyth County as having scored very low for the land subsidence hazard. • Land Subsidence was not addressed in the previous Winston Salem State University Pre-Disaster Mitigation Plan.
Tsunami	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment	• Tsunamis are discussed in the state plan. However, Forsyth County has zero risk for tsunamis.

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?
		• Review of NC State Hazard Mitigation Plan • Review of the previous Winston Salem State University Pre-Disaster Mitigation Plan • Review of FEMA "How-to" mitigation planning guidance (Publication 386-2, "Understanding Your Risks – Identifying Hazards and Estimating Losses).	• Tsunamis were not addressed in the previous Winston Salem State University Pre-Disaster Mitigation Plan. • No record exists of a catastrophic Atlantic basin tsunami impacting the mid-Atlantic coast of the United States. • Tsunami inundation zone maps are not available for communities located along the U.S. East Coast. • 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.
Volcano	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of USGS Volcano Hazards Program website	• There are no active volcanoes in North Carolina. • There has not been a volcanic eruption in North Carolina in over 1 million years. • No volcanoes are located near Winston Salem State University.
Dam Failure	**YES**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NC State Hazard Mitigation Plan • Review of the previous Winston Salem State	• Dam failure is discussed in the state plan as a hazard of concern • Of the 221 dams reported on the National Inventory of Dams in Forsyth County, 55 are high hazard (25%), (High hazard is defined as "where failure or mis

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?
		University Pre-Disaster Mitigation Plan • Review of North Carolina Division of Land Management website	operation will probably cause loss of human life.") • Dam failure was not addressed in the previous Winston Salem State University Pre-Disaster Mitigation Plan.
Erosion	**YES (Referenced in Geological Hazards)**	• Review of NC State Hazard Mitigation Plan • Review of the previous Winston Salem State University Pre-Disaster Mitigation Plan	• Riverine erosion is addressed in the previous Winston Salem State University Pre-Disaster Mitigation Plan. • Coastal erosion is discussed in the state plan but only for coastal areas (there is no discussion of riverine erosion).
Flooding	**YES**	• Review of NC State Hazard Mitigation Plan • Review of historical disaster declarations • Review of NOAA NCEI Storm Events Database • Review of the previous Winston Salem State University Pre-Disaster Mitigation Plan	• The flood hazard is thoroughly discussed in the state plan. • Four of the ten Presidential Disaster Declarations were directly associated with flooding. • NCEI reports that Forsyth County have been affected by 44 flood events since 1996. These events in total caused over $555 thousand (2020 dollars) in property damages. • Flooding was addressed in the previous Winston Salem State University Pre-Disaster Mitigation Plan.
Storm Surge	**NO**	• Review of FEMA's Multi-Hazard Identification and Risk Assessment	• Storm surge is discussed in the state plan under the hurricane hazard; however, Forsyth

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?
		• Review of NC State Hazard Mitigation Plan • Review of the previous Winston Salem State University Pre-Disaster Mitigation Plan • Review of NOAA NCEI Storm Events Database	County has no risk to the hazard. • Storm Surge was not addressed in the previous Winston Salem State University Pre-Disaster Mitigation Plan. • No historical events were reported by NCEI • Given the inland location of Winston Salem State University, storm surge would not affect the area.
OTHER HAZARDS			
Wildfires	**YES**	• Review of NC State Hazard Mitigation Plan • Review of the previous Winston Salem State University Pre-Disaster Mitigation Plan • Review of Southern Wildfire Risk Assessment (SWRA) Data • Review of the NC Division of Forest Resources website	• Wildfires occur in virtually all parts of the United States. Wildfire hazard risk will increase as low-density development along the urban/wildland interface increases. • Wildfires were not addressed in the previous Winston Salem State University Pre-Disaster Mitigation Plan. • According to the North Carolina Division of Forest Resources, Forsyth County experiences an average of 188 fires each year which burn a combined 185 acres
Hazardous Substances	**YES**	• Review of the previous Winston Salem State University Pre-Disaster Mitigation Plan	• Review of Pipeline and Hazardous Materials Safety Administration data indicates 24 HAZMAT incidents, which resulted in $557,148 in property damage, in Forsyth County.

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?
			• EPA Toxic Release Inventory indicates 24 Toxic Release Inventory (TRI) facilities in Forsyth County. • All counties identify hazardous substances as a potential concern. • This update assesses hazardous materials, hazardous chemicals, and oil spills under this hazard.
Infectious Disease	**YES**	• Review of the previous Winston Salem State University Pre-Disaster Mitigation Plan • Review of the NC State Hazard Mitigation Plan.	• Infectious Disease is identified as a hazard in the state plan. • Although the previous WSSU Pre-Disaster Mitigation Plan did not include infectious disease as a hazard, it is assessed in this update to maintain consistency with the NC State Hazard Mitigation Plan • Infectious Disease has caused one of the ten disaster declarations in Forsyth County
TECHNOLOGICAL HAZARDS			
Terrorism	**YES**	• Review of the NC State Hazard Mitigation Plan • Review of previous Winston Salem State University Pre-Disaster Mitigation Plan • Review of local official knowledge	• Although the previous Winston Salem State University Pre-Disaster Mitigation Plan did not include terrorism threat as a hazard, it is assessed in this update to maintain consistency with the NC State Hazard Mitigation Plan. • This hazard will assess chemical, biological, radiological, nuclear, and explosive terrorism events.

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Radiological Emergency – Fixed Nuclear Facilities	**NO**	• Review of the previous Winston Salem State University Pre-Disaster Mitigation Plan • Review of IAEA list of fixed nuclear power stations in the United States • Discussion with local officials about location of nuclear power stations	• Radiological emergencies are not identified in the previous plan. • There are no nuclear facilities located within 50 miles of the Winston Salem State University or Forsyth County
Cyber	**YES**	• Review of NC State Hazard Mitigation Plan	• Changing future conditions encourage the assessment of the possibility of a cyber-attack with the increase in global technology
Electromagnetic Pulse	**YES**	• Review of NC State Hazard Mitigation Plan	• Changing future conditions encourage the assessment of the possibility of an electromagnetic pulse with the increase in global technology

H.5 Hazard Profiles, Analysis, and Vulnerability

This section includes detailed hazard profiles for each of the hazards identified in the Hazard Identification section as significant enough for further evaluation in the Winston-Salem State University Hazard Mitigation Plan. It contains the following subsections:

- H.5.1 Overview
- H.5.2 Drought
- H.5.3 Excessive Heat
- H.5.10 Flooding
- H.5.11 Wildfires
- H.5.12 Infectious Disease

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.

Natural Hazards

H.5.1 Overview

This section includes detailed hazard profiles for each of the hazards identified in the Hazard Identification section as significant enough for further evaluation in the Winston-Salem State University 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 Campus Hazard Mitigation Planning Team as it relates to unique historical or anecdotal hazard information as it applies specifically for Winston-Salem State University.

After reviewing the list of assessed hazards from the previous plan, the WSSU Campus Hazard Mitigation 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**
    - 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
  - Terrorism
  - Cyber
  - Electromagnetic Pulse

Much of the information in this section begins with a review of how the hazards impact Forsyth County because that is the level at which the most readily-available and best-available information is provided. Where feasible, County-level information is supplemented with campus-specific details.

H.5.2 DROUGHT

H.5.2.1 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, 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. It is also notable that drought conditions typically do not cause significant damage to the built environment.

H.5.2.2 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 H.8.**

TABLE H.8: 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 NOAA, Forsyth County has had drought occurrences in seventeen of the last nineteen years (2000-2019) (**Table** H.**9**). 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 H.9: SUMMARY OF DROUGHT OCCURRENCES IN FORSYTH COUNTY (2000-2019)

Year	Forsyth County
2000	Extreme Drought
2001	Extreme Drought
2002	Exceptional Drought
2003	Abnormally Dry
2004	Abnormally Dry
2005	Severe Drought
2006	Severe Drought
2007	Exceptional Drought
2008	Exceptional Drought
2009	Moderate Drought
2010	Moderate Drought
2011	Moderate Drought
2012	Moderate Drought
2013	Moderate Drought
2014	Abnormally Dry
2015	Moderate Drought
2016	Moderate Drought
2017	Moderate Drought
2018	Moderate Drought
2019	Severe Drought

Source: NOAA, Storm and Weather Events Database

H.5.2.3 Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of Forsyth County, including the Winston-Salem State University campus, 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[1].

[1] *U.S. Seasonal Drought Outlook. National Weather Service Climate Prediction Center. http://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php*

H.5.3 EXCESSIVE HEAT

H.5.3.1 Location and Spatial Extent

Excessive heat typically impacts a large area and cannot be confined to any geographic or political boundaries. The entire Winston-Salem State University campus is susceptible to extreme heat conditions.

H.5.3.2 Historical Occurrences

Data from the National Centers for Environmental Information showed that there have not been any historical excessive heat and heat wave events in Forsyth County. Typical weather conditions in Winston-Salem, North Carolina, where the campus is located, tend not to rise above 80 degrees Fahrenheit. **Table H.10** shows the average maximum temperatures from 2001 to 2019.

TABLE H.10: AVERAGE MAXIMUM TEMPERATURE IN WINSTON-SALEM, NORTH CAROLINA

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
49°F	53°F	61°F	71°F	78°F	85°F	89°F	86°F	80°F	71°F	62°F	51°F

Source: State Climate Office of North Carolina

The highest temperature ever recorded in Winston-Salem, was 104°F on June 26, 1952. There were no reported incidents of excessive heat events for Forsyth County within the National Centers for Environmental Information database.

H.5.3.3 Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of Forsyth County, including the Winston-Salem State University campus, has a probability level of possible (1 to 10 percent annual probability) for future extreme heat events to impact the region.

H.5.4 HURRICANE AND COASTAL HAZARDS

H.5.4.1 Location and Spatial Extent

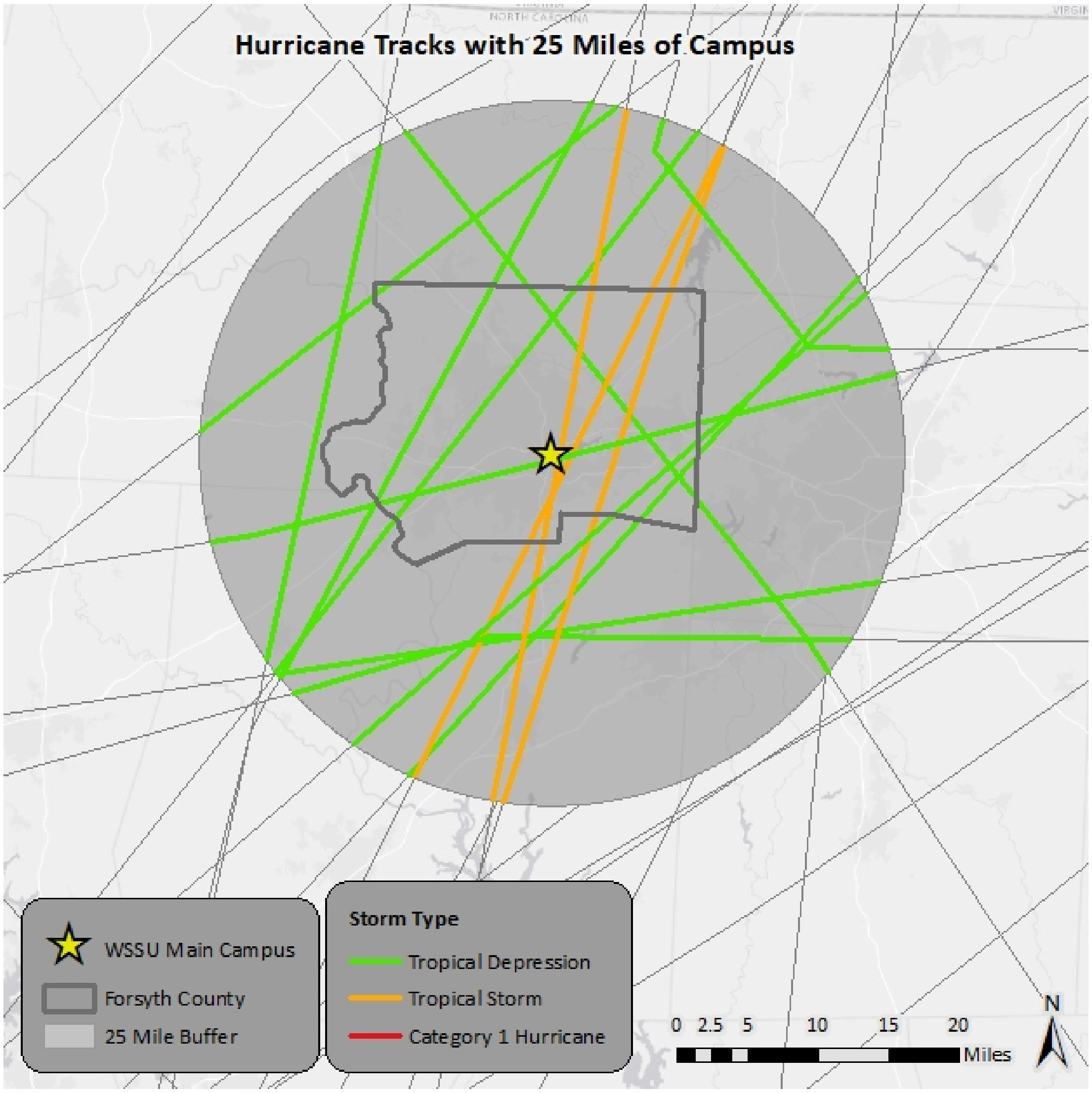
Hurricanes, coastal hazards, and tropical storms threaten the entire Atlantic and Gulf seaboard of the United States. While coastal areas are most directly exposed to the brunt of landfalling storms, their impact is often felt hundreds of miles inland and they can affect the Winston-Salem State University Campus.

H.5.4.2 Historical Occurrences

According to the National Hurricane Center's historical storm track records, 14 tropical storm tracks have passed within 25 miles of WSSU's campus since 1850[2]. This includes 11 tropical depressions and 3 tropical storms. These storm events are shown in **Figure H.5.** Furthermore, **Table H.11** provides for each event the date of occurrence, name (if applicable), maximum wind speed (as recorded within 25 miles of Forsyth County) and Category of the storm based on the Saffir-Simpson Scale.

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

FIGURE H.5: HISTORICAL HURRICANE STORM TRACKS WITHIN 25 MILES OF WINSTON-SALEM STATE UNIVERSITY



Source: National Oceanic and Atmospheric Administration; National Hurricane Center

TABLE H.11: HISTORICAL STORM TRACKS WITHIN 25 MILES OF WINSTON-SALEM STATE UNIVERSITY (1907–2020)

Year	Storm Name	Maximum Wind Speed (knots)	Storm Category
1907	UNNAMED	35	Tropical Depression
1911	UNNAMED	25	Tropical Depression
1915	UNNAMED	35	Tropical Depression
1920	UNNAMED	35	Tropical Depression
1927	UNNAMED	35	Tropical Depression
1928	UNNAMED	30	Tropical Depression

1952	Able	40	Tropical Storm
1968	Abby	25	Tropical Depression
1979	David	45	Tropical Storm
1985	Bob	45	Tropical Storm
1985	Danny	25	Tropical Depression
1988	Chris	20	Tropical Depression
1999	Dennis	25	Tropical Depression
2004	Jeanne	20	Tropical Depression

Source: National Hurricane Center

The National Centers for Environmental Information recorded 4 hurricane and 2 tropical storm events in Forsyth County between 1996 and 2018. A summary of these events is presented in **Table H.12**. Hurricane and tropical storm events have caused 5 presidential disaster declarations in Forsyth County. While these were not recorded in the database, effects from these types of storms were likely still felt in other hazards, including thunderstorms and flooding. Flooding is generally the greatest hazard of concern with hurricane and tropical storm events in the area near Winston-Salem State University.

TABLE H.12: HURRICANE AND TROPICAL STORM DATA FOR FORSYTH COUNTY

Location	Date	Type	Deaths/Injuries	Property Damage	Description
FORSYTH (ZONE)	1996-07-12	Hurricane (Typhoon)	0/0	$0	Hurricane Bertha moved along the edge of the NWSFO Raleigh county warning area. Three counties sustained substantial crop damage. Structural damage was light and was primarily caused by trees on homes and cars. The hardest hit county was Wayne where property damage was estimated at $500,000. Power outages were widespread in the eastern counties as trees took down power lines. Two F0 tornadoes occurred: one in Wake and one in Wilson counties. No injuries or deaths were reported
FORSYTH (ZONE)	1996-09-05	Hurricane (Typhoon)	0/0	$0	Hurricane Fran was the worst natural economic disaster to occur in North Carolina history. In the RAH county warning area along, the damage exceeded 2 billion dollars. Damage to crops, livestock, farm equipment/buildings was over 400 million. The agricultural damage was the greatest in Sampson, Johnston, and Wayne counties. Several hundred thousand trees were uprooted or broken. Tens of thousands of homes were damaged by falling trees. In the path of the storm's center, almost every neighborhood was affected.
FORSYTH (ZONE)	1999-09-04	Hurricane (Typhoon)	0/0	$0	After meandering off the coast and ruining the Labor Day weekend for millions, the remnants of Dennis finally moved inland across the central portion of the state. Its main impact was to end the drought in the eastern half of the state.

FORSYTH (ZONE)	1999-09-15	Hurricane (Typhoon)	0/0	$0	Hurricane Floyd produced more human misery and environmental impact in North Carolina than any disaster in memory. The 15-20 inches of rain that fell across the eastern half of the state caused every river and stream to flood. Many rivers set new flood records. Whole communities were underwater for days, even weeks in some areas. Thousands of homes were lost. Crop damage was extensive. The infrastructure of the eastern counties, mainly roads, bridges, water plants, etc., was heavily damaged. By the end of 1999, $1.5 billion had already been spent, with estimates that the cost would reach $3-4 billion. The counties within the Raleigh county total warning area probably sustained more than half of the state total.
FORSYTH (ZONE)	2016-09-02	Tropical Storm	0/0	$0	Tropical Storm Hermine tracked along the Southeast United States coastline and across coastal portions of the Carolina's. Tropical Storm Hermine produced heavy rain across portions of central North Carolina. However, due to dry antecedent conditions, no flooding occurred despite rainfall amounts of up to 3 to 5 inches across southeastern portions of central North Carolina. Given the rain and gusty winds associated with Hermine there were numerous reports of trees down and wind damage and resultant power outages.
FORSYTH (ZONE)	2018-10-11	Tropical Storm	0/0	$500,000	Tropical Storm Michael moved through North Carolina on Thursday, October 11th. Michael brought heavy rain and strong damaging winds to central North Carolina. While heavy rainfall of 3 to 6 inches produced minor flash flooding across the area, it was high wind gusts of 40 to 60 mph that caused the biggest problems, knocking down score of trees, leading to blocked roadways and thousands without power.

Source: National Centers for Environmental Information

H.5.4.3 Probability of Future Occurrences

Given the inland location of the campus, it is more likely to be affected by remnants of hurricane and tropical storm systems (as opposed to a major hurricane) which may result in flooding or high winds. The probability of being impacted is less than coastal areas, but still remains a real threat to Winston-Salem State University due to induced events like flooding and land sliding. Based on historical evidence, the probability level of future occurrence is possible (between 1 and 10 percent annual probability). However, when the area is impacted, the damage could be severe, threatening lives and property on campus.

H.5.5 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 hailstorms and lightning.

H.5.5.1 Location and Spatial Extent

Tornadoes

Tornadoes occur throughout the state of North Carolina, and thus in the area surrounding Winston-Salem State University. 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 area surrounding the Winston-Salem State University campus 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 Winston-Salem State University typically experiences several straight-line wind events each year. These wind events can and have caused significant damage. It is assumed that the area surrounding the Winston-Salem State University campus 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 all of the area surrounding the Winston-Salem State University campus is uniformly exposed to severe thunderstorms; therefore, the campus itself is also 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 area surrounding the Winston-Salem State University campus is uniformly exposed to lightning.

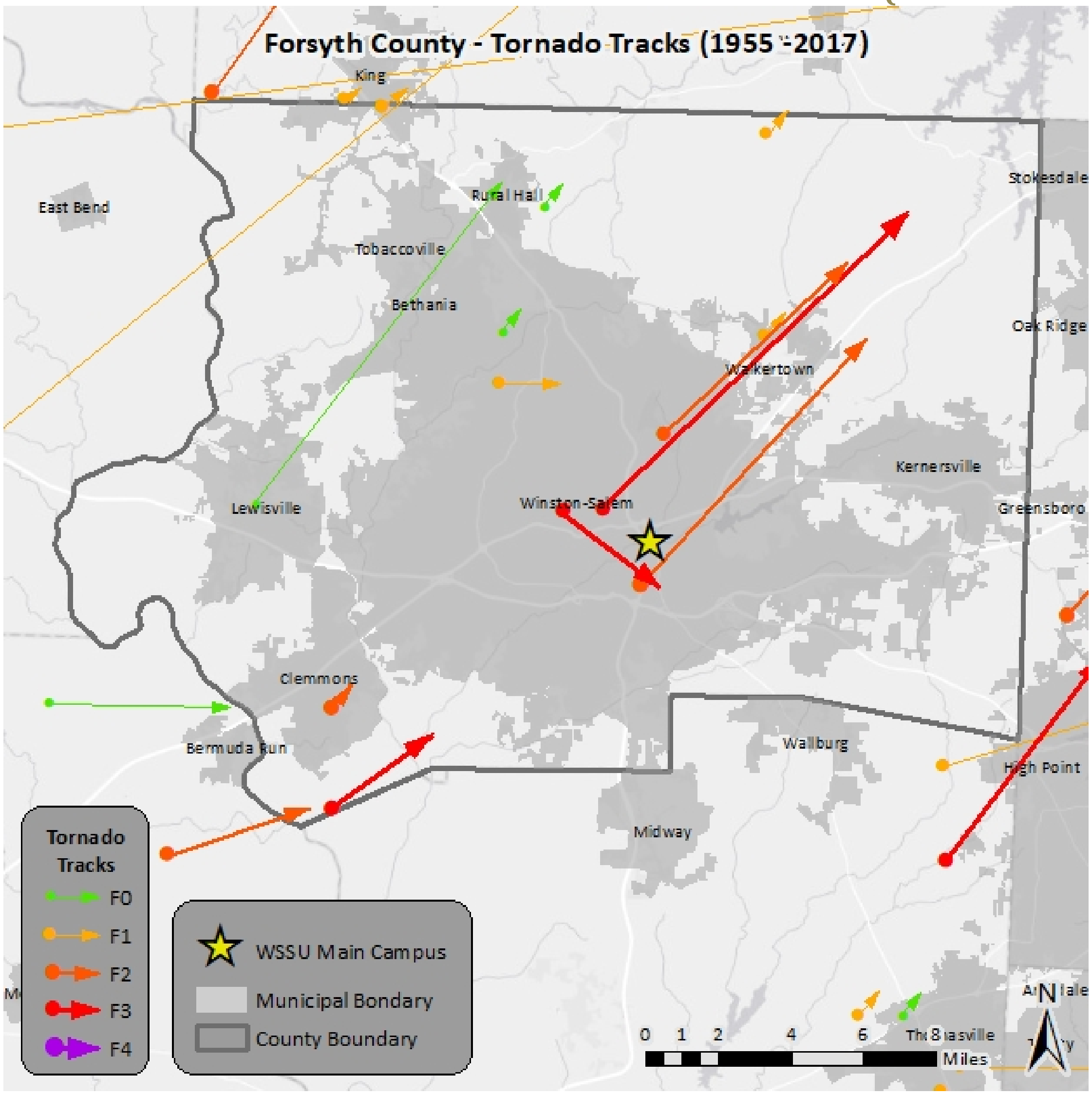
H.5.5.2 Historical Occurrences

Tornadoes

Tornadoes are a somewhat rare occurrence; however, they have and do occur in the area. According to the National Centers for Environmental Information, there have been 16 recorded tornado events in Forsyth County since 1973 (**Table H.13**), resulting in over $85.8 million in property damages[3]. In addition, 56 injuries but no deaths were reported. The magnitude of these tornados' ranges from F0 to F3 in intensity, although an F5 event is possible but not likely. 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. **Figure H.6** shows a map of tornado impact in Forsyth County.

[3] 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 Forsyth County. As additional local data becomes available, this hazard profile will be amended.

FIGURE H.6: TORNADO TRACKS IN FORSYTH COUNTY (1950 – 2017)



Source: National Centers for Environmental Information

TABLE H.13: HISTORICAL TORNADO IMPACTS IN FORSYTH COUNTY

Date	Magnitude	Deaths/Injuries	Property Damage	Details
5/28/1973	F0	0/2	$25,000	N/A
4/9/1980	F1	0/0	$250,000	N/A
6/6/1981	F2	0/1	$250,000	N/A
6/3/1982	F0	0/0	$30	N/A
3/5/1983	F1	0/0	$25,000	N/A
7/22/1983	F1	0/0	$250,000	N/A
5/22/1985	F3	0/0	$2,500,000	N/A
5/5/1989	F2	0/8	$2,500,000	N/A

Date	Magnitude	Deaths/Injuries	Property Damage	Details
5/5/1989	F3	0/30	$25,000,000	N/A
5/5/1989	F2	0/10	$2,500,000	N/A
11/22/1992	F1	0/0	$0	N/A
5/7/1998	F3	0/5	$50,000,000	A large tornado tore through the Waterford Subdivision of Clemmons in southwest Forsyth county. The initial touchdown was at 630 pm local time. Several homes were completely destroyed, several hundred sustained major roof, wall, and window damage. Tree damage was extensive with debris scattered for miles.
7/7/2005	F0	0/0	$0	A weak tornado touched down near Lewisville, blowing several trees onto homes there and in Pfafftown as well. The tornado touched down repeatedly as it traveled northeast, finally lifting at Rural Hall. Mostly tree damage was reported along the path, at Highway 52 and Westinghouse Road, Boiling Springs Road, Ridge Road, and along NC Highway 67.
9/14/2007	EF0	0/0	$0	A weak brief tornado touched down damaging several homes along Peace Haven Street. The tornado ripped the siding off several homes and also knocked down several trees.
5/8/2008	EF2	0/0	$0	An EF-2 tornado tracked northeast out of Davie County and crossed the Yadkin River into Forsyth County. After crossing the Yadkin River, the tornado touched down near the Old Clemmons Water Treatment Plant along Idols Dam Road. The tornado tracked northeast through a heavily wooded area for just over one quarter of a mile and then lifted off the ground. The parent supercell thunderstorm went on to produce another tornado approximately one-mile northeast of the first tornado's ending point. This second tornado went on to produce significant damage to the Clemmons community in Forsyth County.
5/8/2008	EF3	0/2	$2,500,000	This tornado originated from the same parent supercell that produced the tornado in Davie County which lifted in Forsyth County just across the Yadkin River. This second tornado touched down just southwest of Hampton Road. Three metal barns sustained major damage around the 4800 block of Hampton Road with minor damage to two homes. The tornado continued northeast through wooded farmland before hitting the Bridgepoint Subdivision where the tornado strengthened to EF-3 intensity. Three homes were destroyed and approximately thirty homes sustained moderate damage. There were only two minor injuries in the subdivision. The tornado continued to track to the northeast across Frye Bridge Road and through a heavily wooded area. It then dissipated near the intersection of Cooper Road and Fraternity Church Road. A few homes suffered damage, primarily due to fallen trees. Hardwood tree damage in the area was consistent with EF-2 intensity as tree trunks were snapped in a 200 to 300-yard path. The overall path length of the tornado was around 3 miles with a maximum width of 300 yards.

Source: NCEI

Thunderstorms

According to NCEI, there have been 272 reported thunderstorm and high wind events since 1958 in Forsyth County[4]. These events caused over $1.07 million (2020 dollars) in damages. National Centers for Environmental Information reported 1 death and 3 injuries related to thunderstorm wind events. **Table H.14** summarizes this information.

TABLE H.14: HISTORICAL THUNDERSTORM IMPACTS IN FORSYTH COUNTY

Location	Date	Magnitude (kts)	Deaths	Injuries	Property Damage
Forsyth County	5/17/1958	55	0	0	$0
Forsyth County	8/24/1958	0	0	0	$0
Forsyth County	7/20/1959	0	0	0	$0
Forsyth County	8/29/1960	0	0	0	$0
Forsyth County	2/25/1961	84	0	0	$0
Forsyth County	7/15/1961	60	0	0	$0
Forsyth County	3/31/1962	64	0	0	$0
Forsyth County	5/15/1962	50	0	0	$0
Forsyth County	5/25/1962	60	0	0	$0
Forsyth County	6/6/1962	62	0	0	$0
Forsyth County	7/16/1962	100	0	0	$0
Forsyth County	1/24/1965	0	0	0	$0
Forsyth County	5/15/1967	56	0	0	$0
Forsyth County	6/25/1967	0	0	0	$0
Forsyth County	6/24/1969	0	0	0	$0
Forsyth County	7/25/1969	0	0	0	$0
Forsyth County	5/22/1970	0	0	0	$0
Forsyth County	8/6/1970	55	0	0	$0
Forsyth County	6/29/1971	0	0	0	$0
Forsyth County	5/23/1973	0	0	0	$0
Forsyth County	4/2/1974	0	0	0	$0
Forsyth County	5/23/1975	0	0	0	$0
Forsyth County	5/25/1975	57	0	0	$0
Forsyth County	6/5/1975	0	0	0	$0
Forsyth County	2/18/1976	0	0	0	$0
Forsyth County	9/24/1980	65	0	0	$0
Forsyth County	6/6/1981	0	0	0	$0
Forsyth County	7/22/1983	60	0	0	$0
Forsyth County	7/24/1983	0	0	0	$0

[4] 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 Forsyth County. As additional local data becomes available, this hazard profile will be amended.

Location	Date	Magnitude (kts)	Deaths	Injuries	Property Damage
Forsyth County	7/4/1984	0	0	1	$0
Forsyth County	7/25/1984	0	0	0	$0
Forsyth County	6/5/1985	63	0	0	$0
Forsyth County	6/11/1985	0	0	0	$0
Forsyth County	10/15/1985	0	0	0	$0
Forsyth County	6/12/1986	0	0	0	$0
Forsyth County	4/15/1987	0	0	0	$0
Forsyth County	7/24/1987	0	0	0	$0
Forsyth County	5/10/1988	0	0	0	$0
Forsyth County	6/26/1988	0	0	0	$0
Forsyth County	8/10/1988	0	0	0	$0
Forsyth County	5/6/1989	0	0	0	$0
Forsyth County	5/22/1989	0	0	0	$0
Forsyth County	8/23/1989	0	0	0	$0
Forsyth County	8/23/1989	0	0	0	$0
Forsyth County	4/9/1991	0	0	0	$0
Forsyth County	4/29/1991	0	0	0	$0
Forsyth County	4/16/1992	0	0	0	$0
Forsyth County	6/8/1992	50	0	0	$0
Forsyth County	11/22/1992	80	0	0	$0
Winston-Salem	8/20/1993	60	0	0	$0
Forsyth County	7/16/1995	0	0	0	$0
WINSTON-SALEM	4/20/1996	0	0	0	$0
WINSTON-SALEM	5/11/1996	0	0	0	$15,000
TOBACCOVILLE	5/27/1996	0	0	0	$10,000
WINSTON-SALEM	7/2/1996	0	0	0	$0
WINSTON-SALEM	11/8/1996	50	0	0	$0
WINSTON-SALEM	3/5/1997	50	1	1	$20,000
KERNERSVILLE	7/28/1997	50	0	0	$0
WINSTON SALEM	5/26/1998	50	0	0	$20,000
WINSTON SALEM	6/16/1998	50	0	0	$0
RURAL HALL	6/26/1998	50	0	0	$0
WINSTON SALEM	3/11/2000	50	0	0	$0
CLEMMONS	5/20/2000	60	0	0	$0
WINSTON SALEM	5/20/2000	60	0	0	$0
WALKERTOWN	5/25/2000	70	0	0	$0
COUNTYWIDE	6/15/2000	50	0	0	$0
WINSTON SALEM	8/7/2000	50	0	0	$0
RURAL HALL	8/10/2000	50	0	0	$0
BELEWS CREEK	9/14/2000	50	0	0	$0
CLEMMONS	6/28/2001	50	0	0	$0

Location	Date	Magnitude (kts)	Deaths	Injuries	Property Damage
BELEWS CREEK	5/13/2002	50	0	0	$0
WINSTON SALEM	11/11/2002	50	0	0	$0
LEWISVILLE	5/2/2003	60	0	0	$0
WINSTON SALEM	5/2/2003	60	0	0	$0
PFAFFTOWN	6/8/2003	57	0	0	$0
LEWISVILLE	6/8/2003	50	0	0	$0
PFAFFTOWN	11/24/2004	50	0	0	$0
SEWARD	1/14/2005	50	0	0	$0
WINSTON SALEM	6/6/2005	50	0	0	$0
WINSTON SALEM	6/7/2005	50	0	0	$0
TOBACCOVILLE	7/7/2005	50	0	0	$0
CLEMMONS	4/3/2006	50	0	0	$0
LEWISVILLE	4/17/2006	50	0	0	$0
CLEMMONS	4/17/2006	50	0	0	$0
WINSTON SALEM	4/22/2006	50	0	0	$0
KERNERSVILLE	4/22/2006	50	0	0	$0
WINSTON SALEM	6/23/2006	50	0	0	$0
WALKERTOWN	7/4/2006	50	0	0	$0
KERNERSVILLE	7/4/2006	50	0	0	$0
RURAL HALL	7/13/2006	50	0	0	$0
RURAL HALL	7/13/2006	50	0	0	$0
RURAL HALL	7/13/2006	50	0	0	$0
WINSTON SALEM	7/19/2006	50	0	0	$0
WINSTON SALEM	7/19/2006	50	0	0	$0
WINSTON SALEM	7/22/2006	50	0	0	$0
KERNERSVILLE	7/28/2006	50	0	0	$0
WINSTON SALEM	7/28/2006	50	0	0	$0
COUNTYWIDE	9/28/2006	50	0	0	$0
WINSTON SALEM	9/28/2006	50	0	0	$0
WINSTON SALEM	6/11/2007	50	0	0	$0
WINSTON SALEM	6/11/2007	50	0	0	$0
WINSTON SALEM	6/11/2007	50	0	0	$0
WINSTON SALEM	6/19/2007	50	0	0	$0
WINSTON SALEM	6/24/2007	50	0	0	$0
WALKERTOWN	6/27/2007	50	0	0	$0
WINSTON SALEM	6/28/2007	50	0	0	$0
WINSTON SALEM	8/21/2007	50	0	0	$0
WINSTON SALEM	3/4/2008	52	0	0	$0
WINSTON SALEM	3/4/2008	50	0	0	$0
WALKERTOWN	6/27/2008	50	0	0	$0
LEWISVILLE	6/27/2008	50	0	0	$10,000

Location	Date	Magnitude (kts)	Deaths	Injuries	Property Damage
LEWISVILLE	6/28/2008	50	0	0	$0
WINSTON SALEM	7/6/2008	54	0	0	$0
(INT)WINSTON-SALEM A	7/6/2008	63	0	0	$0
DONNAHA	7/9/2008	50	0	0	$0
DONNAHA	7/9/2008	50	0	0	$0
BETHANIA	7/9/2008	50	0	0	$0
CLEMMONS	7/9/2008	50	0	0	$0
WINSTON SALEM	7/22/2008	50	0	0	$0
LEWISVILLE	8/2/2008	50	0	0	$0
HANES	8/2/2008	50	0	0	$0
MUDDY CREEK	8/2/2008	50	0	0	$1,000
CLEMMONS STATION	6/9/2009	52	0	0	$0
KERNERSVILLE	6/10/2009	50	0	0	$0
BROOKWOOD	7/20/2009	50	0	0	$0
LEWISVILLE	9/28/2009	50	0	0	$0
LEWISVILLE	9/28/2009	50	0	0	$15,000
LEWISVILLE	9/28/2009	50	0	0	$0
WINSTON JCT	4/8/2010	50	0	0	$0
PFAFFTOWN	5/28/2010	50	0	0	$7,000
LEWISVILLE	5/28/2010	50	0	0	$0
LEWISVILLE	5/28/2010	50	0	0	$0
CLEMMONS	5/28/2010	50	0	0	$0
WINSTON SALEM	6/2/2010	50	0	0	$10,000
LEWISVILLE	6/2/2010	50	0	0	$10,000
LEWISVILLE	6/14/2010	50	0	0	$1,000
PARK TERRACE	6/14/2010	50	0	0	$5,000
STANLEYVILLE	7/13/2010	50	0	0	$0
WAUGHTOWN	7/13/2010	50	0	0	$0
GUTHRIE	7/27/2010	50	0	0	$0
UNION CROSS	8/5/2010	50	0	0	$0
LEWISVILLE	10/26/2010	50	0	0	$0
DENNIS	11/16/2010	50	0	0	$0
PFAFFTOWN	12/1/2010	50	0	0	$0
DONNAHA	5/13/2011	50	0	0	$0
DOSIER	5/26/2011	50	0	0	$5,000
TOBACCOVILLE	5/26/2011	50	0	0	$0
RURAL HALL	5/26/2011	50	0	0	$0
UNION CROSS	5/27/2011	50	0	0	$25,000
HANES	6/18/2011	50	0	0	$75,000
WALKERTOWN	6/18/2011	50	0	0	$0
CLEMMONS STATION	6/27/2011	50	0	0	$0

Location	Date	Magnitude (kts)	Deaths	Injuries	Property Damage
WAUGHTOWN	6/28/2011	50	0	0	$0
DONNAHA	7/4/2011	50	0	0	$0
VIENNA	7/4/2011	50	0	0	$0
UNION CROSS	7/8/2011	50	0	0	$0
GUTHRIE	7/8/2011	50	0	0	$0
STANLEYVILLE	8/14/2011	50	0	0	$0
WALKERTOWN	8/14/2011	50	0	0	$0
EASTON VIEW	8/14/2011	50	0	0	$0
TOBACCOVILLE	8/21/2011	50	0	0	$0
TOBACCOVILLE	9/2/2011	50	0	0	$0
DONNAHA	2/24/2012	50	0	0	$0
LEWISVILLE	2/24/2012	50	0	0	$0
UNION CROSS	2/24/2012	50	0	0	$0
WINSTON SALEM	2/24/2012	50	0	0	$0
LEWISVILLE	5/14/2012	50	0	0	$0
EASTON VIEW	5/14/2012	50	0	0	$0
WALKERTOWN	5/14/2012	50	0	0	$0
WALKERTOWN	5/14/2012	50	0	0	$0
KERNERSVILLE	5/14/2012	50	0	0	$2,000
WINSTON JCT	5/22/2012	50	0	0	$0
OLDTOWN	6/1/2012	50	0	0	$0
STANLEYVILLE	6/22/2012	50	0	0	$0
CLEMMONS	6/22/2012	50	0	0	$0
KERNERSVILLE	6/22/2012	50	0	0	$0
DOSIER	7/2/2012	50	0	0	$0
WALKERTOWN	7/2/2012	50	0	0	$0
LEWISVILLE	7/5/2012	50	0	0	$0
OLDTOWN	7/27/2012	50	0	0	$0
OLDTOWN	7/27/2012	50	0	0	$5,000
OLDTOWN	9/8/2012	50	0	0	$750
DONNAHA	1/30/2013	50	0	0	$200
ALSPAUGH	4/12/2013	50	0	0	$0
HANES	4/19/2013	50	0	0	$0
KERNERSVILLE	6/10/2013	50	0	0	$0
BETHANIA	6/13/2013	50	0	0	$500,000
BROOKWOOD	6/13/2013	50	0	0	$0
WINSTON SALEM	6/26/2013	50	0	0	$0
CLEMMONS	7/27/2013	50	0	0	$0
CLEMMONS	7/27/2013	50	0	0	$25,000
LEWISVILLE	3/12/2014	52	0	0	$0
KERNERSVILLE	6/10/2014	50	0	0	$500

Location	Date	Magnitude (kts)	Deaths	Injuries	Property Damage
KERNERSVILLE	6/11/2014	50	0	0	$2,000
RURAL HALL	6/19/2014	50	0	0	$0
LEWISVILLE	6/19/2014	50	0	0	$0
LEWISVILLE	5/11/2015	50	0	0	$0
CLEMMONS	6/2/2015	50	0	0	$0
EASTON VIEW	6/2/2015	50	0	0	$0
CLEMMONS	6/27/2015	50	0	0	$0
WALKERTOWN	7/13/2015	50	0	0	$10,000
STANLEYVILLE	8/6/2015	50	0	0	$15,000
HANES	2/24/2016	50	0	0	$7,000
CLEMMONS	5/3/2016	50	0	1	$10,000
CITYVIEW	5/12/2016	50	0	0	$10,000
KERNERSVILLE	7/8/2016	50	0	0	$2,500
CLEMMONS STATION	7/8/2016	50	0	0	$2,500
LEWISVILLE	7/19/2016	50	0	0	$0
LEWISVILLE	7/19/2016	50	0	0	$0
PFAFFTOWN	7/27/2016	50	0	0	$2,500
UNION CROSS	4/6/2017	50	0	0	$1,000
GUTHRIE	5/1/2017	50	0	0	$2,500
KERNERSVILLE	5/1/2017	50	0	0	$500
UNION CROSS	5/1/2017	50	0	0	$2,500
KERNERSVILLE	5/1/2017	50	0	0	$5,000
KERNERSVILLE	5/1/2017	50	0	0	$500
KERNERSVILLE	5/1/2017	50	0	0	$5,000
ALSPAUGH	5/19/2017	50	0	0	$3,000
TOBACCOVILLE	5/24/2017	50	0	0	$0
TOBACCOVILLE	5/24/2017	50	0	0	$0
DONNAHA	5/24/2017	50	0	0	$0
SOUTH WINSTON SALEM	7/18/2017	50	0	0	$10,000
FRONTIS	7/18/2017	50	0	0	$30,000
DONNAHA	7/22/2017	50	0	0	$0
DONNAHA	7/22/2017	50	0	0	$0
GUTHRIE	7/22/2017	50	0	0	$0
LEWISVILLE	7/22/2017	50	0	0	$0
LEWISVILLE	7/22/2017	50	0	0	$1,500
TOBACCOVILLE	7/23/2017	50	0	0	$20,000
KERNERSVILLE	10/23/2017	50	0	0	$1,000
LEWISVILLE	4/15/2018	50	0	0	$3,000
GUTHRIE	5/20/2018	50	0	0	$50,000
LEWISVILLE	6/1/2018	50	0	0	$2,000
LEWISVILLE	6/11/2018	50	0	0	$0

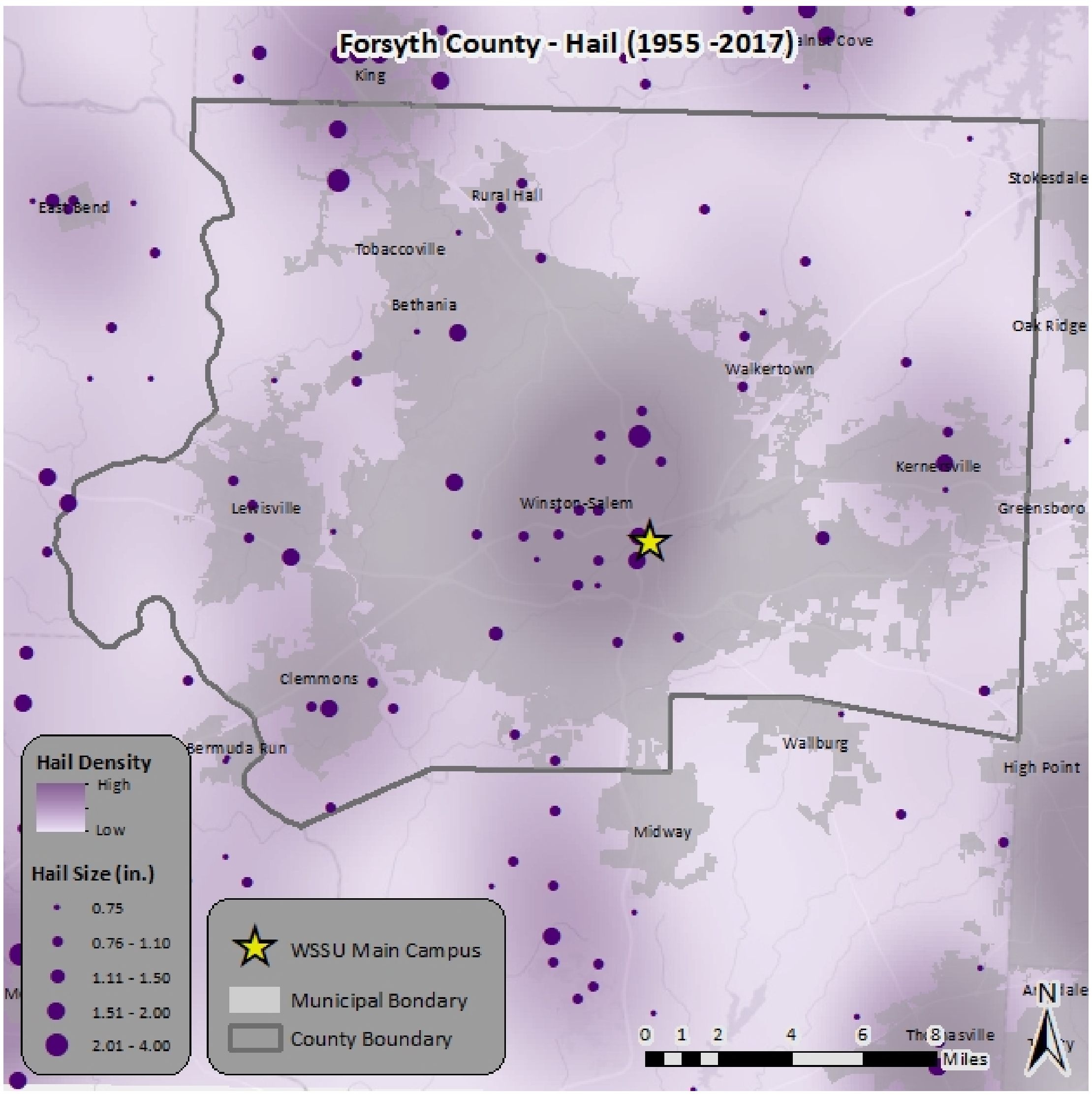
Location	Date	Magnitude (kts)	Deaths	Injuries	Property Damage
LEWISVILLE	6/11/2018	50	0	0	$1,000
LEWISVILLE	6/25/2018	50	0	0	$0
CLEMMONS	6/25/2018	50	0	0	$0
CLEMMONS	7/6/2018	50	0	0	$0
KERNERSVILLE	7/6/2018	50	0	0	$0
(INT)WINSTON-SALEM A	7/22/2018	50	0	0	$5,000
LEWISVILLE	7/22/2018	50	0	0	$0
PFAFFTOWN	7/22/2018	50	0	0	$0
WALKERTOWN	7/22/2018	50	0	0	$0
WALKERTOWN	7/22/2018	50	0	0	$0
DENNIS	7/22/2018	50	0	0	$0
LEWISVILLE	8/2/2018	50	0	0	$10,000
BETHANIA	8/2/2018	50	0	0	$15,000
BETHANIA	8/7/2018	50	0	0	$0
RURAL HALL	8/8/2018	50	0	0	$250
STANLEYVILLE	8/8/2018	50	0	0	$250
WINSTON JCT	8/8/2018	50	0	0	$0
CLEMMONS	4/19/2019	50	0	0	$0
OLDTOWN	4/19/2019	50	0	0	$0
OLDTOWN	5/29/2019	50	0	0	$10,000
BELEWS CREEK	6/20/2019	50	0	0	$2,500
OLDTOWN	7/22/2019	50	0	0	$0
LEWISVILLE	8/13/2019	50	0	0	$0
LEWISVILLE	8/17/2019	50	0	0	$5,000
LEWISVILLE	8/17/2019	50	0	0	$1,500
LEWISVILLE	8/19/2019	50	0	0	$5,000
RURAL HALL	8/21/2019	50	0	0	$5,000
KERNERSVILLE	8/21/2019	50	0	0	$5,000
CLEMMONS	8/22/2019	50	0	0	$0
WALKERTOWN	8/22/2019	50	0	0	$0
DENNIS	8/22/2019	50	0	0	$0
WALKERTOWN	8/22/2019	50	0	0	$0
VIENNA	10/31/2019	50	0	0	$5,000
GRIMS XRDS	10/31/2019	50	0	0	$0
TOBACCOVILLE	1/11/2020	50	0	0	$25,000
CLEMMONS	2/6/2020	50	0	0	$5,000
UNION CROSS	2/6/2020	50	0	0	$5,000
UNION CROSS	2/6/2020	50	0	0	$5,000

Source: NCEI

Hailstorms

According to the National Centers for Environmental Information, 100 recorded hailstorm events have affected Forsyth County since 1970 summarized in **Table H.15.** [5] But, hail occurrences resulted in no reported property or crop damages. Hail ranged in diameter from 0.75 inches to 2.75 inches. It should be noted that hail is notorious for causing substantial damage to cars, roofs, and other areas of the built environment that may not be reported to the National Centers for Environmental Information. **Figure H.7** shows a map of hailstorm occurrences in Forsyth County.

FIGURE H.7: HAIL OCCURANCES IN FORSYTH COUNTY



Source: National Centers for Environmental Information

[5] 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 Forsyth County. 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 H.15: HISTORICAL HAIL OCCURANCES IN FORSYTH COUNTY

Location	Date	Magnitude (inches)	Deaths	Injuries	Property Damage
Forsyth County	4/13/1970	1.75	0	0	$0
Forsyth County	5/22/1970	1	0	0	$0
Forsyth County	5/29/1982	1	0	0	$0
Forsyth County	4/14/1984	2.5	0	0	$0
Forsyth County	7/25/1984	1.75	0	0	$0
Forsyth County	4/16/1985	1.75	0	0	$0
Forsyth County	6/5/1985	0.75	0	0	$0
Forsyth County	7/12/1985	1	0	0	$0
Forsyth County	4/26/1986	0.88	0	0	$0
Forsyth County	5/16/1988	0.75	0	0	$0
Forsyth County	5/17/1988	0.75	0	0	$0
Forsyth County	3/15/1989	0.75	0	0	$0
Forsyth County	4/27/1989	1.75	0	0	$0
Forsyth County	6/15/1989	1	0	0	$0
Forsyth County	4/29/1991	1	0	0	$0
Winston-Salem	8/20/1993	1	0	0	$0
Clemmons	8/16/1994	0.75	0	0	$0
Forsyth County	6/16/1995	0.75	0	0	$0
WINSTON-SALEM	7/2/1996	0.88	0	0	$0
BELOWS LAKE	6/2/1997	0.75	0	0	$0
PFAFFTOWN	3/20/1998	1	0	0	$0
WINSTON SALEM	3/20/1998	1	0	0	$0
WINSTON SALEM	4/17/1998	0.88	0	0	$0
WALKERTOWN	5/1/1998	0.75	0	0	$0
KERNERSVILLE	5/7/1998	1	0	0	$0
BELEWS CREEK	5/8/1998	0.75	0	0	$0
LEWISVILLE	5/26/1998	0.75	0	0	$0
WINSTON SALEM	6/14/1998	0.75	0	0	$0
WINSTON SALEM	6/15/1998	0.75	0	0	$0
KERNERSVILLE	6/3/2000	1.75	0	0	$0
LEWISVILLE	6/15/2000	0.75	0	0	$0
LEWISVILLE	6/1/2002	0.75	0	0	$0
WINSTON SALEM	7/3/2002	1	0	0	$0
CLEMMONS	4/29/2003	1	0	0	$0
WINSTON SALEM	5/2/2003	0.75	0	0	$0
CLEMMONS	5/3/2003	1.75	0	0	$0
RURAL HALL	8/5/2003	1.75	0	0	$0
RURAL HALL	8/5/2003	0.75	0	0	$0
WALKERTOWN	5/9/2004	0.75	0	0	$0
WINSTON SALEM	5/9/2004	0.75	0	0	$0
LEWISVILLE	3/23/2005	1	0	0	$0

Location	Date	Magnitude (inches)	Deaths	Injuries	Property Damage
TOBACCOVILLE	3/23/2005	2.75	0	0	$0
CLEMMONS	4/3/2006	1	0	0	$0
RURAL HALL	4/3/2006	1	0	0	$0
WINSTON SALEM	4/3/2006	0.88	0	0	$0
CLEMMONS	4/3/2006	0.75	0	0	$0
WINSTON SALEM	4/3/2006	1	0	0	$0
WINSTON SALEM	5/26/2006	0.75	0	0	$0
WINSTON SALEM	5/26/2006	0.75	0	0	$0
KERNERSVILLE	6/11/2006	0.75	0	0	$0
CLEMMONS	6/11/2006	0.75	0	0	$0
WINSTON SALEM	7/19/2006	0.75	0	0	$0
KERNERSVILLE	7/22/2006	0.88	0	0	$0
WINSTON SALEM	8/30/2006	0.75	0	0	$0
WINSTON SALEM	9/28/2006	0.88	0	0	$0
CLEMMONS	10/11/2006	1	0	0	$0
CLEMMONS	4/15/2007	0.75	0	0	$0
WINSTON SALEM	6/4/2007	0.75	0	0	$0
RURAL HALL	6/16/2007	0.75	0	0	$0
WINSTON SALEM	6/16/2007	0.88	0	0	$0
WINSTON SALEM	6/16/2007	0.88	0	0	$0
WINSTON SALEM	6/16/2007	0.88	0	0	$0
PFAFFTOWN	6/19/2007	0.75	0	0	$0
PFAFFTOWN	6/19/2007	0.75	0	0	$0
WINSTON SALEM	6/25/2007	0.75	0	0	$0
WALKERTOWN	6/27/2007	0.75	0	0	$0
KERNERSVILLE	8/3/2007	0.75	0	0	$0
WALKERTOWN	8/22/2007	0.88	0	0	$0
PFAFFTOWN	8/22/2007	0.75	0	0	$0
LEWISVILLE	8/22/2007	1.75	0	0	$0
PFAFFTOWN	6/9/2009	1	0	0	$0
BROOKWOOD	7/20/2009	1	0	0	$0
KERNERSVILLE	7/20/2009	0.88	0	0	$0
HANES	9/28/2009	0.88	0	0	$0
DENNIS	6/2/2010	0.88	0	0	$0
WINSTON SALEM	4/9/2011	1	0	0	$0
WINSTON SALEM	4/9/2011	1	0	0	$0
BROOKWOOD	4/9/2011	1	0	0	$0
WINSTON SALEM	4/9/2011	1	0	0	$0
UNION CROSS	4/27/2011	1	0	0	$0
UNION CROSS	5/16/2011	1	0	0	$0
KERNERSVILLE	5/27/2011	1	0	0	$0
CLEMMONS	6/9/2011	1	0	0	$0
TOBACCOVILLE	8/14/2011	1.75	0	0	$0
FIVE PTS	3/20/2012	1	0	0	$0

Location	Date	Magnitude (inches)	Deaths	Injuries	Property Damage
LEWISVILLE	5/22/2012	0.75	0	0	$0
KERNERSVILLE	6/16/2014	1	0	0	$0
LEWISVILLE	6/19/2014	1	0	0	$0
EASTON VIEW	6/19/2014	1	0	0	$0
LEWISVILLE	4/9/2015	1	0	0	$0
SWAINTOWN	4/20/2015	1.25	0	0	$0
HANES	5/2/2016	1	0	0	$0
HANES	5/2/2016	1.75	0	0	$0
CITYVIEW	5/12/2016	1.75	0	0	$0
GUTHRIE	9/28/2016	1.25	0	0	$0
RURAL HALL	5/19/2017	1	0	0	$0
EASTON VIEW	7/18/2017	1	0	0	$0
LEWISVILLE	4/15/2018	1.25	0	0	$0
KERNERSVILLE	5/31/2019	1	0	0	$0
GUTHRIE	5/31/2019	1	0	0	$0

Lightning

According to the National Centers for Environmental Information, there have been a total of 3 recorded lightning events in Forsyth County since 2003[6]. These events resulted in nearly $225,000 (2020 dollars) in damages, as listed in summary **Table H.16**.

It is certain that more than 3 events have impacted the county. 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 H.16: HISTORICAL LIGHTNING IMPACTS IN FORSYTH COUNTY

Location	Date	Deaths	Injuries	Property Damage	Details
LEWISVILLE	4/30/2003	0	0	$40,000	Lightning struck a house, starting a fire.
KERNERSVILLE	6/11/2007	0	0	$175,000	A two-story home in the Tredegar subdivision sustained heavy damage when it was hit by lightning and caught on fire. The entire second floor was damaged. 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.

[6] 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 Forsyth County. The State Fire Marshall's office was also contacted for additional information but none could be provided. As additional local data becomes available, this hazard profile will be amended.

Location	Date	Deaths	Injuries	Property Damage	Details
KERNERSVILLE	6/10/2009	0	0	$10,000	Lightning caused an apartment fire last night when it struck an air conditioning unit in the attic of McConnell Apartments. The fire was confined to the attic. Severe thunderstorms developed across the Northwest Piedmont during the evening hours as a strong mid-level shortwave trough moved across the Appalachians and across the area. The severe thunderstorm wind damage was confined to the Triad. Lightning associated with the convection was excessive with over 600 cloud-to-ground lightning strikes per hour. Two structures were hit by lightning, with one of the structures being completely destroyed as fire consumed the mobile home.

Source: NCEI

H.5.5.3 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 Winston-Salem State University experience a direct tornado strike. The probability of future tornado occurrences affecting Winston-Salem State University 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 are likely (10 to 100 percent annual probability). Since hail is an atmospheric hazard (coinciding with thunderstorms), it is assumed that Winston-Salem State University 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 Forsyth County 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), Winston-Salem State University 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.

H.5.6 SEVERE WINTER WEATHER

H.5.6.1 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. Winston-Salem State University 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.

H.5.6.2 Historical Occurrences

Winter weather has resulted in six disaster declarations Forsyth County. This includes drought and freezing conditions in 1977, a winter storm in 1993, the Blizzard of 1996, another winter storm in 1996, a severe ice storm in 2002, and an additional ice storm in 2003. According to the National Centers for Environmental Information, there have been a total of 67 recorded winter storm events Forsyth County since 1996 (**Table H.17**)[7]. These events resulted in $70,000 (2020 dollars) in damages.

[7] These ice and winter storm events are only inclusive of those reported by the National Centers for Environmental Information (NCEI). It is likely that additional winter storm conditions have affected Forsyth County.

TABLE H.17: WINTER STORM EVENTS IN FORSYTH COUNTY

Date	Deaths	Injuries	Property Damage	Detail
1/8/1997	0	0	$0	Sleet and freezing rain developed across the western piedmont of North Carolina during the midafternoon hours then spread across the Northern Piedmont by sunset, becoming a major ice storm overnight. The hardest hit areas extended from the Winston-Salem and Greensboro areas east to near Burlington where 1 to 2 inches of sleet fell before the precipitation changed to freezing rain. Freezing rain accumulated to between 1/4 to 3/8 of an inch on top of the sleet. This caused major travel problems with some road closures mainly in Davidson, Forsyth, and Guilford counties. Two traffic fatalities occurred in Davidson county during the evening of the 8th. Two thousand residents lost power during the storm in the Piedmont Triad area. There were some icy bridges and overpasses reported but glaze accumulations were limited to metal objects and in the tree tops.
2/13/1997	0	0	$0	Over the eastern and southern piedmont from Albemarle and Troy northeast to Raleigh/Durham to Warrenton, a narrow band of mixed freezing rain and rain fell with a little sleet at the onset. Temperatures remained in the low to mid 30's during the event, preventing a major ice storm. There were some icy bridges and overpasses reported but glaze accumulations were limited to metal objects and in the tree tops. A few tree limbs fell mainly in Durham and Roxboro which caused some power outages but these problems were minor compared to the areas to the west.
12/29/1997	0	0	$0	A Winter Storm affected the western and central portions of North Carolina. Snow fell over the western piedmont with a mixture of snow, sleet, and rain over the central piedmont. Rain fell to the east. Snow developed over the western piedmont of North Carolina just after sunrise and continued through the day. The snow tapered off in the late afternoon. The main rain / snow line set up from near Salisbury northeast to Greensboro and extended northeast to the North Carolina / Virginia border, just west of Roxboro. Snow fell to the west of this line, while rain fell to the east. Along the narrow transition zone from near Salisbury northeast to Roxboro, a mixture of rain and snow fell, occasionally mixed with sleet. Accumulations of snow were heaviest in the city of Winston-Salem and points west and north of the city. Totals there were from 6 to 8 inches, with 4 to 6 inches of snow in Davidson and Guilford counties, including the cities of Lexington and Greensboro. Near the snow to rain transition line...snow accumulations were limited to 1 to 3 inches in a zone from Albemarle in Stanly county northeast through Randolph county including Asheboro and into Alamance and Person counties. Burlington and Roxboro reported around 2 inches of snow. Hundreds of traffic accidents were reported in Davidson, Forsyth, Guilford, Randolph, and Alamance counties. Power outages were also heaviest in Forsyth county.

Date	Deaths	Injuries	Property Damage	Detail
1/18/2000	0	0	$0	Light snow moved over the Triad area in the early morning hours of the 18th and spread slowly east-southeast, reaching the Sandhills and Coastal Plain before daybreak. The snow intensified in the morning in the Triad area where 4 to 6 inches of snow fell. The Sandhills and Coastal Plain received 1 to 3 inches before changing over to sleet and freezing rain in the mid-morning hours. Total accumulations of ice were less than a quarter of an inch. The snow and ice made for slick road conditions across the entire area. Most counties reported numerous accidents, causing many major roads to close.
1/20/2000	0	0	$0	An average of 2 to 3 inches of snow fell in the northern half of central North Carolina with a few locations near the Virginia border receiving up to 4 inches. The southern counties in central North Carolina received mostly rain with a trace of snow. The snow began around midnight on the 20th over the Northwest Piedmont and moved east. The light snow tapered off to rain and freezing drizzle in the early morning hours. Some secondary roads were reported to be slick while most major roads remained clear.
1/22/2000	0	0	$0	A winter storm producing snow and ice moved from west to east across central North Carolina beginning on the evening of the 22nd. The storm produced 2 to 5 inches of snow across the western Piedmont where Stanly and Anson counties reported 4 to 5 inches and the Triad around 2 inches. Amounts less than an inch covered the ground in the Triangle and Rocky Mount areas while the southern tier counties got 1 to 3 inches. After a lull in the late-night precipitation, sleet and freezing rain developed early on the 23rd. The accumulation of ice was less than a quarter inch in the southern counties where precipitation was mostly rain. In the central counties including Nash, Wake, Chatham, and Randolph, the ice accumulated to around a quarter inch, causing scattered power outages and downed tree limbs. Precipitation in the northern counties remained mostly snow throughout the event.

Date	Deaths	Injuries	Property Damage	Detail
1/24/2000	0	0	$0	This record-setting snow storm began with freezing drizzle in the early morning hours of the 24th. Road surfaces quickly froze during this time when the temperature dropped from 32 degrees to 27 degrees. Numerous traffic accidents were reported. By mid-morning, additional precipitation was advancing northward into the southern portions of central North Carolina. During the afternoon of the 24th, rain was falling across southeastern North Carolina while an area of snow was located over the southwest Piedmont to the western Sandhills. Later that evening the precipitation reached the Triangle area, beginning as mostly sleet before quickly changing to all snow. The snowfall became heavy early on the 25th with snowfall rates estimated at 4 inches per hour. A north-to-south oriented band of heavy snow remained in place over Moore, Lee, Wake, Franklin, Granville, Vance, and Warren counties for several hours. Snowfall amounts exceeded 20 inches in some locations in these counties. The western Piedmont counties recorded 8 to 12 inches of snow, while the Coastal Plain received 4 to 8 inches of snow with light icing at the end of the event. The heavy snow brought central North Carolina to a standstill. Many roads were impassable, and power outages were reported across the entire area. Statewide, an estimated 260,000 people were without power, mostly in the Sandhills. Strong, gusty winds produced snow drifts several feet high. At the Raleigh-Durham Airport, the record snowfall from one storm was set at 20.3 inches. The total cost of the storm to the state was estimated at $800 million.
1/28/2000	0	0	$0	Sleet and freezing rain began to fall in the western Piedmont of North Carolina on the evening of the 28th. The ice accumulated to a half inch in some locations near the Triad area and along the Virginia border, with most locations in the area receiving around a quarter of an inch of ice. The rest of central North Carolina received a thin coating of less than a quarter inch, creating patchy spots of ice on roads and causing downed trees and power lines. Approximately 30,000 people were without power across the state at the peak of the storm. In eastern portions of the Sandhills and in the Coastal Plain, the freezing rain changed to light rain, preventing more widespread icing in that area. A lull in the precipitation from the predawn hours on Sunday until Sunday morning also kept ice accumulation minimal.
2/12/2001	0	0	$0	A mixture of snow, sleet, and freezing rain fell in the early morning hours of February 12. The precipitation began as snow, then changed to sleet a few hours later. Around sunrise, the precipitation fell as freezing rain before ending late in the morning. The snow accumulated to around an inch in some locations with an additional quarter inch of ice accumulation in the Northwest Piedmont. The frozen precipitation made roads slick, which led to several accidents.
1/3/2002	0	0	$0	The first winter storm of the season brought significant snowfall to central North Carolina. An initial round of snow began to fall during the evening of the 2nd. The snow was heavy at times, and accumulated between 3 and 5 inches. The snow changed to sleet and light freezing rain in the Coastal Plain through the early morning hours of the 3rd. After a period of little or no precipitation on the morning of the 3rd, snow began to fall again across the entire area, and was heavy at times, adding an additional 4 to 8 inches. Storm total snowfall amounts were over a foot from the Sandhills northeast across the Piedmont to the Virginia border. The Northwest Piedmont, including the Triad area, received 6 to 10 inches. Snowfall amounts were

Date	Deaths	Injuries	Property Damage	Detail
				lower in the Southern and Central Coastal Plain, between 4 and 8 inches, due to the snow mixing with sleet and freezing rain.
1/6/2002	0	0	$0	A period of freezing rain caused dangerous driving conditions across the Northwest Piedmont on the morning of January 6. Icy roads were reported across the Northwest Piedmont, mainly to the north of Interstate 40. Conditions were made worse by existing snow cover from a snow storm a few days earlier. The freezing rain fell for a few hours before changing over to rain in the afternoon.
12/4/2002	0	0	$0	One of the worst ice storms to ever hit Central North Carolina began in the late afternoon on December 4, and ended in the early morning hours of December 5. Precipitation mainly began as a mix of snow and sleet, then turned to freezing rain. A quarter inch of ice or more covered locations mainly to the west of I-95. The highest precipitation amounts stretched across the Piedmont, from Albemarle to Asheboro to Durham to Warrenton, where a half inch to one-inch thick layer of ice was reported. 1 to 2 inches of snow also fell in the Triad area and in the counties bordering Virginia with trace amounts elsewhere. Large trees and power lines were downed by the ice all across the area. The storm caused a record number of power outages, as nearly one million people lost power in Central North Carolina, some for nearly a week.
1/23/2003	0	0	$0	Snow accumulated to three to five inches across portions of the northern Piedmont and northwest Piedmont on the morning of the 23rd. The snow began to fall shortly after midnight, and continued to fall into the late morning hours. An area of three to four inches accumulated in the northern Piedmont from Person to Franklin counties, and four to five inches were reported in Davidson and Forsyth counties. Less than three inches of snow was reported elsewhere in Central North Carolina.
2/16/2003	0	0	$0	Sleet and freezing rain fell across much of central North Carolina. Sleet accumulated between 1 and 3 inches across the Piedmont, mainly west of a line from Southern Pines to Raleigh to Roanoke Rapids. The highest accumulations were near the Virginia border and in the Triad area. Mainly freezing rain fell across the Sandhills and Coastal Plain, with ice accumulations around a quarter inch along a narrow corridor from Wadesboro to Smithfield to Rocky Mount.
2/27/2003	0	0	$0	Freezing rain began in the early morning hours of the 27th, and continued into the afternoon. Ice accumulated to nearly one inch just north of the Triad area. Much of the Piedmont from Raleigh north and west received a quarter to a half inch of ice. Numerous trees were downed and power outages were widespread across the Piedmont.
12/13/2003	0	0	$0	A mix of freezing rain and sleet fell across the northwest piedmont from Roxboro, Burlington, Asheboro and Denton west across the Triad. Accumulation of freezing rain reached a quarter of an inch in addition to as much as an inch of sleet. Numerous traffic accidents were reported due to icy road conditions.
1/26/2004	0	0	$0	A winter storm occurred on January 25th and 26th when snow and sleet fell across central North Carolina. The precipitation fell as snow and sleet over much of the area on the 25th, then became freezing rain over the southeastern sections on the 26th. 3 to 6 inches of snow and sleet fell over the Piedmont on the 25th, with as much as 1/4 inch of freezing rain reported in the southern coastal plain on the 26th.
2/15/2004	0	0	$0	Snow began falling on the evening of the 15th, and ended the morning of the 16th. Bands of snow spread northward across the area, producing between 3 and 6 inches across the northern half of central North Carolina.

Date	Deaths	Injuries	Property Damage	Detail
2/26/2004	0	0	$0	A strong storm arrived on February 26th and continued into the morning of the 27th. This storm hit the area with a one-two punch, affecting southern sections on the 26th, then northern sections late on the 26th and the 27th. The first punch dumped heavy snow over portions of the southern Piedmont and Sandhills. Accumulations totaled 6 to locally 10 inches in areas such as Laurinburg, Hamlet, Fayetteville, and Raeford. Much lighter amounts fell to the north during the day. The second punch arrived in western sections of the area late in the day and shifted northeast across central and eastern portions overnight. The heavy snow was accompanied by thunder and lightning across the western Piedmont. Snowfall amounts ranged between 12 to 18 inches from Albemarle northeast to Greensboro. Other sections of the Piedmont, including the Triangle, received between 3 and 6 inches.
1/29/2005	0	0	$0	A mix of snow and sleet moved across the Piedmont on Saturday afternoon. This brought a half inch of sleet to the Winston-Salem area. A lull in the precipitation was followed by a period of freezing rain Sunday morning. A quarter inch of ice accrued in the central and western Piedmont, which created icy roads and caused numerous accidents.
12/15/2005	0	0	$0	Freezing rain fell across the Triad from around 4 am to noon with accumulations up to a quarter of an inch. No major power outages were reported in the area, however, hundreds of automobile accidents resulted from the freezing rain.
1/18/2007	0	0	$0	Snow moved into Central North Carolina just prior to sunrise on January 18th impacting local schools and morning commuters. Between one to two inches of snow fell across the area resulting in numerous accidents. About eight children were injured in Asheboro when a school bus over turned and two indirect deaths were reported near Goldsboro as a result of a single vehicle accident. Snow changed over all rain by afternoon.
1/21/2007	0	0	$0	A light glaze of freezing rain up to a tenth of an inch thick accumulated over the piedmont from 5pm to midnight.
12/7/2007	0	0	$20,000	Light freezing rain during the early morning hours just prior to sunrise resulted in several automobile accidents from black ice on numerous bridges.
1/17/2008	0	0	$0	Around one inch of snow fell countywide with a few locations in the western portion of the county receiving 2 to 3 inches of snow.
1/19/2008	0	0	$0	Around one-half inches of snow accumulated during the afternoon and early evening hours.
2/13/2008	0	0	$0	Between one to three inches of snow fell across Forsyth County with the heavier amounts north of Winston Salem.
1/22/2009	0	0	$0	Up to 1 inch of snow fell across the county resulting in the closing of local schools.
2/3/2009	0	0	$0	Between one to two inches of snow fell across the county around the time of evening rush hour.
3/1/2009	0	0	$0	Between six to eight inches of snow fell countywide. Several automobile accidents were reported the mornings following the storm due to the re-freezing of the melting snow overnight.
12/18/2009	0	0	$0	Between 4 to 8 inches of snow fell across Forsyth county and Winston-Salem. Many primary roads including Highway 52, Highway 421 and portions Interstate 40 became impassible during the evening. Law enforcement responded to hundreds of automobile accidents.

Date	Deaths	Injuries	Property Damage	Detail
12/30/2009	0	0	$0	Light freezing rain was reported across the area resulting in a light coating of ice on elevated surfaces such as trees, bushes and power lines. Area roads remained clear.
1/29/2010	0	0	$0	Between 8 to 10 inches of snow fell across the county. Power outages in the county totaled 9400. The heavy wet snow caused numerous trees to fall countywide resulting in blocked roads and some damage. Due to the cold temperatures icy road conditions persisted for several days resulting in the closure of schools and businesses.
2/5/2010	0	0	$50,000	Up to three inches of snow fell across portions of the county along with up to a quarter inch of freezing rain. Twelve thousand homes in the county were without power at one point during the storm. A total of over fifty thousand people were without power in North Carolina. North Carolina Highway patrol responded to over 725 calls involving vehicle accidents. Numerous trees fell due to the weight of the freezing rain.
2/12/2010	0	0	$0	Around one to two inches of snow fell across the county Friday night and early Saturday.
3/2/2010	0	0	$0	Around 3 to 4 inches of snow fell across the county. Only a few minor vehicle accidents and power outages were reported.
12/4/2010	0	0	$0	Two to three inches of snow fell across the county with the heaviest amounts reports along and north of Interstate 40.
12/16/2010	0	0	$0	A half inch of snow combined with a tenth of an inch of freezing rain to create hazardous driving conditions across the area.
12/25/2010	0	0	$0	Six to eight inches of snow fell countywide including in Winston-Salem. Many roads were impassible due to the heavy snow, however, other than a few minor accidents no other problems were reported due to the holiday.
1/6/2011	0	0	$0	A high school student attending Regan High School was killed on his way to school when his SUV slid on a patch of ice then striking a tree. Rapidly clearing skies allowed temperatures to fall below freezing in the morning resulting in areas of ice on road surfaces. Numerous other accidents were reported.
1/10/2011	0	0	$0	One to three 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. A man was killed in a head on collision near Walkertown as a result of slippery roads.
11/26/2013	0	0	$0	Light freezing rain resulted in minor glazing on trees and other elevated surfaces in the area.
1/21/2014	0	0	$0	A dusting of snow was reported.
1/28/2014	0	0	$0	Snowfall averaged 1 to 2 inches across the county.
2/12/2014	0	0	$0	Snow fall averaged 7-9 inches across the county. In addition, ice accrual averaged 1/10 of an inch.
3/3/2014	0	0	$0	Snowfall amounts averaged between 1 to 1.5 inches across the county. A glaze of ice from freezing rain was also reported on trees and power-lines.
3/6/2014	0	0	$0	Snowfall of 2 to 5 inches fell across the county.

Date	Deaths	Injuries	Property Damage	Detail
3/17/2014	0	0	$0	Ice accretion averaged around five hundredths of an inch across the county, with also a tenth or two of snow.
1/13/2015	0	0	$0	A thin glaze of ice was reported on trees and elevated surfaces. Icy bridges and overpasses created difficult travel conditions during the morning on the 14th, with several automobile accidents reported across the county.
2/16/2015	0	0	$0	Snowfall amounts 1 to 3 inches fell across the county. In addition, a trace of freezing rain accrual was reported.
2/24/2015	0	0	$0	Snowfall amounts of 1 to 2 inches fell across the county.
2/25/2015	0	0	$0	Snowfall/sleet amounts of 4 to 5 inches fell across the county.
1/17/2016	0	0	$0	Northwestern portions of Forsyth County received up to one inch of snow.
1/20/2016	0	0	$0	Snowfall amounts of 0.25 to 0.5 inches fell across the county.
1/22/2016	0	0	$0	Snowfall/sleet amounts of 2 to 5 inches fell across the county.
2/14/2016	0	0	$0	Snowfall/sleet amounts of 2 to 3 inches fell across the county. In addition, a tenth to a quarter of freezing rain accrual was reported.
1/6/2017	0	0	$0	Snowfall amounts of 8 to 11 inches fell across the county.
12/8/2017	0	0	$0	Three to six inches of snow fell across Forsyth county.
1/17/2018	0	0	$0	Five to seven inches of snow fell across the county.
3/12/2018	0	0	$0	Snowfall totals across the county averaged 2 inches, with a few locations reporting 2.5 to 3.5 inches.
3/21/2018	0	0	$0	One-half inch to one inch of snow fell across northern portions of the county.
3/24/2018	0	0	$0	One inch of snow fell across the county.
12/9/2018	0	0	$0	Snowfall amounts ranged between 11 to 14 inches across the county.
1/12/2019	0	0	$0	One-quarter to one-third of an inch of ice from freezing rain downed numerous trees across the county. At its peak, nearly 40,000 customers in the county were without power.
1/23/2019	0	0	$0	A trace to 0.02 inches of ice from freezing rain was reported across northern portions of the county, resulting in several automotive accidents due to icy roads.
12/13/2019	0	0	$0	Freezing rain was reported across the county. Freezing rain amounts were less than a tenth of an inch.
2/20/2020	0	0	$0	Snowfall amounts ranged from 1 to 2 inches across the county.

Source: National Centers for Environmental Information

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.

H.5.6.3 Probability of Future Occurrences

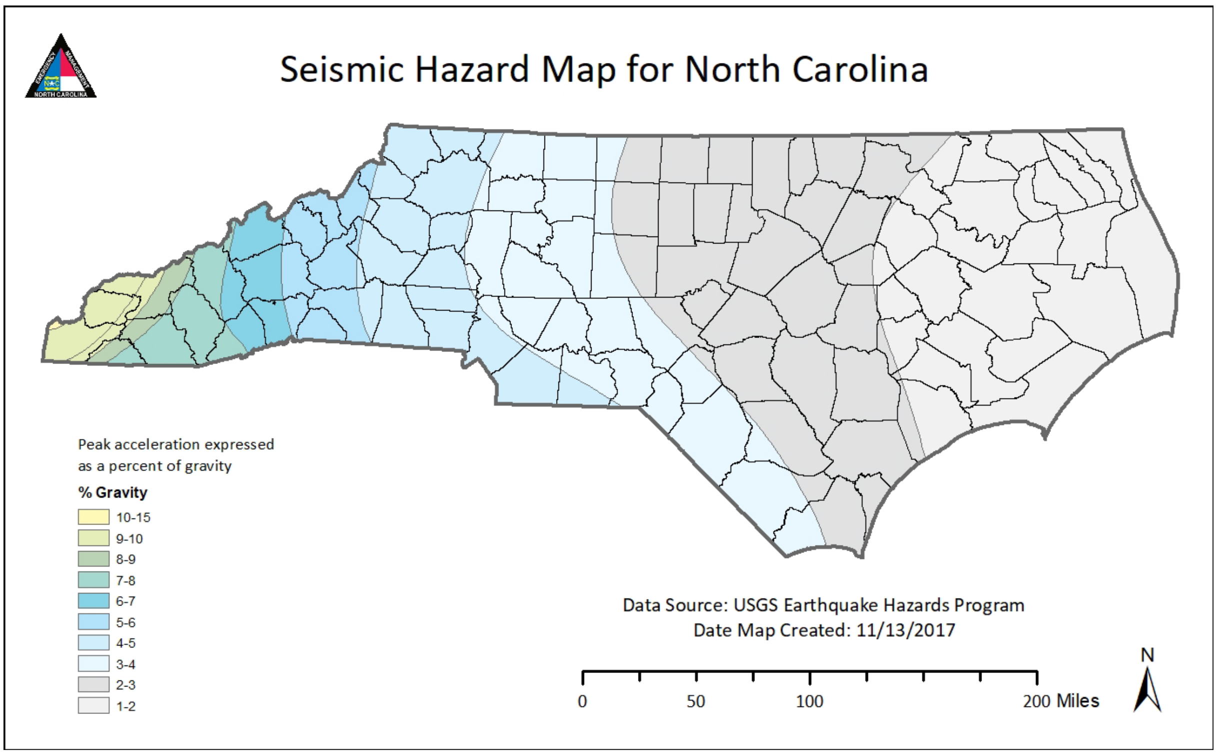
Winter storm events will remain a regular occurrence for Winston-Salem State University due to its location in the central piedmont part of the state. According to historical information the University often experiences several winter storms events each year. Therefore, the annual probability is likely (10 to 100 percent

H.5.7 EARTHQUAKES

H.5.7.1 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 H.8** is a map showing geological and seismic information for North Carolina.

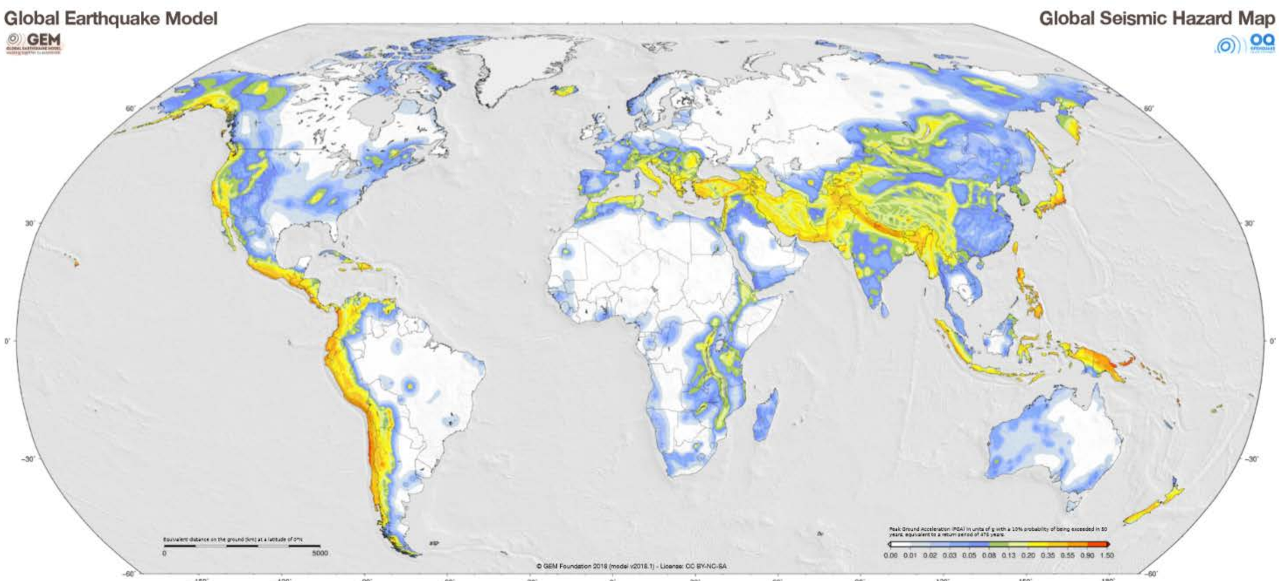
FIGURE H.8: GEOLOGICAL AND SEISMIC INFORMATION FOR NORTH CAROLINA



Source: North Carolina Geological Survey

Figure H.9 shows the intensity level associated with the world 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 campus as a whole exists within an area of moderate seismic risk.

FIGURE H.9: PEAK ACCELERATION WITH 10 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS



Source: Global Earthquake Model, 2018

H.5.7.2 Historical Occurrences

At least 9 earthquakes are known to have affected Forsyth County since 1886. The strongest of these measured a V on the Modified Mercalli Intensity (MMI) scale. **Table H.18** provides a summary of earthquake events reported by the National Geophysical Data Center between 1898 and 1980.

TABLE H.18: EARTHQUAKES IMPACTING FORSYTH COUNTY

Location	Date	Magnitude	MMI
Winston Salem	2/21/1916	--	3
Winston Salem	11/3/1928	--	3
Winston Salem	11/20/1969	4.3	4
Winston Salem	9/10/1970	--	3
Lewisville	9/13/1976	3.3	4
Rural Hall	9/13/1976	3.3	5
Winston Salem	7/27/1980	5.1	2
Winston Salem	11/25/1898	--	4
Winston Salem	5/3/1897	--	3

Source: USGS; National Geophysical Data Center

A list of earthquakes that have caused damage throughout North Carolina is presented below in **Table H.19.**

TABLE H.19: EARTHQUAKES WHICH HAVE CAUSED DAMAGE IN NC

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

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).

H.5.7.3 Probability of Future Occurrences

The probability of significant, damaging earthquake events affecting the area surrounding Winston-Salem State University 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 campus. The annual probability level for the campus 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, and for Forsyth County the likelihood was 4 - 5%.

H.5.8 GEOLOGICAL

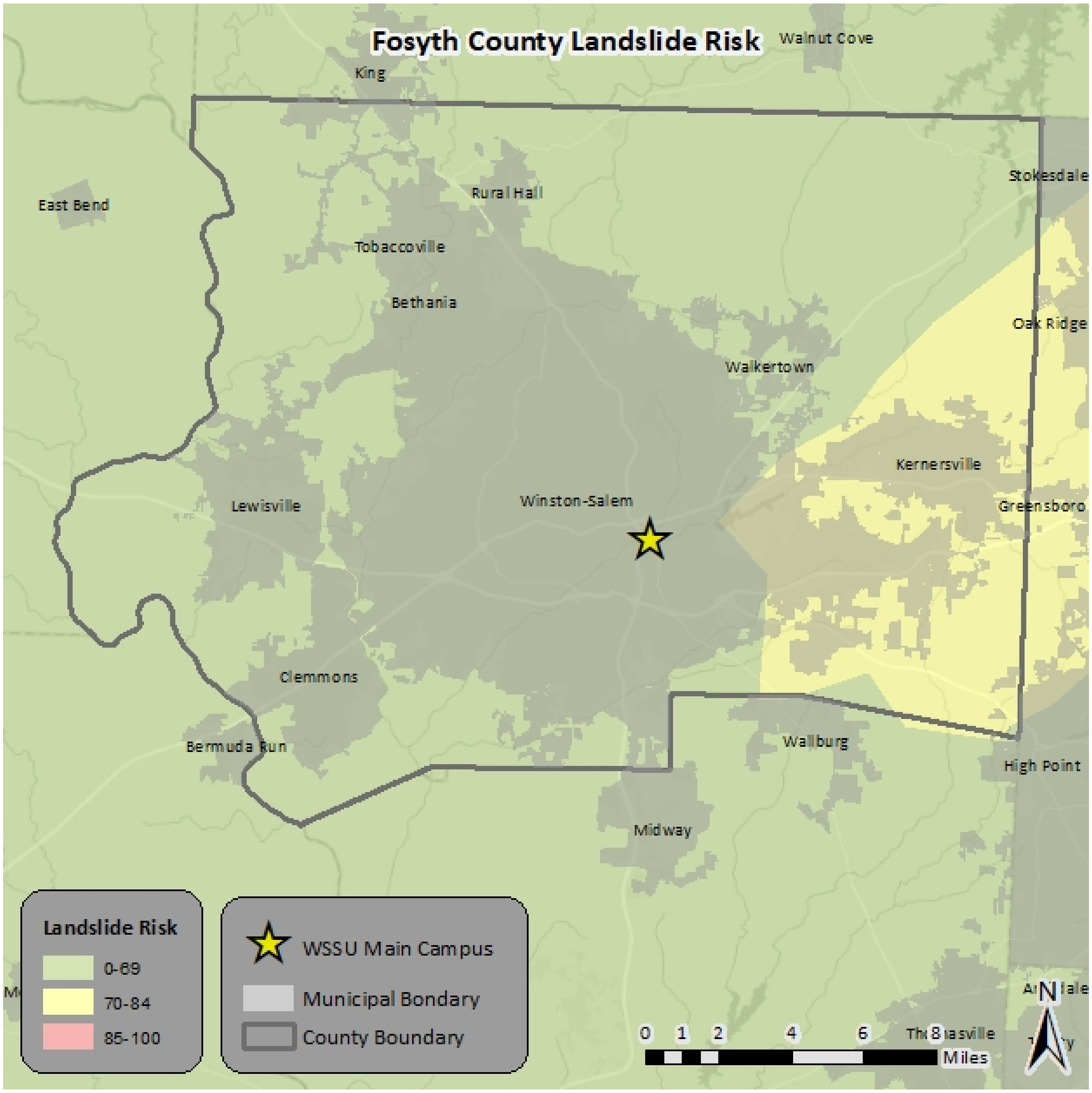
H.5.8.1 Location and Spatial Extent

Landslides

Landslides occur along steep slopes when the pull of gravity can no longer be resisted (often due to heavy rain throughout the region. Forsyth County and Winston-Salem State University has a gently sloping terrain throughout the county. Any landslide event that may occur within Forsyth county will probably be in the form of very isolated and small-scale slumps of steep slope areas that are heavily saturated and/or under a load condition from a nearby structure such as a house or road.

According to **Figure H.10** below, much of Forsyth County, has low risk to landslides.

FIGURE H.10: LANDSLIDE SUSCEPTIBILITY AND INCIDENCE MAP OF FORSYTH COUNTY

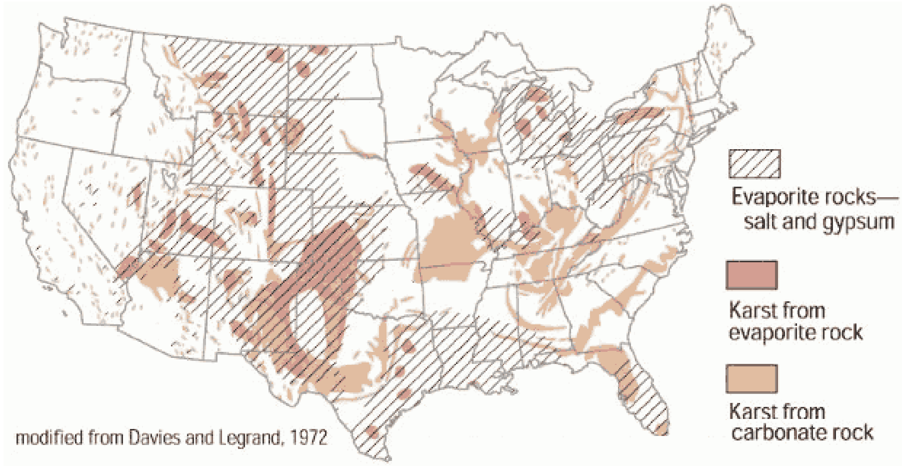


Source: United States Geological Survey

Sinkholes

Figure H.11 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 H.11: UNITED STATES GEOLOGICAL SURVEY OF KARST MODIFIED FROM DAVIES AND LEGRAND, 1972



Erosion

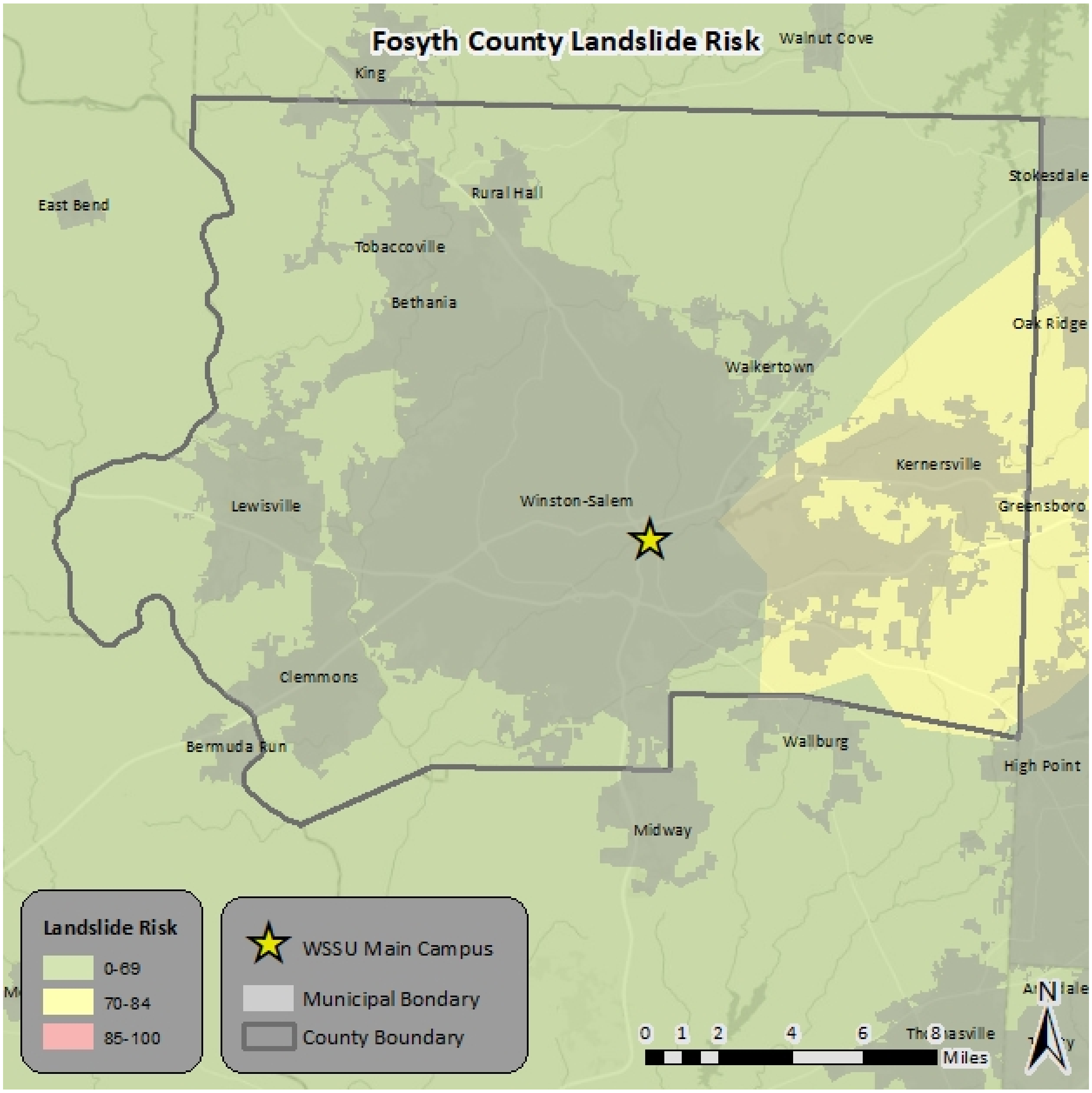
Erosion on the Winston-Salem State University campus is typically caused by flash flooding events. Unlike coastal areas, where the soil is mainly composed of fine-grained particles such as sand, Forsyth County soils have much greater organic matter content. Furthermore, vegetation also helps to prevent erosion in the area. Erosion occurs on the Winston-Salem State University campus, particularly along the banks of rivers and streams, but it is not an extreme threat to any of the buildings on campus. No areas of concern were reported by the Campus Hazard Mitigation Planning Team.

H.5.8.2 Historical Occurrences

Landslides

Due to the low sloping topography in Forsyth County, there is a minimal risk to landslides. Most landslides are caused by heavy rainfall in the area. The locations of landslide events around Winston-Salem State University as provided by the North Carolina Slope Movement-Slope Movement Deposit Database (NCSM_SMD database) are presented in **Figure H.12.** While some incidence mapping has been completed throughout the western portion of North Carolina, it is not complete; therefore, it should be noted that many more incidents than what is reported are likely to have occurred in the area.

FIGURE H.12: LOCATION OF PREVIOUS LANDSLIDE OCCURRENCES IN FORSYTH COUNTY



Source: North Carolina Geological Survey

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. Therefore, previous hazard mitigation plans, geological data, and local media outlets were considered for sinkhole activity in Forsyth County. Local media reports suggest there have been a few sinkholes which have occurred due to leaking water and sewer line main breaks under state-maintained roads and highways and some local roads.

Erosion

Most historical occurrences of erosion are seen near the coast of North Carolina, but Winston-Salem State University is still susceptible to the hazard. Several sources were vetted to identify areas of erosion at Winston-Salem State University. This includes searching local newspapers, interviewing local officials, and reviewing previous hazard mitigation plans. Forsyth County have previous mitigation actions that address erosion including bank stabilization and meeting erosion control requirements. Such actions will continue to be implemented as necessary throughout the region. There was no recorded history of significant erosion events and it was found to be hazard with a negligible potential impact.

H.5.8.3 Probability of Future Occurrences

Landslides

Based on historical information and the USGS susceptibility index, the probability of future landslide events are possible (1 to 10 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 of the Winston-Salem State University campus 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 in Forsyth County. While many sinkholes have been relatively small, it is still unlikely (between 1 and 33.3 percent annual probability) that the campus will continue to be affected in the future.

Erosion

Erosion remains a natural, dynamic, and continuous process for Winston-Salem State University, 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 H.6 – *Capability Assessment*.

H.5.9 DAM FAILURE

H.5.9.1 Location and Spatial Extent

The North Carolina Division of Energy, Mineral and 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 H.20** explains these classifications.

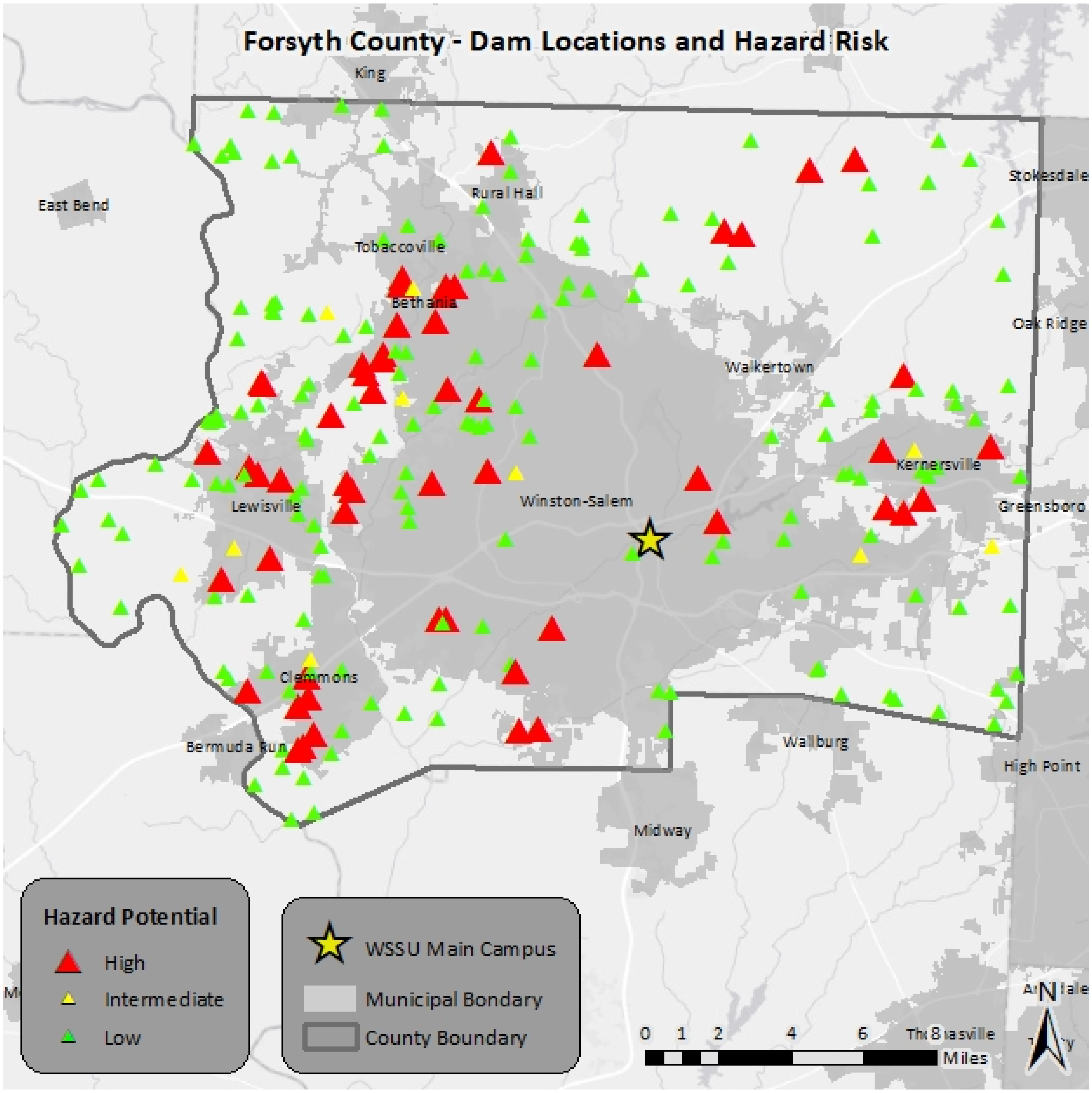
TABLE H.20: NORTH CAROLINA DAM HAZARD CLASSIFICATIONS

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 Management, there are 221 dams in Forsyth County. **Figure H.13** shows the dam location and the corresponding hazard ranking for each. Of these dams, 55 are classified as high hazard potential. These high hazard dams are listed in **Table H.21.** According to a consensus of the Campus Hazard Mitigation Planning Team, there is an extremely low possibility that any of these state-recognized dams would cause any damage whatsoever to Winston-Salem State University should a dam breach or failure occur, despite the hazard classifications assigned to these dams by the state.

FIGURE H.13: FORSYTH COUNTY DAM LOCATION AND HAZARD RANKING



Source: North Carolina Division of Land Resources

TABLE H.21: FORSYTH COUNTY HIGH HAZARD DAMS

Dame Name	Hazard Potential	Surface Area (acres)	Max Capacity (Ac-ft)	State Regulated?
Forsyth County				
Shelton Lake Dam	High	10.0	122	N
Haynes Estate Lake Dam #1	High	4.0	35	N
Haynes Estate Lake Dam #2	High	4.0	22	Y
Lea Lake Dam	High	6.1	43	N
Reynolds Lake Dam #1	High	4.5	32	Y
Lasater Mill Pond Dam	High	30.6	245	N
Lake Falmouth Dam	High	7.0	112	Y
Parker Lake Dam #2	High	3.1	32	Y
Conrad Lake Dam	High	10.5	176	Y
Shallowford Lakes Dam #1	High	11.0	203	Y
Shallowford Lakes Dam #2	High	8.0	80	Y
Beroth Lake Dam	High	1.3	10	N
Salem Lake Dam	High	297.5	9230	Y
Winston Lake Dam	High	16.5	1368	Y
Joyner Lake Dam	High	20.0	96	Y
Hauser Lake Dam	High	2.1	14	Y
Kernersville Water Supply Dam	High	40.0	300	N
Sabrina Lake Dam	High	5.8	42	N
Janita Lake Dam Upper	High	2.5	16	N
Myers Lake Dam	High	5.4	65	N
Haynes Lake Dam	High	3.6	30	Y
Whitaker Lake Dam	High	3.3	27	Y
Brookberry Farm Lake Dam West	High	6.0	58	Y
Brookberry Farm Lake - South Dam	High	3.5	25	Y
Beauchamp Lake Dam	High	6.3	42	N
Town Fork Creek Watershed Dam #5	High	12.0	112	Y
Town Fork Creek Watershed Dam #6	High	11.5	173	Y
Town Fork Creek Watershed Dam #2	High	34.0	584	Y
Town Fork Creek Watershed Dam #1-B	High	17.4	271	Y
Young Lake Dam #2	High	5.0	58	Y
Hanes Lake Dam	High	25.0	288	N
Gambill Lake Dam Middle	High	3.0	30	N
Fowler Lake Dam #2	High	2.8	46	Y
Fowler Lake Dam #1	High	2.0	40	N
Fowler Lake Dam #3	High	2.9	20	N
Creeson Lake Dam	High	3.0	60	N
K & W Lake Dam	High	3.4	43	Y
Mallard Lake Dam Lower	High	15.9	170	Y

Dame Name	Hazard Potential	Surface Area (acres)	Max Capacity (Ac-ft)	State Regulated?
Mallard Lake Dam Upper West	High	5.0	42	Y
Lake Hills Club Dam	High	10.6	111	Y
Woodview Lake Dam-Lower	High	3.2	25	Y
Wall Lake Dam	High	5.0	37	Y
Gambill Pond Dam Lower	High	3.1	22	N
Mallard Lake Dam Upper	High	8.3	77	Y
Town and Country Lake Dam	High	3.7	29	Y
Century Park Lake Dam	High	5.0	39	Y
Brookdale Lake Dam	High	1.7	15	Y
Beaver Brook Drive Dam	High	3.4	11	N
Arboretum Townhouse Dam	High	1.5	17	Y
Northwest Water Treatment Plant Dam #1	High	8.0	131	Y
Northwest Water Treatment Plant Dam #2	High	15.4	231	Y
Dell Phase 1 SWDP Dam	High		3	Y
Hillcrest Towne Center Pond B Dam	High	1.0	4	Y
Hillcrest Towne Center Pond E Dam	High	2.4	22	Y
Kaymoore Dam	High	1.9	9	N

Source: North Carolina Division of Land Resources

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

H.5.9.2 Historical Occurrences

According to information from the North Carolina Division of Energy, Mineral and Land Resources, there has only been fifteen dams breached in Forsyth County. There are no reports of death, injury, or property damage with any of this event. Further, there are no known levees in Forsyth County.

H.5.9.3 Probability of Future Occurrence

Given the current dam inventory and historic data, a dam breech is possible (between 1 and 10 percent annual probability) in the future. However, with regular monitoring, these events can be prevented as has been demonstrated in the past.

Inventories of statewide dam inundation data is an area that NCEM-RM is currently working hard to improve. At this time, there is geospatial data in final quality control review for 19 dams in North Carolina and that number is expected to increase significantly over the next several years. Additionally,

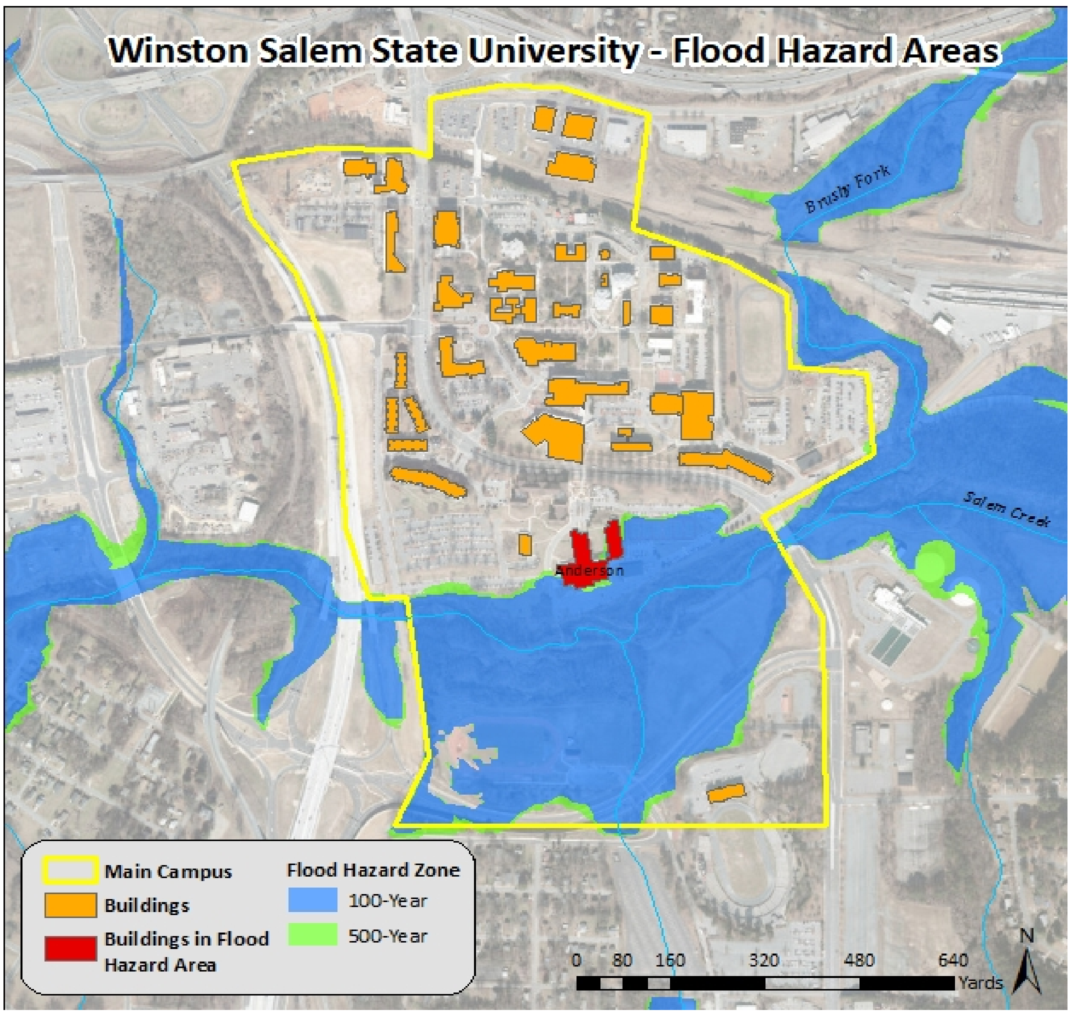
NCEM is currently working with the USACE to acquire inundation data for 9 dams under the Corps' management. As this data becomes available, detailed assessments can be run to better determine vulnerability to dam failures. The 2025 update of this plan may include a much more robust analysis of dam failure vulnerability at the County level.

H.5.10 FLOODING

H.5.10.1 Location and Spatial Extent

There are areas on the Winston-Salem State University campus that are susceptible to flooding from Salem Creek and Brushy Fork Creek. Special flood hazard areas on the Winston-Salem State University campus were mapped using Geographic Information System (GIS) and FEMA Digital Flood Insurance Rate Maps (DFIRM). This includes the 1-percent annual chance floodplain (100-year), and the 0.2-percent annual chance floodplain (500-year). **Figure H.14** illustrates the location and extent of currently mapped special flood hazard areas for the campus based on best available FEMA DFIRM data from October of 2018. 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 H.14: SPECIAL FLOOD HAZARD AREAS ON THE WINSTON-SALEM STATE UNIVERSITY CAMPUS



Source: Federal Emergency Management Agency

Of the 39 buildings on the main campus, one was found to lie in a special flood hazard area. A list of these buildings can be seen in **Table H.22**.

TABLE H.22: FLOOD RISK ANALYSIS FOR WSSU

Building Name	Building Type	100-Year	500-Year
Anderson	Education	X	X
Total Number of Buildings		**1**	**1**

H.5.10.2 Historical Occurrences

Information from the National Centers for Environmental Information was used to ascertain historical flood events. A summary of major flooding events is presented in **Table H.23**. The National Centers for Environmental Information reported a total of 44 events throughout Forsyth County since 1996[8]. A summary of these events is presented in **Table H.24**. These events accounted for over $555,000 (2020 dollars) in property damage throughout the county.

TABLE H.23: MAJOR FLOOD OCCURRENCES IN FORSYTH COUNTY

Area	Date	Type	Property Damage	Crop Damage	Description
WINSTON-SALEM	6/19/1996	Flash Flood	$0	$0	Three feet of water at intersection of Popular and First streets in downtown. Several other roads in town were also seriously flooded due to 3 or more inches of rain in one hour.
WINSTON-SALEM	9/10/1996	Flash Flood	$0	$0	Several major roads in Winston-Salem were covered with 3 feet of water due to persistent heavy rain.
WALKERTOWN	1/8/1998	Flood	$0	$0	Thunderstorms produced very heavy rain over eastern Forsyth county. Street flooding was reported at several locations in Walkertown.
WINSTON SALEM	4/17/1998	Flash Flood	$0	$0	An isolated strong thunderstorm moved over the Winston-Salem area very slowly from the northwest. Flooding was reported in many locations including Reynolda Road at Wake Forest University and along Interstate 40 and Highway 52 near downtown. 2 to 2.5 inches of rain fell in an hour over the western and downtown sections of the city. The slow-moving storm also caused streams to come out of their banks west of the city all the way to the Yadkin River.
CLEMMONS	8/7/2000	Flash Flood	$0	$0	Flooding on I-40 at Silas Creek Parkway.
KERNERSVILLE	9/14/2000	Flash Flood	$0	$0	Hwy. 158 was flooded along with several secondary roads.
NORTH CENTRAL PORTION	9/18/2002	Flash Flood	$0	$0	Flooding occurred on Highway 52 and University Parkway, and on Highway 65 near Winston-Salem. Creeks overflowed their banks near Pfafftown, flooding several roads.
RURAL HALL	2/22/2003	Flash Flood	$0	$0	Residences were flooded.

[8] These events are only inclusive of those reported by NCEI. It is likely that additional occurrences have occurred and have gone unreported.

Area	Date	Type	Property Damage	Crop Damage	Description
	3/20/2003	Flood	$150,000	$0	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.
	4/10/2003	Flood	$0	$0	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.
PFAFFTOWN	5/25/2003	Flash Flood	$0	$0	Streets were flooded and a basement of a home was flooded off Highway 67.
WINSTON SALEM	7/29/2003	Flash Flood	$100,000	$0	Little Creek overflowed its banks, and an apartment complex was damaged from flooding. A furniture store also sustained flood damage.
KERNERSVILLE	9/23/2003	Flash Flood	$0	$0	Some homes were flooded.
WINSTON SALEM	8/2/2004	Flash Flood	$0	$0	Salem Chapel United Methodist Church on Salem Chapel Road was flooded.
WINSTON SALEM	8/12/2004	Flash Flood	$0	$0	Flash flooding was reported on 28th Street and Liberty, with two cars disabled due to high water.
WINSTON SALEM	9/27/2004	Flash Flood	$0	$0	Several blocks of downtown Winston-Salem were flooded. One apartment complex had to be evacuated.
PFAFFTOWN	7/7/2005	Flash Flood	$0	$0	Heavy rainfall flooded a golf course with several inches of water, and the back yards of several homes had high water as well. Several ponds and small lakes overflowed and threatened homes. A spotter reported 6.79 inches of rainfall in just over five hours.
HANES	5/8/2008	Flash Flood	$0	$0	Flash flooding caused the evacuation of apartments on Johnsborough Court in the western portion of Winston-Salem. In total, five water rescues were conducted.
SWAINTOWN	5/8/2008	Flash Flood	$0	$0	Heavy rain caused flash flooding on Peters Creek Parkway.
BETHANIA	8/27/2008	Flash Flood	$0	$0	Law enforcement reported several roads flooded including Beroth Road in the Lewisville area.
PFAFFTOWN	1/25/2010	Flash Flood	$0	$0	Flash flooding resulted in the closure of several roads due to flooding and a landslide.
CLEMMONS	5/28/2010	Flash Flood	$10,000	$0	Flash flooding was reported at several locations in Clemmons, NC, including Lewisville Clemmons Road. In addition, a vehicle was reported to be under water at the intersection of Stadium Drive and Brookland Drive.

Area	Date	Type	Property Damage	Crop Damage	Description
GUTHRIE	6/2/2010	Flash Flood	$0	$0	Flooding was reported on many side streets around Winston-Salem resulting in numerous road closures.
KERNERSVILLE	8/11/2010	Flash Flood	$0	$0	Flash flooding resulted in road closures at the intersection of Highway 66 and Business 40, the intersection of Piney Grove Road and North Main Street and portions of East Mountain Street.
GUTHRIE	9/30/2010	Flash Flood	$0	$0	Linville Road was closed due to flashing flooding.
(INT)WINSTON-SALEM A	10/27/2010	Flash Flood	$0	$0	The 3300 block of New Walkertown Road was closed due to flooding.
OLDTOWN	10/27/2010	Flash Flood	$0	$0	Bethabara Road and North Point Boulevard was closed due to flash flooding.
LEWISVILLE	10/27/2010	Flash Flood	$0	$0	Flash flooding was reported near the intersection of Grapevine Road and Conrad Road.
MUDDY CREEK	7/8/2011	Flash Flood	$0	$0	Road was closed due to flooding near the intersection of Griffith Road and West Clemmonsville Road.
WNSTN SALEM SIDES AR	3/20/2012	Flash Flood	$0	$0	Minor flooding was reported just south of the Winston Salem area. The flooding resulted in a couple of road closures, including the 4200 block of Fox Meadow Lane and Bridgeton Road near Peters Creek Parkway.
WINSTON SALEM	5/14/2012	Flash Flood	$0	$0	Two to three feet of water was reported over some roads and parking lots in downtown Winston-Salem, North Carolina near Business Highway 40. Some cars were reported to be partly submerged.
PFAFFTOWN	5/14/2012	Flash Flood	$0	$0	Two feet of water was reported over Claredon Avenue.
BETHANIA	5/14/2012	Flash Flood	$0	$0	Up to two feet of water was reported inside of businesses along Reynolda Road.
PFAFFTOWN	5/14/2012	Flash Flood	$5,000	$0	Hilltop Drive was closed due to flash flooding as the culvert failed resulting in 30 feet of asphalt washing away.
PARK TERRACE	8/28/2012	Flash Flood	$30,000	$0	Street flooding resulted in the closings of several roads in the area. Approximately 30 people were evacuated by inflatable rafts at a local business on Northwest Boulevard. Additionally, flash flood waters swept five vehicles from the parking lot into Peter's Creek.
OLDTOWN	7/27/2013	Flash Flood	$0	$0	Several roads closed due to flooding in the Bethabara Park area.
TOBACCOVILLE	10/8/2016	Flash Flood	$0	$0	Widespread heavy rainfall of 3 to 4 inches caused minor flash flooding on several roads across the county.
WAUGHTOWN	7/22/2018	Flash Flood	$0	$0	Flash flooding was reported on numerous roads around the US Highway 52 corridor, running through Winston Salem. This includes but not limited to the following roads: |US-421 N at S Main Street, Wake Forest University in the coliseum area, US-52 and along Peters Creek Parkway in multiple areas from Silas Creek Parkway to US-421.

Area	Date	Type	Property Damage	Crop Damage	Description
LEWISVILLE	7/24/2018	Flash Flood	$0	$0	Heavy rain caused Mills Creek to overflow, flooding Conrad Sawmill Road near the intersection of Grapevine Road.
DONNAHA	7/25/2018	Flash Flood	$0	$0	Heavy rain caused nearby creeks and streams to overflow their banks, flooding portions of Reynolda Road.
GUTHRIE	8/2/2018	Flash Flood	$0	$0	Several roads were closed due to flash flooding in the Sedge Garden area. The road closures included Gumtree Road near NC-109, High Point Road at Union Cross Road, Sawmill Road, and Longreen Drive.
WALKERTOWN	8/2/2018	Flash Flood	$10,000	$0	Several roads were closed due to flash flooding in the Walkertown area, including the intersection of Highway 66 and Highway 311.
TOBACCOVILLE	9/17/2018	Flash Flood	$0	$0	Heavy rainfall of 4 to 8 inches flooded several roads across the county.
UNION CROSS	10/11/2018	Flash Flood	$250,000	$0	Heavy rainfall of 4 to 6 inches flooded several roads across the county. Several water rescues were also performed throughout the county.

Source: National Centers for Environmental Information

TABLE H.24: SUMMARY OF FLOOD OCCURRENCES

Location	Number of Occurrences	Deaths	Injuries	Property Damage (2020)
Bethania	2	0	0	$0
High Point	0	0	0	$0
Kernersville	3	0	0	$0
King	0	0	0	$0
Lewisville	2	0	0	$0
Rural Hall	1	0	0	$0
Walkertown	2	0	0	$10,000
Winston-Salem	9	0	0	$100,000
Unincorporated Area	25	0	0	$445,000
Forsyth County Total	**44**	**0**	**0**	**$555,000**

Source: National Centers for Environmental Information

H.5.10.3 Probability of Future Occurrences

Flood events will remain a threat to Winston-Salem State University, 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).

It can be inferred from the floodplain location maps, previous occurrences, and repetitive loss properties that risk varies throughout the Winston-Salem State University campus.

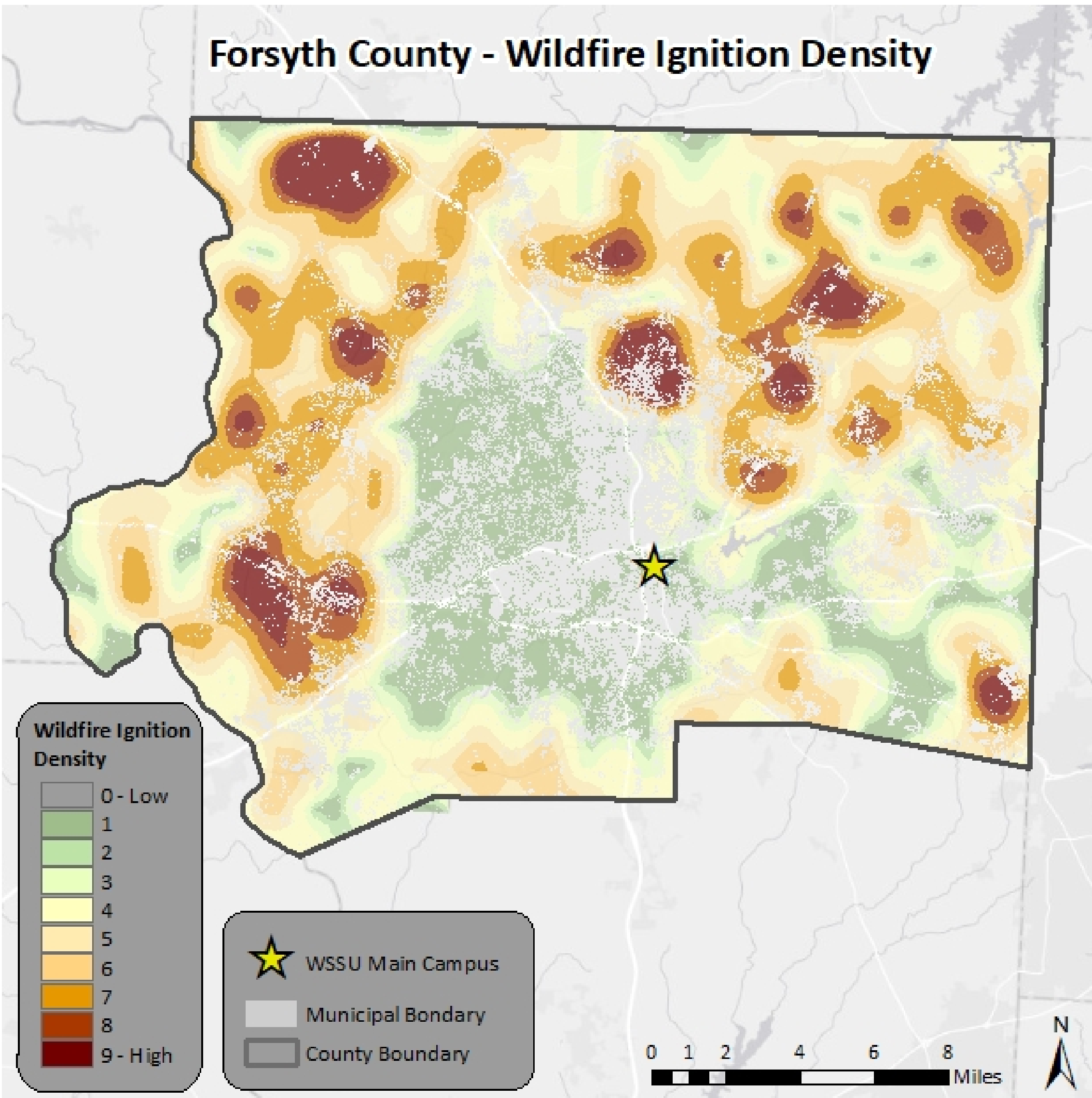
H.5.11 WILDFIRES

H.5.11.1 Location and Spatial Extent

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

Figure 5.15 shows the Wildfire Ignition Density in for Forsyth County 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.

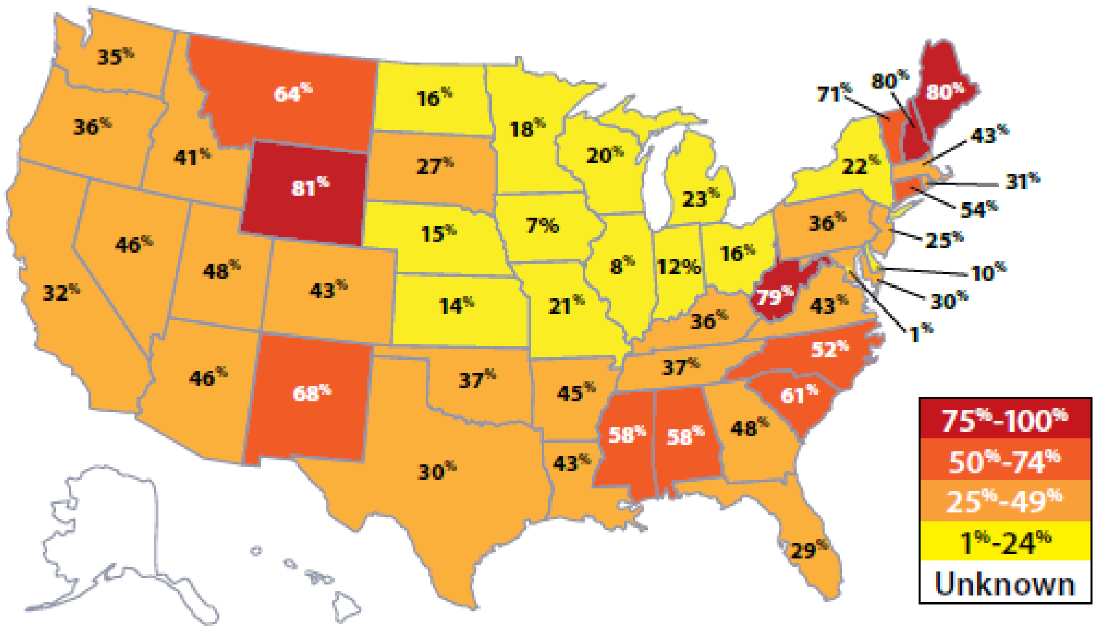
FIGURE H.15: WILDFIRE IGNITION DENSITY IN FORSYTH COUNTY



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 H.16** 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.

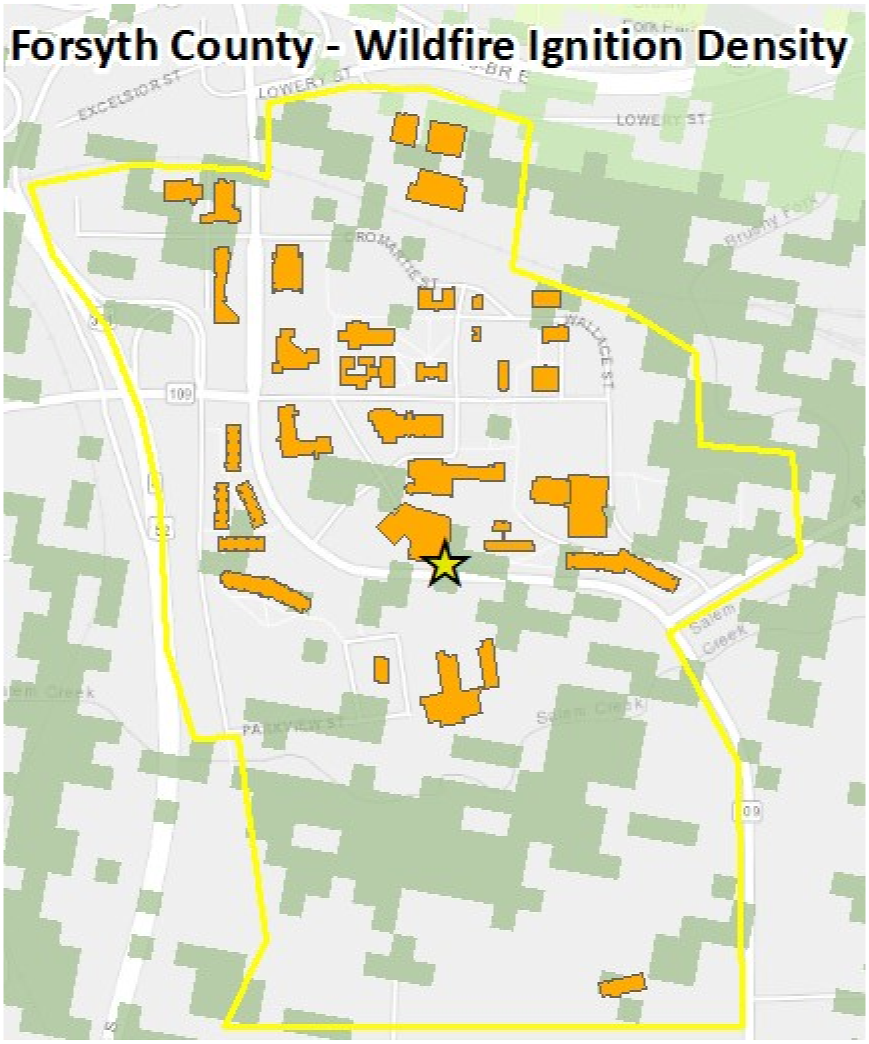
FIGURE H.16: % OF HOMES IN THE WILDLAND URBAN INTERFACE



Source: US Department of Agriculture

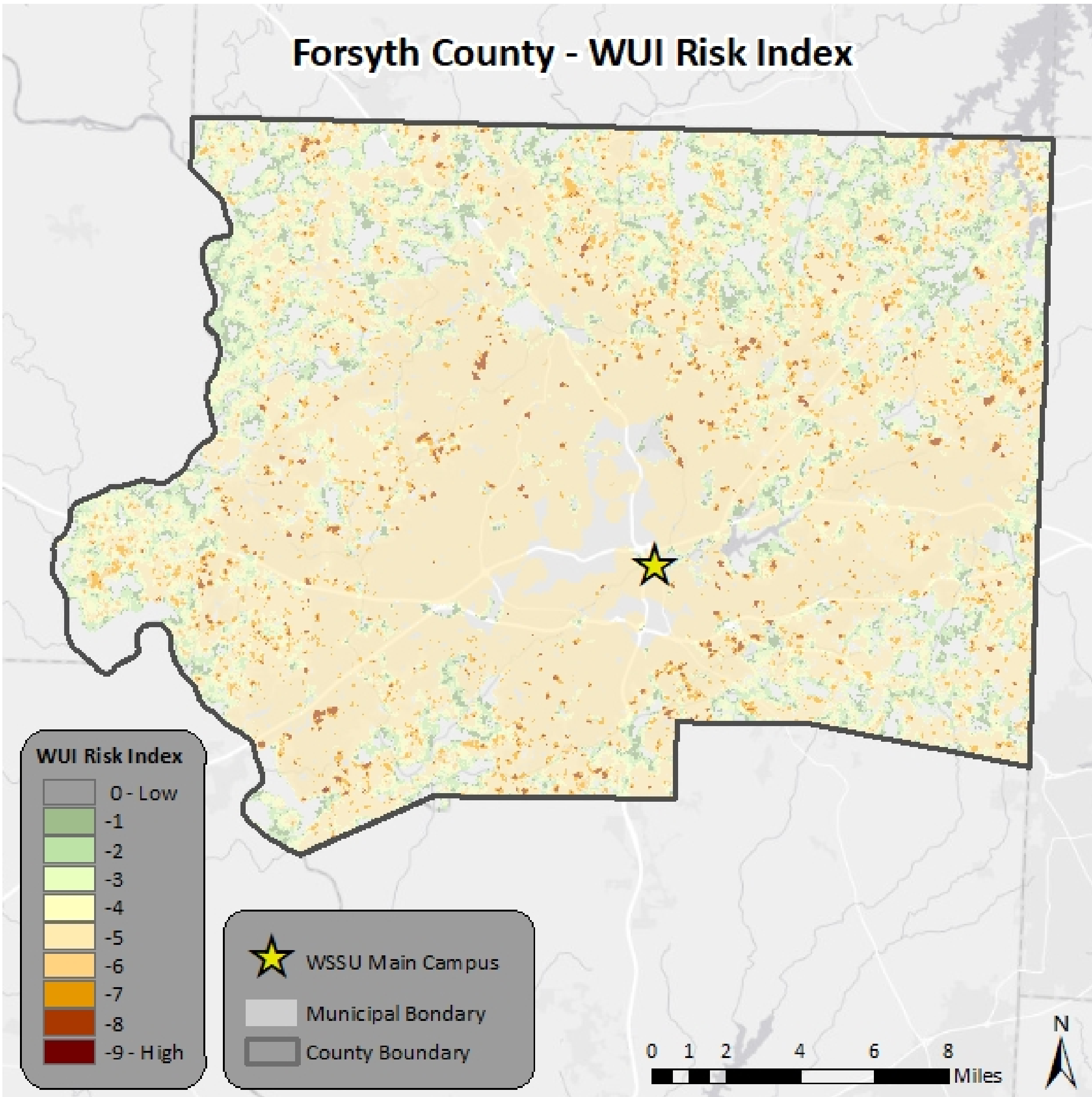
Below, **Figure H.17** displays the Wildfire Ignition Density specifically for Winston-Salem State University, and **Figure H.18** shows the WUI Risk Index for Forsyth County.

FIGURE H.17: WSSU CAMPUS WILDFIRE IGNITION DENSITY



Source: Southern Wildfire Risk Assessment

FIGURE H.18: FORSYTH COUNTY WILDFIRE URBAN INTERFACE RISK INDEX



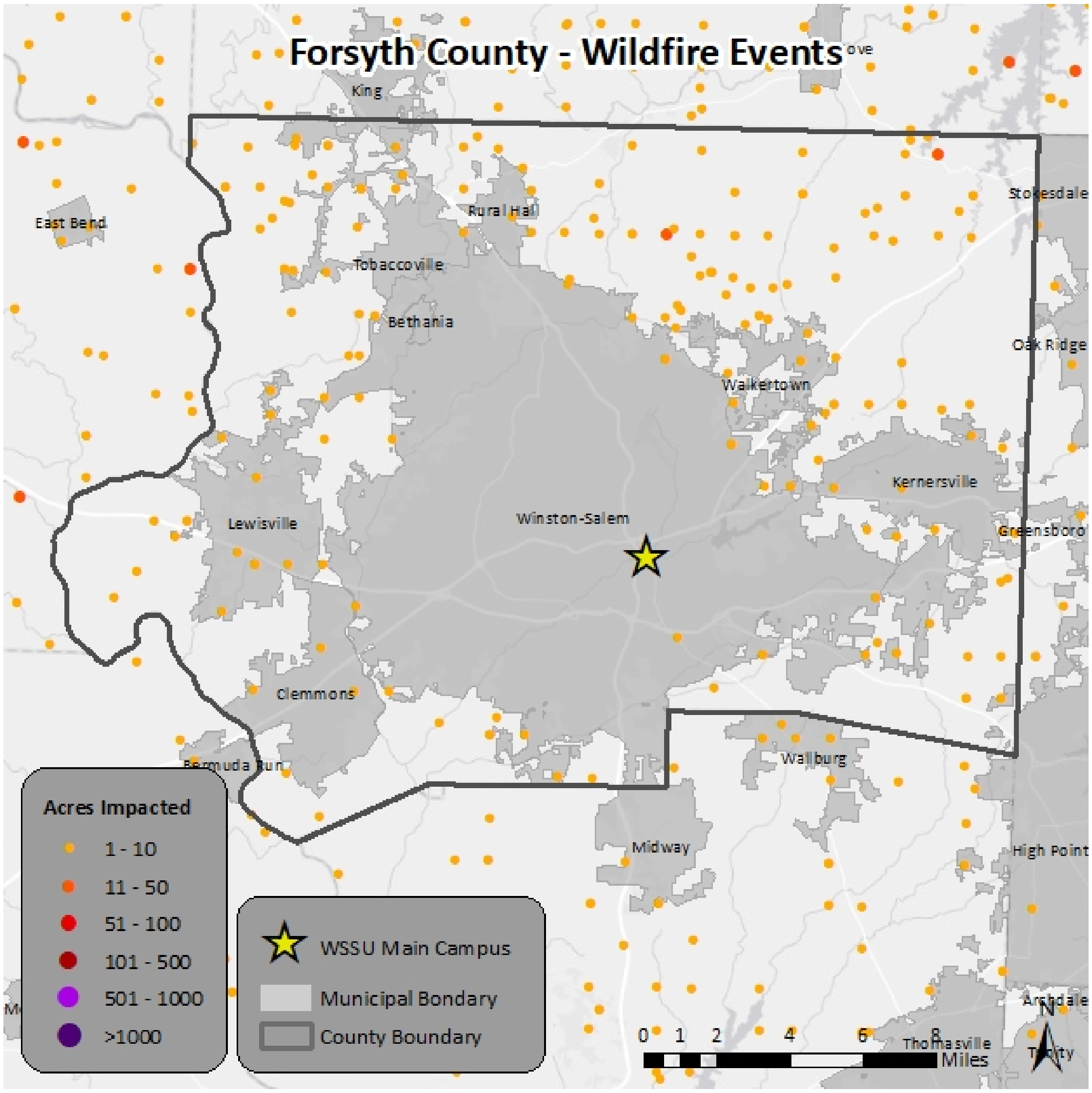
Source: Southern Wildfire Risk Assessment

H.5.11.2 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 335 events that impacted an area greater than 1 acre have occurred throughout the Forsyth County since 2001[9]. **Figure H.19** displays wildfire events in Forsyth County.

[9] These events are only inclusive of those reported by NASFI. It is likely that additional events have occurred and have gone unreported.

FIGURE H.19: WILDFIRE EVENTS IN FORSYTH COUNTY



Source: NASFI

Based on data from the North Carolina Division of Forest Resources from 2001 to 2019, Forsyth County 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.

H.5.11.3 Probability of Future Occurrences

Wildfire events will be an ongoing occurrence in Forsyth County and for Winston-Salem State University. 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 Winston-Salem State University for future wildfire events are likely (10 to 100 percent annual probability).

H.5.12 INFECTIOUS DISEASE

H.5.12.1 Location and Spatial Extent

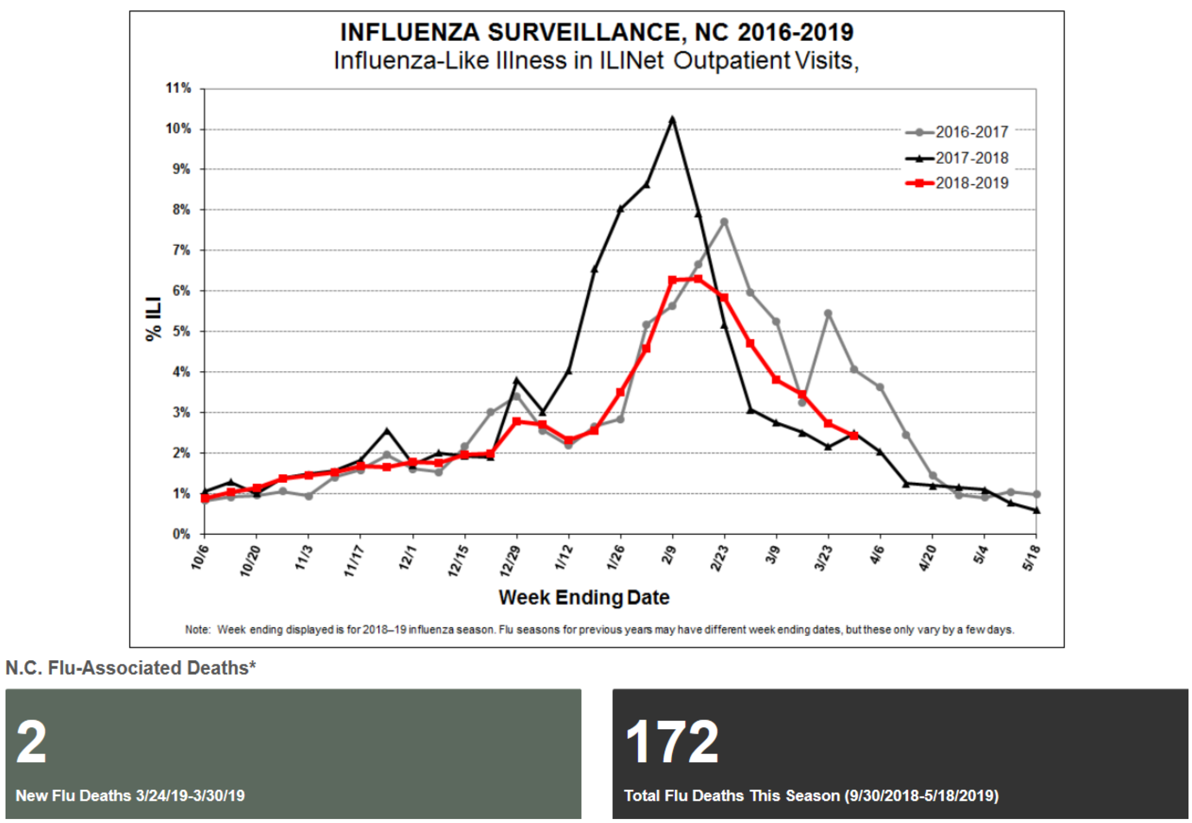
Extent is difficult to measure for an infectious disease event as the extent is largely dependent on the type of disease and on the effect that it has on the population. Extent can be somewhat defined by the number of people impacted, which depending on the type of disease could number in the tens of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

H.5.12.2 Historical Occurrences

Infectious Disease

Influenza is historically the most common infectious disease that has occurred in Forsyth County. Cases of the flu tend to occur in the late fall to early winter months. In recent years, cases of the influenza and influenza-like illnesses have been reported in hospitals. As seen in **Figure H.20** below, 172 people throughout North Carolina died from the flu between 2018 and 2019.

FIGURE H.20: INFLUENZA SURVEILLANCE, NC 2016-2019



Source: NC Department of Health and Human Services

Starting in 2020, the COVID-19 infectious disease pandemic began to impact North Carolina and Forsyth County. The NC Department of Health and Human Services has been actively monitoring and tracking cases since the first case arrived in the State. A Presidential disaster declaration was declared for North Carolina on March 24, 2020 for the COVID-19 pandemic. **Table H.25** provides a summary of confirmed cases of COVID–19 in Forsyth County as of the date of the final version of this plan in 2021. The COVID-19 pandemic is still evolving even though vaccines have been created that are slowing the spread. The pandemic unfolded as this plan was being developed, so the information below presents only a small sample of the pandemic's impacts on Forsyth County. On April 27, 2020, the UNC System made the decision to postpone in-person classes for the remainder of the school year. As a result, WSSU and all other universities in North Carolina, shifted to online courses. Due to Executive Order 135, which extended the existing statewide stay-at-home order through May 8, 2020; college campuses were asked to vacate any on-campus university housing.

TABLE H.25: SUMMARY OF CONFIRMED COVID – 19 CASES IN FORSYTH COUNTY

Location	Number of Cases	Number of Deaths*
Forsyth County	**35,824**	**378**

Source: North Carolina Department of Health and Human Services as of 5/13/21
** Deaths reflect deaths in persons with laboratory-confirmed COVID-19 reported by local health departments to the 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[10].

H.5.12.3 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 Winston-Salem State University will experience an outbreak of infectious diseases in the future.

Technological Hazards

H.5.13 HAZARDOUS SUBSTANCES

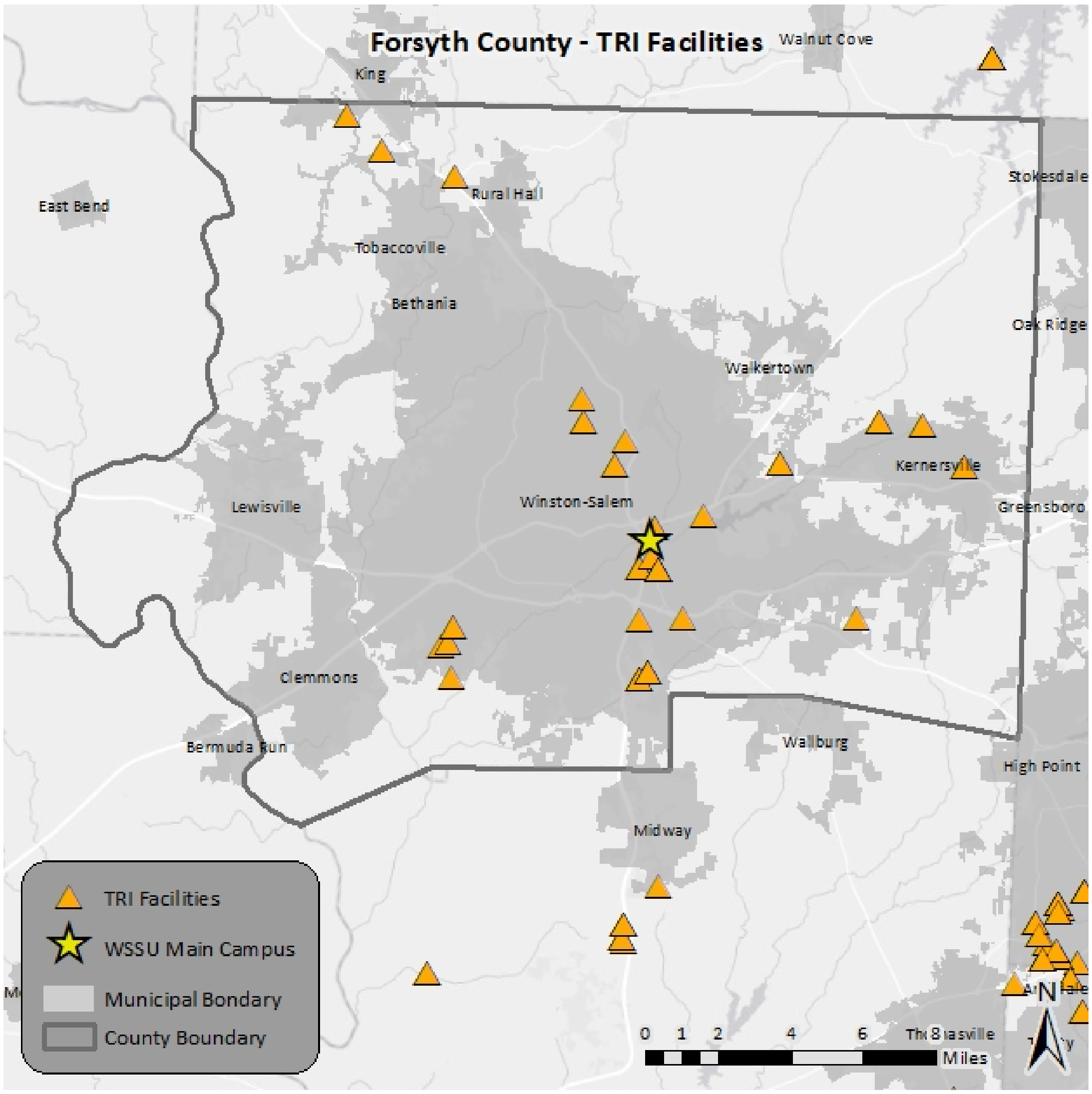
H.5.13.1 Location and Spatial Extent

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 collection information from industrial facilities on the releases and transfers of

[10] https://www.ncdhhs.gov/news/press-releases/nc-prepared-zika-virus-risk-local-virus-carrying-mosquitoes-low

certain toxic agents. This information is then reported in the Toxic Release Inventory (TRI). TRI sites indicate where such activity is occurring. Forsyth County has 24 TRI sites. A map for Forsyth County TRI Facilities is shown in **Figure H.21.**

FIGURE H.21: TOXIC RELEASE INVENTORY (TRI) SITES



Source: EPA

H.5.13.2 Historical Occurrences

The U.S. Department of Transportation Pipeline and Hazard 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.

The Pipeline and Hazardous Materials Safety Administration (PHMSA) is an agency of the United States Department of Transportation that was established in 2004. The PHMSA maintains a database of hazardous materials incidents for communities across the United States. Summary results of their data for events that have occurred in Forsyth County can be found in **Table H.26.**

TABLE H.26: SUMMARY OF HAZMAT INCIDENTS IN FORSYTH COUNTY

Location	Incidents Reported	Injuries	Fatalities	Type	Costs
Bethania	0	0	0	n/n	$0
High Point*	3	0	0	Highway	$0
Kernersville**	5	0	0	Highway	$159,163
King***	0	0	0	n/a	$0
Lewisville	1	0	0	Highway	$83,473
Rural Hall	1	0	0	Highway	$33,681
Walkertown	0	0	0	n/a	$0
Winston-Salem	13	0	0	Highway and Rail	$280,831
Unincorporated Areas	1	0	0	Highway	$0
Forsyth County Total	**24**	**0**	**0**		**$557,148**

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

H.5.13.3 Probability of Future Occurrence

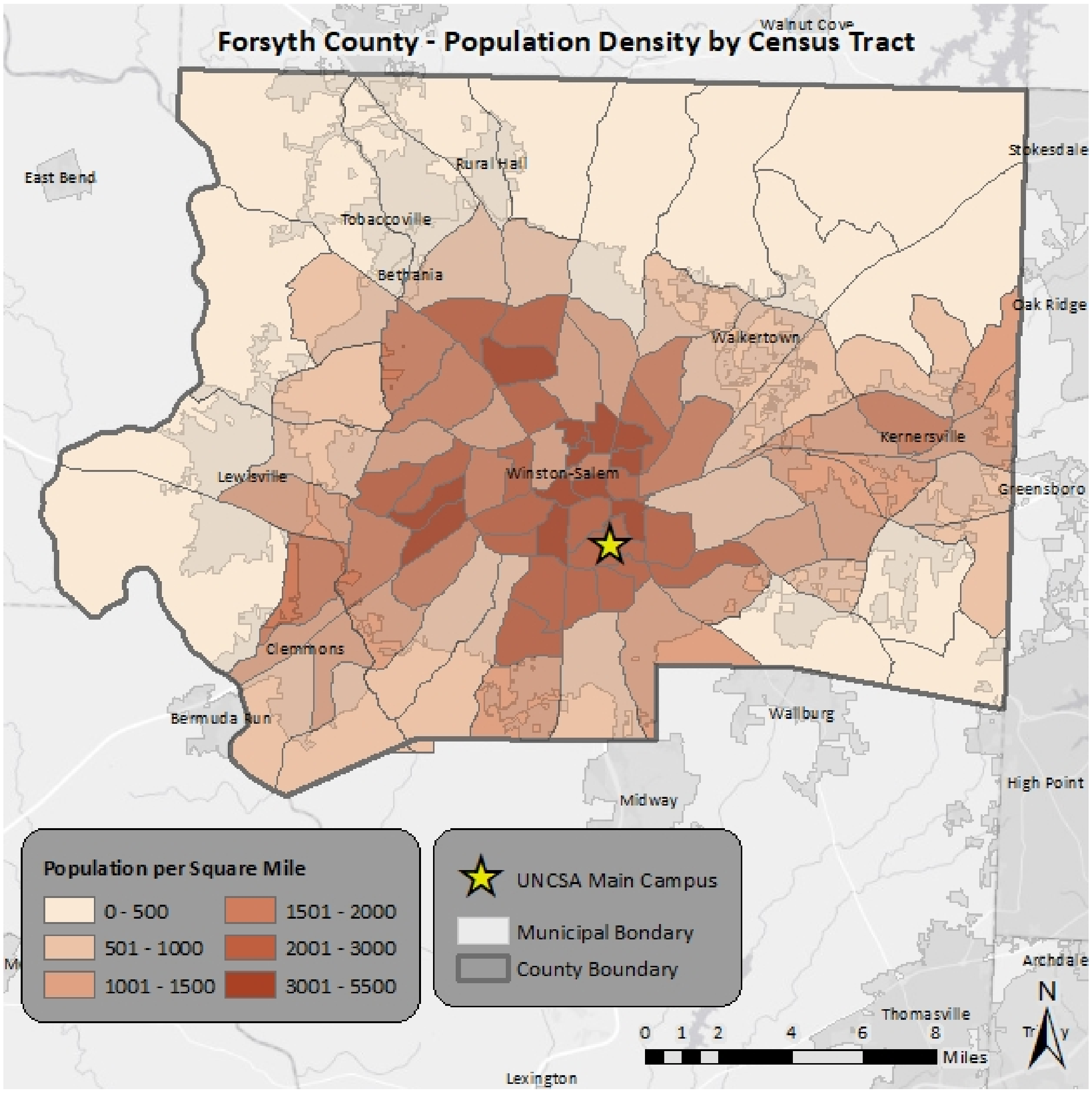
Given the location of toxic release inventory sites in Forsyth County, it is possible that a hazardous material incident may occur. University officials are mindful of this possibility and take precautions to prevent such an event from occurring.

H.5.14 TERRORISM

H.5.14.1 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 H.22** displays the population density in Forsyth County using census tract levels.

FIGURE H.22: POPULATION DENSITY



Source: US Census Bureau

Furthermore, the most recent population counts of each participating county and jurisdictions can be seen in **Table H.27** below.

TABLE H.27 2018 POPULATION ESTIMATES IN FORSYTH COUNTY

Location	2018 Population Estimate
Bethania	350
High Point*	112,791
Kernersville**	24,660
King***	6,877
Lewisville	14,228

Rural Hall	3,216
Walkertown	5,150
Winston-Salem	247,945
Winston-Salem State University	1,144
Unincorporated Areas	4,690
Forsyth County Total	**382,295**

Source: US Census Bureau, NC Office of State Budget and Management
**High Point population estimate from mostly in Guilford County, also in Randolph County, Davidson County*
***Kernersville population estimate partially in Guilford County*
****King mostly in Guilford County, also in Randolph County, Davidson County*

H.5.14.2 Historical Occurrences

No extreme cases of terror attacks have previously affected Forsyth County or Winston-Salem State University. However, as the population in the area continues to increase, so does the chance of an attack. There is an ongoing concern on college campuses about active shooter events. Information from the National Center on Safe and Supportive Learning Environments, a recent study found between the 2001-2002 and 2015-2016 school years, 437 people were shot in 190 college campus shooting incidents.

H.5.14.3 Probability of Future Occurrence

Neither Forsyth County nor Winston-Salem State University have experienced a 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.

H.5.15 CYBER

H.5.15.1 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. Winston-Salem State University is susceptible to cyber-attacks. The ITS Office of Information Security (ITS-OIS) and the Student Cyber Security Operations Center (SCSOC) are WSSU's information security unit.

H.5.15.2 Historical Occurrences

In North Carolina, 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. **Table H.28** displays the North Carolina Cybercrimes and Victim Counts in 2018.

TABLE H.28: NORTH CAROLINA CYBERCRIMES AND VICTIM COUNTS IN 2018

Crime Type by Victim Count

Crime Type	*Victim Count*	*Crime Type*	*Victim Count*
Advanced Fee	436	Identity Theft	330
BEC/EAC	430	Investment	47
Charity	11	Lottery/Sweepstakes/Inheritance	213
Civil Matter	15	Malware/Scareware/Virus	49
Confidence Fraud/Romance	432	Misrepresentation	148
Corporate Data Breach	39	No Lead Value	246
Credit Card Fraud	306	Non-payment/Non-Delivery	1,647
Crimes Against Children	28	Other	172
Denial of Service/TDos	28	Overpayment	406
Employment	391	Personal Data Breach	1,125
Extortion	1,219	Phishing/Vishing/Smishing/Pharming	947
Gambling	4	Ransomware	29
Government Impersonation	255	Re-shipping	31
Hacktivist	2	Real Estate/Rental	286
Harassment/Threats of Violence	330	Spoofing	430
Health Care Related	9	Tech Support	361
IPR/Copyright and Counterfeit	30	Terrorism	2
Descriptors*			
Social Media	902	Virtual Currency	790

Source: FBI Internet Crime Compliant Center, 2018

Although Winston-Salem State University has not reported any major catastrophic cyberattacks, the potential to experience one is unpredictable and can happen at any time.

H.5.15.3 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 at Winston-Salem State University, and it is considered likely (between 10 and 100 percent annual probability) to experience one in the near future.

H.5.16 ELECTROMAGNETIC PULSE

H.5.16.1 Location and Spatial Extent

An EMP can happen in any location, and they are relatively unpredictable. Due to advancing technologies, densely populated areas may be more prone to damages from an EMP. Therefore, Winston-Salem and the Winston-Salem State University campus may be more susceptible.

H.5.16.2 Historical Occurrences

There have been no reports of EMP occurrences at Winston-Salem State University.

H.5.16.3 Probability of Future Occurrences

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

H.5.17 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.

H.5.17.1 Hazard Extent

Table H.29 describes the extent of each natural hazard identified for Winston-Salem State University. The extent of a hazard is defined as its severity or magnitude, as it relates to the planning area.

TABLE H.29 EXTENT OF WINSTON-SALEM STATE UNIVERSITY 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. According to the North Carolina Drought Monitor Classifications, the most severe drought condition is Exceptional. Forsyth County has received this ranking (three times) over the nineteen-year reporting period. According to the NOAA, Forsyth County has had drought occurrences in seventeen of the last nineteen years (2000-2019).
Excessive Heat	The extent of excessive heat can be defined by the maximum temperature reached. The highest temperature recorded in Forsyth County is 104 degrees Fahrenheit (reported on June 26, 1952).
Hurricane and Coastal Hazards	Hurricane extent is defined by the Saffir-Simpson Scale which classifies hurricanes into Category 1 through Category 5. The greatest classification of hurricane to traverse directly through Forsyth County was Tropical Storm David in 1979 which carried tropical force winds of 45 kts (51 miles per hour) upon arrival.
Tornadoes /Thunderstorms	Tornadoes: Tornado hazard extent is measured by tornado occurrences in the US provided by FEMA as well as the Fujita/Enhanced Fujita Scale. The greatest magnitude reported in Forsyth County was an F3 (reported on May 22, 1985). Thunderstorms: Thunderstorm extent is defined by the number of thunder events and wind speeds reported. According to a 63-year history from the National Centers for Environmental Information, the strongest recorded wind event in Forsyth County was reported on July 16, 1962 at 100 knots (approximately 115 mph). It should be noted that future events may exceed these historical occurrences. Lightning: According to the Vaisala flash density map, Winston-Salem State University 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.

	Hailstorms: Hail extent can be defined by the size of the hail stone. The largest hail stone reported in Forsyth County was 2.75 inches (reported on March 23, 2005). It should be noted that future events may exceed this.
Severe Winter Weather	The extent of winter storms can be measured by the amount of snowfall received (in inches). The greatest 24-hour snowfall was reported in Forsyth County was 18 inches reported on December 17, 1930.
Earthquakes	Earthquake extent can be measured by the Richter Scale and the Modified Mercalli Intensity (MMI) scale and the distance of the epicenter to Forsyth County. According to data provided by the National Geophysical Data Center, the greatest MMI to impact Forsyth County was VI (strong) with a correlating Richter Scale measurement of approximately 5 (reported on September 9, 1976). The epicenter of this earthquake was located between 236 and 284 km away.
Geological	Landslide: As noted above in the landslide profile, the landslide data provided by the North Carolina Geological survey is incomplete. This provides a challenge when trying to determine an accurate extent for the landslide hazard. However, when using the USGS landslide susceptibility index, extent can be measured with incidence, which is low throughout most of Forsyth County. There is also a low susceptibility throughout a majority of the county. Sinkhole: The central piedmont part of North Carolina and Winston-Salem State University are susceptible to sinkholes; however, there are no historical records of sinkholes in Forsyth County. Erosion: The extent of erosion can be defined by the measurable rate of erosion that occurs. There are no erosion rate records available for Forsyth County or Winston-Salem State University.
Dam Failure	Dam failure extent is defined using the North Carolina Division of Land Resources criteria. Of the 221 dams in Forsyth County, 55 are classified as high-hazard.
Flooding	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 7 percent of the total land area for Winston-Salem State University. Flood depth and velocity are recorded via United States Geological Survey stream gages throughout the region. While a gauge does not exist on Winston-Salem State University's campus, there is one at or near many areas. The greatest peak discharge recorded for the area was reported in June 21, 1972. Water reached a discharge of 73,300 cubic feet per second and the stream gage height was recorded at 27.83 feet. Peak discharge for the gage on the Yadkin River near Enon, NC is in the table below.

Location/Jurisdiction	Date	Peak Discharge (cfs)	Gage Height (ft)
Forsyth County			
Yadkin River at Enon, NC	1972-06-21	73,300	27.83

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 Forsyth County: ▪ The greatest number of fires to occur in any year was 69 in 2001. ▪ The greatest number of acres to burn in a single year occurred in 2001 when 110 acres were burned. ▪ The largest acres burned in a single incidence occurred in 2001 when 20 acres were burned. Although this data lists the extent that has occurred, larger and more frequent wildfires are possible throughout Forsyth County.
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 Winston-Salem State University 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 Forsyth County is 7500 LGA released on the highway on November 25, 1986. It should be noted that larger events are possible.
Terrorism	Although no severe terrorism attacks have been reported at Winston-Salem State University, the entire campus 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 for Winston-Salem State University. Technology usage, however, is increasing. A cyber-attack could potentially devastate the campus and could have lasting negative impacts.
Electromagnetic Pulse	Electromagnetic Pulse (EMP) occurrences have not taken place at Winston-Salem State University, 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.

H.5.17.2 Priority Risk Index

In order to draw some meaningful planning conclusions on hazard risk for Winston-Salem State University, the results of the hazard profiling process were used to generate hazard classifications according to a "Priority Risk Index" (PRI). The purpose of the PRI is to categorize and prioritize all potential hazards for Winston-Salem State University 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 Winston-Salem State University to consider as part of their proposed mitigation strategy.

The prioritization and categorization of identified hazards for Winston-Salem State University 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 Winston-Salem State University Campus Hazard Mitigation Planning Team in gaining consensus on the determination of those hazards that pose the most significant threat to the campus 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 at Winston-Salem State University 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[11], as summarized in **Table H.30**. 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:

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

According to the weighting scheme and point system applied, the highest possible value for any hazard is 4.0. When the scheme is applied for Winston-Salem State University, 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 Winston-Salem State University Campus Hazard Mitigation Planning Team.

TABLE H.30: PRIORITY RISK INDEX FOR THE WINSTON-SALEM STATE UNIVERSITY

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	

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

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

PRI Category	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
	More than one week	Self-explanatory	4	

H.5.17.3 Priority Risk Index Results

Table H.31 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 Campus Hazard Mitigation Planning Team. The results were then used in calculating PRI values and making final determinations for the risk assessment.

TABLE H.31: SUMMARY OF PRI RESULTS FOR THE WINSTON-SALEM STATE UNIVERSITY

Hazard	Sub hazard(s) Assessed	Category/Degree of Risk					
		Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Natural Hazards							
Drought		Likely	Minor	Large	More than 24 hours	More than one week	2.5
Excessive Heat		Likely	Minor	Large	More than 24 hours	Less than one week	2.5
Hurricane and Coastal Hazards		Likely	Critical	Large	More than 24 hours	Less than 24 hours	2.9
Tornadoes/ Thunderstorms	Hailstorm, Lightning	Highly Likely	Critical	Moderate	Less than 6 hours	Less than 6 hours	3.2
Severe Winter Weather		Likely	Limited	Large	12 to 24 hours	Less than 6 hours	2.6
Earthquakes		Possible	Minor	Moderate	Less than 6 hours	Less than 6 hours	2.3
Geological	Landslide, Sinkholes, Erosion	Possible	Limited	Small	Less than 6 hours	Less than 6 hours	2.1
Dam Failure		Unlikely	Critical	Moderate	More than 24 hours	Less than 6 hours	2
Flooding		Likely	Limited	Moderate	6 to 12 hours	Less than 24 hours	2.5
Other Hazards							

Wildfires		Likely	Minor	Small	Less than 6 hours	Less than 1 week	2.3
Infectious Disease		Unlikely	Minor	Small	More than 24 hours	More than one week	1.5
Technological Hazards							
Hazardous Substances		Unlikely	Limited	Small	Less than 6 hours	Less than 24 hours	1.9
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

H.5.18 FINAL DETERMINATIONS

The conclusions drawn from the hazard profiling process for Winston-Salem State University, including the PRI results and input from the Campus 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 at Winston-Salem State University. It should be noted that although some hazards are classified below as posing low risk, their occurrence of varying or unprecedented magnitudes is still possible in some cases and their assigned classification will continue to be evaluated during future plan updates.

Table H.32 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 Winston-Salem State University Campus Hazard Mitigation Planning Team.

TABLE H.32: 2021 CONCLUSIONS ON HAZARD RISK FOR WINSTON-SALEM STATE UNIVERSITY

HIGH RISK	Tornadoes/Thunderstorms Hurricane and Coastal Hazards Severe Winter Weather Flooding
MODERATE RISK	Drought Excessive Heat Wildfires Earthquakes Dam Failure Geological Terrorism
LOW RISK	Hazardous Substances Radiological Emergency Electromagnetic Pulse Infectious Disease Cyber

H.6 Capability Assessment

The purpose of conducting a capability assessment for an institution of higher learning is to determine the ability of the institution to implement a comprehensive mitigation strategy and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs, or projects[12]. 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 the university's regulatory framework, level of administrative and technical support, access to fiscal resources, and current political climate.

A capability assessment is generally based upon two primary components: 1) an inventory of the university's relevant plans, programs and policies already in place and 2) an analysis of the university's capacity to carry them out. Careful examination of campus capabilities will detect any existing gaps, shortfalls, or weaknesses with ongoing 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 university, which should continue to be supported and enhanced through future mitigation efforts.

The capability assessment completed for WSSU 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,

[12] While the Final Rule for implementing the Disaster Mitigation Act of 2000 does not require a local capability assessment to be completed for hazard mitigation plans, it is a critical step in developing a mitigation strategy that meets the needs of the campus while taking into account their own unique abilities. The Rule does state that a 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)).

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.

Capability Assessment Findings and Conclusion

Collectively, WSSU's administrative, technical and fiscal capabilities are high. WSSU's high capability will help ensure that the Mitigation Strategy is effectively carried out and that hazard risk reduction for the campus is an attainable goal. 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 Campus Hazard Mitigation Planning Committee considered not only their level of hazard risk, but also their existing capability to minimize or eliminate that risk.

H.7 Mitigation Action Plan

The Mitigation Action Plan, or MAP, provides a functional plan of action for each building at the Western Carolina State University. It is designed to achieve the mitigation goals established in Section 4: Mitigation Strategy of the main plan and will be maintained on a regular basis according to the plan maintenance procedures established in Section 5: Plan Maintenance of the main plan.

Each proposed mitigation action has been identified as an effective measure (policy or project) to reduce hazard risk to the buildings on WSSU's campus. 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's 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. 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.

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 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.
- Relative Cost
- Identification of University Department Responsible for each action
- Implementation Schedule—Date by which the action should be completed. More information is provided when possible.
- Implementation Status (2021)—Indication of completion, progress, deferment, or no change since the previous plan. If the action is new, that will be noted here.

All of the mitigation actions in this section have been assigned to Emergency Management and Facilities staff to ensure their implementation. Other University Departments will be consulted for input on an as-needed basis.

For the update of this plan, the WSSU Campus Hazard Mitigation Planning Team participated in three activities related to the mitigation strategy for the university. Those activities included the following:

1. Review and reapproval of previous mitigation goals for the UNC Western Campuses. All eight of the campuses in the Western region decided to leave the previous mitigation goals in place and unchanged.
2. Review and update of existing mitigation actions. The Campus Hazard Mitigation Planning Team reviewed each existing action to determine if it was still relevant, if the prioritization of the action remained the same and to provide an update on the status of implementation for the actions.
3. Identification of any new mitigation actions as determined necessary. The Campus Hazard Mitigation Team identified several new actions for inclusion in the plan. New mitigation actions for this update are marked as such in the Mitigation Action Plan.

The Mitigation Action Plan for WSSU is found on the following pages.

Campus-Wide Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Property Protection							
CW-PP-1	As feasible and as funding is available, install generators/back-up power, for critical facilities campus wide	All Hazards	Moderate	$25,000-$100,000 per generator	Emergency Management and Facilities Management	2026	New action for the 2021 update.

Anderson Hall Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Structural Projects							
AH-SP-1	The source of water infiltration in the mechanical room should be identified and corrected to prevent damage to mechanical equipment.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood, Drought	Moderate	$25,000-$100,000	Emergency Management and Facilities Management	2026	Implementation pending staff time and funding. Issue under investigation.
AH-SP-2	The structure should be reroofed using a non-gravel ballasted roofing system with appropriate slope and drainage.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood	Moderate	>$100,000	Emergency Management and Facilities Management	2026	Implementation pending staff time and funding. The work is proposed to be performed upon release of repair and renovation funds.
AH-SP-3	Areas prone to floodwaters should have critical/valuable contents moved before heavy rain events or permanently relocated.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood	Moderate	>$100,000	Emergency Management and Facilities Management	Completed	Completed. Items in the areas prone to damage are moved as required.
Property Protection							
AH-PP-1	The large trees surrounding the structure and mechanical equipment should be routinely pruned to prevent damage from falling limbs. Dead or dying trees should be removed to prevent damage to the facility or components.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood, Drought	Moderate	<$5,000	Emergency Management and Facilities Management	Completed	Trees are routinely maintained to prevent damage to the facility and components.

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
AH-PP-2	The drains in the courtyard should be routinely serviced to prevent backups. Alternate drainage or pumping equipment should be maintained in the event of an emergency.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood	Moderate	$5,000-$25,000	Emergency Management and Facilities Management	Completed	Debris is routinely removed from exterior areas drains.

Eller Hall Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Prevention							
EH-P-1	Develop plans for business continuity of vital functions in the event of a power outage or enhance emergency generator capacity to provide power for business functions and telecom switching center.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood, Drought	Moderate	\$25,000-\$100,000	Emergency Management and Facilities Management	Completed	A generator currently provides emergency backup power for telecom switching center.
Structural Projects							
EH-SP-1	The condenser unit should be anchored to its foundation to comply with code requirements.	All Hazards	Moderate	<\$5,000	Emergency Management and Facilities Management	2026	This issue is under investigation for a viable solution.
EH-SP-2	The cause of cracking in the parapet wall should be identified and repaired to prevent injury as a result of falling debris.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood, Drought	Moderate	\$25,000-\$100,000	Emergency Management and Facilities Management	2026	This issue is under investigation for a viable solution.
Property Protection							
EH-PP-1	Large trees adjacent to the structure should be routinely pruned to prevent damage from falling limbs/debris. Trees overhanging the roof should be cut back to minimize damage from falling debris and minimize the chance that debris will clog roof drains	Tornadoes/Thunderstorms, Severe Winter Weather, Flood, Drought	Moderate	<\$5,000	Emergency Management and Facilities Management	Completed	Tress are routinely maintained to prevent damage to the facility and components.

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
EH-PP-2	The façade should be waterproofed and flashing around windows and openings installed/repaired to prevent the growth of mold as a result of water infiltration.	Severe Winter Weather, Flood	Moderate	>$100,000	Emergency Management and Facilities Management	2026	The issue is under investigation for a viable solution.

Elva J. Jones Computer Science Building Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Property Protection							
EJCS-PP-1	Windows in the data center should be reinforced with laminating film or replaced with impact resistant lites.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood, Drought	Moderate	$25,000-$100,000	Emergency Management and Facilities Management	2026	The issue is under investigation for a viable solution.
Structural Projects							
EJCS-SP-1	Overhead utility lines should be buried where possible.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood	Moderate	>$100,000	Emergency Management and Facilities Management	2026	Overhead utilities are not the property of the university.
EJCS-SP-2	The drainage system should be routinely serviced to prevent system failure. Maintenance personnel should have access to emergency pumping equipment that can be used in the event of a system failure.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood, Drought	Moderate	<$5,000	Emergency Management and Facilities Management	2026	Drainage systems are service and emergency pumps can be made available in the event of a systems failure.

F.L. Atkins Building Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Property Protection							
FLA-PP-1	All mechanical equipment should be anchored to the structure or a foundation in compliance with code requirements	All Hazards	Moderate	$5,000-$25,000	Emergency Management and Facilities Management	2026	The issue is under investigation for a viable solution.
Structural Projects							
FLA-SP-1	The drainage system should be routinely serviced to prevent system failure. Maintenance personnel should have access to emergency pumping equipment that can be used in the event of a system failure.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood, Drought	Moderate	<$5,000	Emergency Management and Facilities Management	2026	Drainage systems are service and emergency pumps can be made available in the event of a systems failure.
FLA-SP-2	The cause of cracking in the wall of the stairwell should be identified and corrected to prevent further damage.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood, Drought	Moderate	$25,000-$100,000	Emergency Management and Facilities Management	2026	The issue is under investigation for a viable solution.

Gaines Center/Whitaker Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Property Protection							
GCW-PP-1	The clerestory windows and supporting mullions should be replaced to prevent further damage during the next high wind event.	Tornadoes/Thunderstorms, Severe Winter Weather	Moderate	>$100,000	Emergency Management and Facilities Management	Completed	Repair of replacement of clearstory windows at Gaines Pool has been performed.
GCW-PP-2	The cause of cracking in the main gymnasium shear walls should be identified and remedied.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood	Moderate	$25,000-$100,000	Emergency Management and Facilities Management	2026	The issue is under investigation for a viable solution.
GCW-PP-3	All mechanical equipment should be anchored to a foundation to comply with code.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood	Moderate	<$5,000	Emergency Management and Facilities Management	2026	The issue is under investigation for a viable solution.
Structural Projects							
GCW-SP-1	The cause of ongoing cracking in Whittaker and its neighboring retaining wall should be identified and remedied. Cracks should be filled to prevent water intrusion.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood, Drought	Moderate	>$100,000	Emergency Management and Facilities Management	2026	The issue is under investigation for a viable solution.
GCW-SP-2	Drains should be added to prevent ponding on the roof or the roof's slope modified during reroofing.	Severe Winter Weather, Flood	Moderate	$25,000-$100,000	Emergency Management and Facilities Management	2026	Implementation pending staff time and funding. The work is proposed to be performed upon release of repair & renovation funds

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
GCW-SP-3	Areas where water collects around the facility's perimeter should have a drain installed or their slopes modified to direct water away from the facility. Drains should be routinely serviced to prevent flooding. C	Severe Winter Weather, Flood	Moderate	$25,000-$100,000	Emergency Management and Facilities Management	2026	The issue is under investigation for a viable solution. Debris is routinely removed from exterior area drains.

Hall-Patterson Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Property Protection							
HP-PP-1	The improperly constructed and/or missing flashing on the building façade should be corrected to prevent further water intrusion.	Severe Winter Weather, Flood	Moderate	>$100,000	Emergency Management and Facilities Management	2026	Implementation pending staff time and funding. The work is proposed to be performed upon as a part of the repair & renovation projects.
HP-PP-2	Heat pumps and other mechanical equipment should have positive attachment to their foundations as required by code.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood, Drought	Moderate	<$5,000	Emergency Management and Facilities Management	2026	The issue is under investigation for a viable solution
HP-PP-3	The large tree adjacent to the structure should be regularly pruned or removed to prevent damage as a result of a wind or ice storm. The tree should be trimmed back from the building to prevent debris from clogging roof drains.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood, Drought	Moderate	<$5,000	Emergency Management and Facilities Management	2026	Trees are routinely maintained to prevent damage to the facility and components.

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
HP-PP-4	The cables and supports for rooftop antennae should be checked for deterioration. Loose or severely corroded anchorage hardware should be replaced. The loose antennae cable should be secured to the structure.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood, Drought	Moderate	<$5,000	Emergency Management and Facilities Management	2026	Implementation pending staff time and funding. The work is proposed to be performed upon as a part of the repair & renovation projects
HP-PP-5	Provide sufficient emergency power to operate the radio station for mass notification.	All Hazards	Moderate	>$100,000	Emergency Management and Facilities Management	2026	An emergency generator is to be installed to provide emergency power to support the radio station.

Kenneth R. Williams Auditorium Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2021 Action Implementation Status
Property Protection							
KW-PP-1	The loose cables on the roof deck should be secured to the structure.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood	Moderate	<$5,000	Emergency Management and Facilities Management	Completed	The antenna secured to the roof has been removed.
KW-PP-2	The wall mounted light fixtures at the front of the facility should be removed or replaced.	Tornadoes/Thunderstorms, Severe Winter Weather	Moderate	$5,000-$25,000	Emergency Management and Facilities Management	Completed	Light fixtures at the front of the facility have been repaired.
KW-PP-3	The large trees adjacent to the structure should be regularly pruned or removed to prevent damage as a result of a wind or ice storm. The tree should be trimmed back from the building to prevent debris from clogging roof drains.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood	Moderate	<$5,000	Emergency Management and Facilities Management	Completed	Trees are routinely maintained to prevent damage to the facility and components.
Structural Projects							
KW-SP-1	Overhead power lines should be buried where possible.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood	Moderate	>$100,000	Emergency Management and Facilities Management	2026	Overhead utilities are not the property of the university.

O'Kelly Library Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2020 Action Implementation Status
Property Protection							
OKL-PP-1	Mechanical equipment should be anchored to its foundation or the structure as required by code.	All Hazards	Moderate	$5,000-$25,000	Emergency Management and Facilities Management	2026	The issue is under investigation for a viable solution
OKL-PP-2	The privacy fence should be repaired to prevent it from damaging mechanical equipment during high winds.	Tornadoes/Thunderstorms, Flood	Moderate	<$5,000	Emergency Management and Facilities Management	Completed	Privacy fence has been repaired.
OKL-PP-1	Sufficient emergency power or alternate climate control should be provided to the Diggs Gallery to protect art on loan during power outages.	All Hazards	Moderate	>$100,000	Emergency Management and Facilities Management	2026	Implementation pending staff time and funding. The work is proposed to be performed upon release of repair & renovation funds
Natural Resource Protection							
OKL-NRP-1	Areas subject to ongoing erosion should be re-graded to enhance drainage and erosion control measures implemented to prevent damage.	Severe Winter Weather, Flood, Drought	Moderate	<$5,000	Emergency Management and Facilities Management	Completed	Erosion measures have been installed.
	Structural Projects						

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2020 Action Implementation Status
OKL-SP-1	The concrete walkway in front of the service door should be replaced to provide proper drainage.	Severe Winter Weather, Flood	Moderate	\$5,000-\$25,000	Emergency Management and Facilities Management	2026	Implementation pending staff time and funding. The work is proposed to be performed upon as a part of the repair & renovation projects.
OKL-SP-2	The mechanical equipment at the rear of the building should be protected by bollards to prevent accidental vehicle impacts.	Tornadoes/Thunderstorms, Severe Winter Weather, Flood, Drought	Moderate	\$5,000-\$25,000	Emergency Management and Facilities Management	2026	Protection of mechanical equipment is to be installed.

Old Maintenance Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2020 Action Implementation Status
Property Protection							
OM-PP-1	Trees adjacent to the emergency generator and gas connection should be routinely pruned to prevent damage during wind or ice storms.	High Wind/ Tornado, Winter Weather, Flood	Moderate	<$5,000	Emergency Management and Facilities Management	Completed	Trees are routinely maintained to prevent damage to the facility and components.
OM-PP-2	The corrosion in the stairs should be repaired and the concrete sealed to prevent further damage.	High Wind/ Tornado, Winter Weather, Flood, Drought	Moderate	$5,000-$25,000	Emergency Management and Facilities Management	2026	Implementation pending staff time and funding. The work is proposed to be performed upon as a part of the repair & renovation projects
OM-PP-3	Loose flashing at the roof level should be securely fastened to prevent damage.	High Wind/ Tornado, Winter Weather, Flood	Moderate	$5,000-$25,000	Emergency Management and Facilities Management	2026	The issue is under investigation for a viable solution
OM-PP-4	Windows and flashing should be repaired to prevent water intrusion.	High Wind/ Tornado, Winter Weather, Flood	Moderate	$25,000-$100,000	Emergency Management and Facilities Management	2026	The issue is under investigation for a viable solution
OM-PP-5	Implement additional roof drains and slope to the roof during the next roof replacement.	High Wind/ Tornado, Winter Weather, Flood	Moderate	>$100,000	Emergency Management and Facilities Management	2026	The issue is under investigation for a viable solution

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2020 Action Implementation Status
Structural Projects							
OM-SP-1	The damage in the retaining wall should be repaired and the tree causing ongoing damage removed.	High Wind/ Tornado, Winter Weather, Flood, Drought	Moderate	\$5,000-\$25,000	Emergency Management and Facilities Management	2026	The issue is under investigation for a viable solution
OM-SP-2	Consider moving shipping and receiving to another location where occupants are not continually working under overhead steam lines.	High Wind/ Tornado, Winter Weather, Flood, Drought	Moderate	\$25,000-\$100,000	Emergency Management and Facilities Management	Complete	Shipping and receiving has been relocated.
Emergency Services							
OM-ES-1	Sufficient emergency power should be installed to supply heat to the campus during an outage.	High Wind/ Tornado, Winter Weather, Flood, Drought	Moderate	>\$100,000	Emergency Management and Facilities Management	Complete	Connection have been installed to provide hook up of a portable generator.

Thompson Student Center Mitigation Action Plan

Action #	Description	Hazard(s) Addressed	Relative Priority	Relative Cost	University Department Responsible	Target Completion Date	2020 Action Implementation Status
Property Protection							
TSC-PP-1	The damaged flashing and any corrosion jacking at the upper shelf angle should be corrected to prevent damage to the masonry façade.	Winter Weather, Flood	Moderate	$25,000-$100,000	Emergency Management and Facilities Management	2026	Implementation pending staff time and funding.
TSC-PP-2	Loose coping should be secured to the structure to prevent the wind from pulling it off the roof.	High Wind/ Tornado, Winter Weather	Moderate	<$5,000	Emergency Management and Facilities Management	2026	Implementation pending staff time and funding.
Structural Projects							
TSC-SP-1	Areas affected by water infiltration should be corrected to prevent further damage and the growth of mold.	Winter Weather, Flood	Moderate	>$100,000	Emergency Management and Facilities Management	2026	Implementation pending staff time and funding.
Emergency Services							
TSC-ES-1	A larger emergency generator should be installed to provide adequate power for climate control systems in the event the facility must be used as a shelter during a power outage.	High Wind/ Tornado, Winter Weather, Flood, Drought	Moderate	>$100,000	Emergency Management and Facilities Management	2026	Implementation pending staff time and funding.

Appendix A: Local Mitigation Plan Review Tool

APPENDIX A:
LOCAL MITIGATION PLAN REVIEW TOOL

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA's evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of the each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

Jurisdiction:	**Title of Plan:**	**Date of Plan:**
University of North Carolina System – Western Campuses Appalachian State University, North Carolina Agricultural and Technical University, University of North Carolina at Asheville, University of North Carolina at Charlotte, University of North Carolina at Greensboro, University of North Carolina School of the Arts, Western Carolina University, and Winston-Salem State University.	UNC Western Campuses Hazard Mitigation Plan – 2021 Update	DRAFT – May 2021
Local Point of Contact: Nathan Slaughter	**Address:** 2200 Gateway Centre Blvd., Suite 216 Morrisville, NC 27560	
Title: Hazard Mitigation Department Manager		
Agency: ESP Associates, Inc.**,**		
Phone Number: 919-678-1070	**E-Mail:** nslaughter@espassociates.com	

State Reviewer:	**Title:**	**Date:**
Carl Baker	**Hazard Mitigation Planner**	**May 27, 2021** **June 11, 2021**

FEMA Reviewer:	Title:	Date:
Josh Vidmar Edwardine S. Marrone Edwardine S. Marrone	CERC Planner NC-FIT-Mitigation Planner NC-FIT-Mitigation Planner	7/15/2021 8/19/2021(QC) 9/1/21 (Revisions Review)
Date Received in FEMA Region RIV	06/14/21	
Plan Not Approved	8/19/2021	
Plan Approvable Pending Adoption		
Plan Approved	9/2/21	

SECTION 1:
REGULATION CHECKLIST

INSTRUCTIONS: The Regulation Checklist must be completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been 'Met' or 'Not Met.' The 'Required Revisions' summary at the bottom of each Element must be completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is 'Not Met.' Sub-elements should be referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable. Requirements for each Element and sub-element are described in detail in this *Plan Review Guide* in Section 4, Regulation Checklist.

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan (section and/or page number)**	**Met**	**Not Met**
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Section 2 entire section Annexes A-H (Annex Section 1 in each) A1a. Sec. 2, pp. 1-9; Annx. A-H; App. B A1b.. Sec. 1, p. 1; App. B A1c. Annx. A-H, p. 1; App. B A1d. Annx. A-H, pp. 1-2; App. B A1e. Sec. 2, pp. 1-9; Annx. A-H; App. B	X	
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Section 2, subsection 2.7, Appendix B A2a. Sec. 2, p. 9 ; Annx. A-H; App. B A2b. Sec. 2, p. 9 ; Annx. A-H; App. B A2c. Sec. 2, p. 9 ; Annx. A-H; App. B	X	
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Section 2.6, page 2:8 Appendix B A3a, b. Sec. 2, pp. 8-9	X	
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Section 3 and Annex Sections 5 A4a, b. ;References throughout the plan	X	
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Section 5, page 5:5 A5a. Sec. 5, p. 5	X	
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Section 5, entire section A6a-d. Sec. 5, pp. 5-6	X	

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT A: REQUIRED REVISIONS NCEM 1st Review: A1: "* Primary Point of Contact" is missing from Table A.1. ESP Response: Added. A2: No revisions required. A3: Public meeting listed as TBD. Individual campuses utilized online surveys. Highlighted statement on page 2:8 "Selected survey results are presented below". Nothing presented. ESP Response: Revised the wording. Page 2:8; states full results of public survey are available from NCEM HM Planning section? ESP Response: That is our standard language we use in most of our hazard mitigation plans. We can make the full survey results available to whomever should be the keeper of that data and change that reference as needed. A4: Section 6 of annexes does not list existing plans, programs, and policies that were considered during planning. There is some mention in Section 5. ESP Response: Made the change referenced above to this plan review tool A5: No revisions required. A6: No revisions required. **NCEM 2nd Review:** A1: No revisions required. A2: No revisions required. A3: No revisions required. A4: No revisions required. A5: No revisions required. A6: No revisions required.			

B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? 44 CFR 201.6(c)(2)(i) and 44 CFR 201.6(c)(2)(iii)	Section 3 Annexes A-H, Sect. 5 **B1a. Description** Drought, Sec. 3, pp. 6 Heat, Sec. 3, pp. 11-12 Hurricane, Sec. 3, pp. 16 Tornadoes/Storms, Sec. 3, pp. 20-27 Winter Weather, Sec. 3, pp. 28-31 Dam Failure, Sec. 3, pp. 44 Flood, Sec. 3, pp. 47 Earthquakes, Sec. 3, pp. 31-36 Geological, Sec. 3, pp. 38-47 Wildfire, Sec. 3, pp. 50 Disease, Sec. 3, pp. 58 **B1b. Omission of Common Hazards** Sec.3, pp. 6-75 **B1c. Location** **Drought**, A:29, B:29, C:28, D:27, E:28, F:28, G:27, H:28 **Excessive Heat**, N/A, B:31, N/A, D:28, E:29, F:30, G:30, H:30 **Hurricane and Coastal Hazards**, A:32, B:32, C:30, D:29, E:30, F:31, G:31, H:30 **Tornado/Thunderstorm**, A:35, B:35, C:34, D:32, E:33, F:34, G:33, H:33 **Severe Winter Weather**, A:43, B:55, C:48, D:40, E:53, F:50, G:44, H:49 **Earthquakes**, A:51, B:59, C:75, D:42, E:57, F:58, G:46, H:57 **Geological**, A:55, B:62, C:80, D:45, E:59, F:61, G:49, H:60 **Dam Failure,** A:60, B:65, C:84, D:48, E:62, F:63, G:53, H:64 **Flooding**, A:63, B:70, C:89, D:54, E:67, F:67, G:58, H:69 **Wildfires**, A:71, B:74, C:96, D:55, E:71, F:71, G:63, H:74 **Infectious Disease**, A:78, B:79, C:101, D:62, E:76, F:78, G:68, H:79 **B1c. Extent** Drought, Sec. 3, pp. 7-8 Heat, Sec. 3, pp. 12-13 Hurricane, Sec. 3, pp. 16 Tornadoes/Storms, Sec. 3, pp. pp. 20-27 Winter Weather, Sec. 3, pp. 28-31 Dam Failure, Sec. 3, pp. 44 Flood, Sec. 3, pp. 47 Earthquakes, Sec. 3, pp. 33-34 Geological, Sec. 3, pp. 38-47 Wildfire, Sec. 3, pp. 51-52 Disease, Sec. 3, pp. 58	X	

B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Section 3 Annexes A-H Sect. 5 **B2a. Previous Occurrences** **Drought**, A:29, B:29, C:28, D:27, E:28, F:29, G:27, H:28 **Excessive Heat**, B:31, , D:29, E:30, F:30, G:30, H:30 **Hurricane and Coastal Hazards**, A:32, B:32, C:30, D:29, E:30, F:31, G:31, H:30 **Tornado/Thunderstorm**, A:35, B:35, C:34, D:32, E:33, F:34, G:34, H:34 **Severe Winter Weather**, A:43, B:55, C:48, D:40, E:53, F:50, G:44, H:49 **Earthquakes**, A:53, B:60, C:77, D:43, E:58, F:59, G:48, H:58 **Geological**, A:57, B:63, C:81, D:46, E:61, F:62, G:51, H:62 **Dam Failure**, A:62, B:69, C:87, D:52, E:66, F:67, G:57, H:68 **Flooding**, A:65, B:70, C:90, D:55, E:67, F:68, G:59, H:70 **Wildfires**, A:75, B:74, C:99, D:59, E:71, F:76, G:66, H:77 **Infectious Disease**, A:78, B:79, C:101, D:62, E:76, F:78, G:68, H:79 **Hazardous Substances**, A:81, B:82, C:104, D:65, E:78, F:80, G:71, H:81 **Radiological Emergency**, B:85, D:67, E:80, **Terrorism**, A:83, B:86, C:106, D:69, E:82, F:83, G:74, H:84 **Cyber**, A:84, B:86, C:107, D:69, E:82, F:83, G:74, H:84 **Electromagnetic Pulse**, A:85, B:88, C:108, D:71, E:83, F:84, G:75, H:85 **B2b. Future Probability** **Drought**, A:31, B:30, C:29, D:28, E:29, F:30, G:30, H:29 **Excessive Heat**, B:31, D:29, E:30, F:31, G:31, H:30 **Hurricane and Coastal Hazards**, A:34, B:34, C:33, D:31, E:32, F:33, G:33, H:33 **Tornado/Thunderstorm**, A:42, B:54, C:47, D:39, E:52, F:49, G:43, H:48 **Severe Winter Weather**, A:51, B:59, C:75, D:41, E:57, F:57, G:46, H:56 **Earthquakes**, A:55, B:61, C:79, D:44, E:59, F:60, G:49, H:59 **Geological**, A:59, B:64, C:83, D:47, E:62, F:63, G:53, H:64 **Dam Failure**, A:63, B:69, C:87, D:53, E:66, F:67, G:57, H:68 **Flooding**, A:71, B:74, C:96, D:55, E:71, F:71, G:63, H:73 **Wildfires**, A:77, B:79, C:100, D:61, E:75, F:77, G:68, H:78	X	

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** **(section and/or page number)**	**Met**	**Not Met**
	Infectious Disease, A:79, B:82, C:102, D:63, E:77, F:79, G:70, H:80 **B2c. Occurrences since Previous Plan** **Drought**, A:29, B:29, C:28, D:27, E:28, F:29, G:27, H:28 **Excessive Heat**, B:31, D:29, E:30, F:30, G:30, H:30 **Hurricane and Coastal Hazards**, A:32, B:32, C:30, D:29, E:30, F:31, G:31, H:30 **Tornado/Thunderstorm**, A:35, B:35, C:34, D:32, E:33, F:34, G:34, H:34 **Severe Winter Weather**, A:43, B:55, C:48, D:40, E:53, F:50, G:44, H:49 **Earthquakes**, A:53, B:60, C:77, D:43, E:58, F:59, G:48, H:58 **Geological**, A:57, B:63, C:81, D:46, E:61, F:62, G:51, H:62 **Dam Failure**, A:62, B:69, C:87, D:52, E:66, F:67, G:57, H:68 **Flooding**, A:65, B:70, C:90, D:55, E:67, F:68, G:59, H:70 **Wildfires**, A:75, B:74, C:99, D:59, E:71, F:76, G:66, H:77 **Infectious Disease**, A:78, B:79, C:101, D:62, E:76, F:78, G:68, H:79		
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Section 3 **B3a. Impact** Drought, Sec. 3, pp. 9-10 Heat, Sec. 3, pp. 15-16 Hurricane, Sec. 3, pp. Tornadoes/Storms, Sec. 3, pp. Winter Weather, Sec. 3, pp. Dam Failure, Sec. 3, pp. Flood, Sec. 3, pp. Earthquakes, Sec. 3, pp. 20-27 Geological, Sec. 3, pp. Wildfire, Sec. 3, pp. Disease, Sec. 3, pp. **B3b. Vulnerability** Appalachian State University, pp. A:8-12 N. Carolina A&T, pp. B:9-12 UNC Asheville, pp. C:9-13 UNC Charlotte, pp. D:7-10 UNC Greensboro, pp. E:9-11 UNC School of Arts, pp. F:9-12 Western Carolina, pp. G:7-11 Winston-Salem, pp. H:8-12	X	
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	NA, the universities are "self-insured B4a. Sec. 3, p. 47	X	

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT B: REQUIRED REVISIONS NCEM 1st Review: B1: Locations are discussed in campus Annexes A-H. Flood and wildfire maps are also located in the campus annexes. B2: Historical occurrences and future probabilities are discussed in campus Annexes A-H. B3: Vulnerabilities discussed in Consequence Analysis for each identified hazard in Section 3. B4: Add statement: Individual campuses are not required to maintain NFIP Flood Insurance as North Carolina is a self-insuring state. All state-owned facilities are covered by the NC General Assembly. (Section 3, Page 3:47) ESP Response: Added. **NCEM 2nd Review:** B1: No revisions required. B2: No revisions required. B3: No revisions required. B4: No revisions required.			
ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Annex Sections 6 (Capability Assessment) **C1a.** Individual Annexes Appalachian State University, p. A:92 N. Carolina A&T, p. B:96 UNC Asheville, p. C:115 UNC Charlotte, p. D:79 UNC Greensboro, p. E:93 UNC School of Arts, p. F: 92 Western Carolina, p. G:84	X	
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	NA, the universities do not participate in the NFIP C2a. Sec. 3, p. 47	X	
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Section 4, page 4:3 C3a, b. Sec. 1, pp. 3-4	X	
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Section 4 and Annex section 7s **C4a, b, c. Individual Annexes** Appalachian State University, pp. A:93-106 N. Carolina A&T, pp. B:99-107 UNC Asheville, pp. C:117-130 UNC Charlotte, pp. D:82-101 UNC Greensboro, pp. E:97-119 UNC School of Arts, pp. F:98-106 Western Carolina, pp. G:87-104 Winston-Salem, pp. 93-94	X	

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** **(section and/or page number)**	**Met**	**Not Met**
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Annex Section 7s C5a. Sec. 4, pp. 2-3 C5b. Sec. 4, pp. 2-3 **C5c. Individual Annexes** Appalachian State University, pp. A:93-106 N. Carolina A&T, pp. B:99-107 UNC Asheville, pp. C:117-130 UNC Charlotte, pp. D:82-101 UNC Greensboro, pp. E:97-119 UNC School of Arts, pp. F:98-106 Western Carolina, pp. G:87-104 Winston-Salem, pp. 96-11	X	
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Section 5 C6a-d. Sec. 5, pp. 1-2	X	

ELEMENT C: REQUIRED REVISIONS

NCEM 1st Review:

C1: No revisions required.

C2: See remarks for Element B4.

C3: No revisions required.

C4:

1. Page A:4 states that ASU has dedicated several million dollars to mitigate on campus flooding, this is not demonstrated in the mitigation action plan.
   ESP Response: The work that was previously completed was not part of the previous mitigation action plan, but is mitigation nonetheless and an indicator of capability for ASU.
2. Consider revising critical facility identification in campus annexes to match backup generator consideration.
3. UNCG mitigation plan table should read “2021 Implementation Status”.
   ESP Response: Deleted word “Action”.
4. Ensure all identified hazards match the HIRA in Section 3.
   ESP Response: Hazards Table for Annexes A – D updated to match all identified hazards in Section 3.
5. See Review Tool Addendum for additional comments.

Additional comments from Addendum:

1. Consider making specific building actions a campus wide consideration. (e.g. securing HVAC equipment.) Recommend changing to an **All Hazards** action.
   ESP Response: For the sake of providing updates to existing actions, as required by FEMA, the building-specific actions remain the same for this update. Campus-wide actions, as recommended, have been added in some cases.
2. Actions regarding sprinklers and firefighting apparatus are listed as Wildfire actions. These do not address a natural hazard.
   ESP Response: Unsure of how to address this comment. Wildfire is a natural hazard and sprinkler systems would appear to be a property protection mitigation action against the hazard.
3. Consider amending generator/back-up power actions to one campus wide for critical facilities as an all-hazard, property protection mitigation action.
   ESP Response: Added a campus wide action for each University as recommended.

School / Building	***Action #***	***Description***	***Hazard(s) Addressed***	***Comment***
ASU, Anne Belk Hall	ABH-P-1	Install HVAC.	Earthquake, Geological, Tornadoes/Thunderstorms, Wildfire, Flood	Installation of HVAC is not a mitigation action. See also Note 3. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	ABH-P-2	Pruning trees.	Tornadoes/Thunderstorms, Severe Winter Weather	As described this is a maintenance item and will not count as a

				mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	ABH-PP-1	Moving dumpster away from generator and installing bollards.	Earthquake, Geological, Tornadoes/Thunderstorms, Wildfire, Flood	This is not a mitigation action. Though related to property protection, the hazards addressed are not appropriate. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	ABH-PP-2	Installing building sprinkler system.	Wildfire	Note 2.
ASU, B.B. Dougherty Administration Bldg.	DAB-P-1	Install backup power.	Earthquakes, Geological, Tornadoes/Thunderstorms, Wildfire, Flood	Note 3.
	DAB-P-2	Inspect roof drains.	Flood, Severe Winter Weather	Change to wind/rain events. ESP Response: Done
	DAB-PP-2	Pruning trees.	Hurricane, Tornadoes/Thunderstorms, Severe Winter Weather	As described this is a maintenance item and will not count as a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.

ASU, Central Dining Hall	CDH-P-1	Inspection of bridge.	Flood	As described this is a maintenance item and will not count as a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	CDH-P-2	Monitoring roof for snow accumulation.	Severe Winter Weather	As described this is a maintenance item and will not count as a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
ASU, Drinking Water System	DWS-P-1 DWS-P-S DWS-PP-1 DWS-NRP-1 DWS-NRP-2 DWS-SP-1	Perimeter maintenance road, tree pruning, etc.		While vital projects, these items do not address natural hazard mitigation. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
ASU, Holmes Convocation Center	HCC-P-1	Installing vibration isolators on rooftop equipment.	Earthquake, Geological	Note 1.
	HCC-PP-2	Install protective bollards.	Earthquake, Geological, Hurricane and Coastal Hazards, Tornadoes/Thunderstorms, Severe Winter Weather, Wildfire, Flood	This is not a mitigation action. Though related to property protection, the hazards addressed are

				not appropriate. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	HCC-ES-1	Emergency power.	All	Note 3.
ASU, Miles Annas SSC	SCC-P-1	Relocate generator or install bollards.	None listed.	This is not a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	SSC-P-2	Pruning trees.	Earthquake Geological, Tornadoes/Thunderstorms	As described this is a maintenance item and will not count as a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
ASU, Physical Plant Complex	PPC-P-1 PPC-P-3	Construct vehicle bollards.	None listed.	This is not a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	PPC-P-2	Pruning trees.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms, Severe Winter Weather, Earthquake, Geological	As described this is a maintenance item and will not count as a mitigation action.

				ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	PPC-ES-1	Install a fire alarm.	Wildfire	Note 2.
ASU, Raley Hall	RH-P-2 RH-P-4	Service drains in courtyard and surrounding outside air intakes.	Flood	As described this is a maintenance item and will not count as a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	RH-P-5	Pruning trees.	Hurricane and Coastal Hazards, Tornadoes/Thunderstorms	As described this is a maintenance item and will not count as a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
ASU, Rivers Street Parking Garage	RSPG-P-1	Construct second exit from Police dispatch room.	All	This is a life safety item, not a natural hazard mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	RSPG-P-2	Service drainage system.	Flood	As described this is a maintenance

				item and will not count as a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
ASU, Steam Plant Complex	SPC-P-1	Increase number of exits routes for egress.	Wildfire	While vital projects, these items do not address natural hazard mitigation. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
NCAT, Campus Wide	CW-PP-1	Update emergency plans and continue training.	All Hazards	Change to PEA. ESP Response: Done
	CW-ES-2	Preparedness training.	All Hazards	Change to PEA. ESP Response: Done
NCAT, Carver Hall	CH-P-1	Install generator.	Hurricanes and Coastal Hazards, Tornadoes/Thunderstorms, Severe Winter Weather	Note 3. Change to All Hazard. ESP Response: Done
UNCA, Founders Hall	FH-PP-1	Anchor generator.	Hazards do not match Section 3. ESP Response: Corrected	Note 1.
	FH-PP-2	Pruning trees.	Hazards do not match Section 3. ESP Response: Corrected	As described this is a maintenance item and will not count as a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.

	FH-PP-3	Repair shelf angle.	Hazards do not match Section 3. ESP Response: Corrected	Note 4. ESP Response: No Note 4 provided.
	FH-PP-4	Repair masonry caulking.	Flood	Change to wind/rain events. ESP Response: Done
	FH-SP-1	Vehicular access to building.	Hazards do not match Section 3. ESP Response: Corrected	While vital projects, these items do not address natural hazard mitigation. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
UNCA, Health and Fitness Center	HFC-PP-1 HFC-PP-2	Anchoring equipment.	Hazards do not match Section 3. ESP Response: Corrected	Note 1.
	HFC-PP-3	Pruning trees.	Hazards do not match Section 3. ESP Response: Corrected	As described this is a maintenance item and will not count as a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	HFC-SP-1	Install bollards.	Hazards do not match Section 3. ESP Response: Corrected	This is not a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	HFC-ES-1	Install generator	Hazards do not match Section 3. ESP Response: Corrected	Note 3.

UNCA, Justice Gym	JG-PP-1 JG-PP-2 JG-PP-3 JG-SP-1			As described these are maintenance items and will not count as a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	JG-ES-1	Backup power.	Earthquake	Note 3.
UNCA, Karpen Hall	KH-PP-1 KH-PP-4	Remove/anchor equipment.	Hazards do not match Section 3.	Note 1.
	KH-PP-2	Install HVAC in the data center and provide backup power.	Hazards do not match Section 3.	HVAC installation is not a mitigation action. See also Note 3. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	KH-PP-3	Pruning trees.	Hazards do not match Section 3.	As described these are maintenance items and will not count as a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
UNCA, Lipinsky Hall	LH-PP-1 LH-PP-3	Pruning trees.	Hazards do not match Section 3.	As described these are maintenance items and will not count as a mitigation action.

				ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	LH-PP-2	Anchor equipment.	Hazards do not match Section 3.	Note 1.
UNCA, Mills Hall	MH-PP-1	Anchor equipment.	Hazards do not match Section 3.	Note 1.
	MH-PP-2	Pruning trees.	Hazards do not match Section 3.	As described these are maintenance items and will not count as a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	MH-SP-1	Install bollards or other barriers.	Hazards do not match Section 3.	This is not a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
UNCA, Phillips Hall	PH-PP-1	Pruning trees.	Hazards do not match Section 3.	As described these are maintenance items and will not count as a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	PH-ES-2	Provide emergency generator.	Hazards do not match Section 3.	Note 3.

UNCA, Rhoades, Rhoades Tower, Robinson	RRRT-PP-1 RRRT-PP-4	Anchor equipment.	Hazards do not match Section 3.	Note 1.
	RRRT-PP-3	Anchoring gas cylinders.	Hazards do not match Section 3.	As described this is a safety item and will not count as a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
UNSS, Atkins Library	AL-PP-1	Fire suppression system installation.	Earthquake, Tornadoes/Thunderstorms, Severe Winter Weather, Wildfire, Flood, Drought	While vital projects, these items do not address natural hazard mitigation. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	AL-PP-4	Increasing emergency egress.	Earthquake, Tornadoes/Thunderstorms, Severe Winter Weather, Wildfire, Flood, Drought	While vital projects, these items do not address natural hazard mitigation. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
UNCC, Burson Physical Science Building	BPSB-P-1	Anchoring rooftop equipment.	Earthquake, Tornadoes/Thunderstorms, Severe Winter Weather, Wildfire, Flood	Note 1.
	BPSB-PP-1	Enhance vehicular building access.	Earthquake, Tornadoes/Thunderstorms, Severe Winter Weather, Wildfire, Flood	This is not a mitigation action. ESP Response: The University

				would like to keep this action in their Mitigation Action Plan.
	BPSB-PP-1	Installing fire suppression system.	Earthquake, Tornadoes/Thunderstorms, Severe Winter Weather, Wildfire, Flood	While vital projects, these items do not address natural hazard mitigation. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
UNCC, Cameron Applied Science Center	CASC-PP-2	Pruning trees.	Hazards do not match Section 3.	As described these are maintenance items and will not count as a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	CASC-PP-3	Anchoring rooftop equipment.	Hazards do not match Section 3.	Note 1.
UNCC, King Building	KB-PP-2	Alternative environmental controls	Hazards do not match Section 3.	This is not a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	KB-PP-4	Fire suppression system.	Earthquake	This does not address natural hazard mitigation. ESP Response: The University would like to keep this

				action in their Mitigation Action Plan.
UNCC, Power Substation	PS-PP-2	Cutting high grass surrounding power station.	Wildfire, Drought	As described these are maintenance items and will not count as a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	PS-PP-2	Pruning trees.	Hazards do not match Section 3.	As described these are maintenance items and will not count as a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
UNCC, Residence Hall	RH-PP-1 RH-PP-3 RH-PP-4	Enhancing access to buildings for public safety vehicles, increasing egress points, and installing sprinkler systems	Hazards do not match Section 3.	While vital projects, these items do not address natural hazard mitigation. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
UNCC, Regional Utilities Plant	RUP-PP-1	Install bollards.	Hazards do not match Section 3.	This is not a mitigation action. ESP Response: The University would like to keep this action in their

				Mitigation Action Plan.
	RUP-PP-2	Evaluating code compliance.	Hazards do not match Section 3.	This is not a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
UNCG, Campus Wide	CW-P-6	2-Factor-Authentification	Cyber	This does not address natural hazards, and will not count as a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	CW-P-7	Cyber-security Incident Response Plan	Cyber	This does not address natural hazards, and will not count as a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	CW-P-8	Update pedestrian pathways and crosswalks.	Traffic Accidents.	This does not address natural hazards, and will not count as a mitigation action. Change to Emergency Services. ESP Response: The University would like to

				keep this action in their Mitigation Action Plan.
	CW-SP-1	Emergency/Backup Power	Utility Interruption, Tornadoes/Thunderstorms, Hurricanes and Coastal Hazards, Severe Winter Weather	Change to All Hazards and Property Protection. ESP Response: Done
UNCG, Weil Winfield Quad	WWQ-ES-1 GCB-SP-1	Emergency/Backup power.	Utility Interruption, Tornadoes/Thunderstorms, Hurricanes and Coastal Hazards, Severe Winter Weather	Note 3.
UNCG, Gate City Boulevard Corridor	GCB-SP-1	Redundant power supply.	Utility Interruption, Tornadoes/Thunderstorms, Hurricanes and Coastal Hazards, Severe Winter Weather	Note 3.
UNCSA, Administration Building	AB-ES-1	Backup generator.	Hazards do not match Section 3. ESP Response: Corrected	Change to All Hazards and Property Protection. ESP Response: Done
	AB-PP-2	Fire suppression system.	Lightning	This does not address natural hazard mitigation. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
UNCSA, Center Stage	CS-PP-2	Install fire sprinkler system.	Lightning, Wildfire	This does not address natural hazard mitigation. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
UNCSA, Facilities, 300 Waughtown	FW-PP-1	Install vehicle barriers.	Winter Weather	This does not address

				natural hazard mitigation. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	FW-PP-2	Install fire sprinkler system.	Lightning, Wildfire	This is not a mitigation action. ESP Response: The University would like to keep this action in their Mitigation Action Plan.
	FW-ES-1	Backup generator.	Hazards do not match Section 3. ESP Response: Corrected	Change to All Hazards and Property Protection. See also Note 3.
UNCSA, Fitness Center	FC-ES-1	Backup generator.	Hazards do not match Section 3. ESP Response: Corrected	Change to All Hazards and Property Protection. See also Note 3. ESP Response: Done
UNCSA, Hanes Student Commons	HSC-ES-1	Backup generator.	Hazards do not match Section 3. ESP Response: Corrected	Change to All Hazards and Property Protection. ESP Response: Done See also Note 3.
	HSC-PP-1	Install vehicle barriers.	Hazards do not match Section 3. ESP Response: Corrected	This does not address natural hazard mitigation. ESP Response: The University would like to keep this action in their Mitigation Action Plan.

WCU, H.F. Robinson Administration	HFR-PP-1 HFR-PP-2	Anchoring equipment.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Note 1.
WCU, Ramsey Center	RC-P-1	Backup generator.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	Change to All Hazards and Property Protection. ESP Response: Done See also Note 3.
	RC-P-2	Anchoring equipment.	Earthquake, Geological, Severe Winter Weather, Wildfire, Flood	See Note 1.
WSSU, Eller Hall	EH-SP-1	Anchoring equipment.	Hazards do not match Section 3. ESP Response: Corrected	See Note 1.
WSSU, F.L. Atkins Building	FLA-PP-1	Anchoring equipment.	Hazards do not match Section 3. ESP Response: Corrected	See Note 1.
WSSU, Gaines Center/Whitaker	GCW-PP-3	Anchoring equipment.	Hazards do not match Section 3. ESP Response: Corrected	See Note 1.
WSSU, Hall-Patterson	HP-PP-2	Anchoring equipment.	Hazards do not match Section 3. ESP Response: Corrected	See Note 1.
	HP-ES-1	Backup power.	Hazards do not match Section 3. ESP Response: Corrected	Change to All Hazards and Property Protection. ESP Response: Corrected See also Note 3.
WSSU, O'Kelly Library	OKL-PP-1	Anchoring equipment.	Hazards do not match Section 3. ESP Response: Corrected	See Note 1.
	OKL-ES-1	Backup power.	Hazards do not match Section 3. ESP Response: Corrected	Change to All Hazards and Property Protection. ESP Response: Corrected See also Note 3.
	OKL-SP-1	Install bollards.	Hazards do not match Section 3. ESP Response: Corrected	This is not a mitigation action.

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met

				ESP Response: The University would like to keep this action in their Mitigation Action Plan.

C5: Section 5 in annexes states that quantitative analysis will be provided in Section 6 "Vulnerability Assessment". Section 6 is "Capability Assessment".
ESP Response: Removed that entire sentence from each annex.
C6: No revisions required.

NCEM 2nd Review:
C1: No revisions required.
C2: No revisions required.
C3: No revisions required.
C4: Each campus met the minimum number of all hazard actions. No further revisions required.
C5: No revisions required.
C6: No revisions required.

Element C5-c: The Local Mitigation Plan Review Guide (page 25) says, "The plan must identify the position, office, department, or agency responsible for implementing and administering the action (for each jurisdiction) and identify potential funding sources and expected time frames for completion."
The mitigation actions for each campus do not clearly indicate who is responsible for each one. While the plan does state that there will be leads for the actions, these must be identified for all mitigation actions.

Required Revisions – Provide the lead department, agency, or person who is responsible for each of the mitigation actions.

For additional information, please see the "Local Mitigation Plan Review Guide", dated October 1, 2011 - Element C, Mitigation Strategy, Pages 22-25. See also Task 6 of the Local Mitigation Plan Handbook dated March 2013. Links to these documents can be found in Section 3 of this Plan Review Tool.

ESP Response: This has been added for each mitigation action.

9-2-21 **FEMA REVISIONS REVIEW:** The revisions are as noted, C5.c. is now met.

ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Annex Section 7s **D1a. Development since previous plan** Appalachian State University, pp. A:8-10 N. Carolina A&T, pp. B:8-10 UNC Asheville, pp. C:9-11 UNC Charlotte, pp. D:6-8 UNC Greensboro, pp. E:8-11 UNC School of Arts, pp. F:8-10 Western Carolina, pp. G:7-11 Winston-Salem, pp. H:8-11	X	
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Annex Section 7s **D2a. Mitigation Action Plan** Appalachian State University, pp. A:93-106 N. Carolina A&T, pp. B:99-107 UNC Asheville, pp. C:117-130 UNC Charlotte, pp. D:82-101 UNC Greensboro, pp. E:97-119 UNC School of Arts, pp. F:98-106 Western Carolina, pp. G:87-104 Winston-Salem, pp. H:96-11	X	
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Annex Section 7s D3a. Sec. 2, pp. 2-9; Sec. 3, pp. 4-5	X	
ELEMENT D: REQUIRED REVISIONS			
ELEMENT E. PLAN ADOPTION			
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))	E1a. Ch. 1, p. 11		X
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))	E2a. Ch. 1, p. 11		X

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT E: REQUIRED REVISIONS **Element E1. a/E2. a –** The Local Mitigation Plan Review Guide (page 29) says, "Each jurisdiction that is included in the plan must have its governing body adopt the plan prior to FEMA approval, even when a regional agency has the authority to prepare such plans." None of the participating jurisdictions have provided documentation of adoption of the updated plan. This requirement will be marked as met following the submittal of documentation. **Required Revisions –** • The plan must include documentation of plan adoption for each participating jurisdiction, usually a resolution by the governing body or other authority. • If adopted after FEMA review, adoption must take place within one calendar year of receipt of FEMA's "Approvable Pending Adoption". • Each jurisdiction that is included in the plan must have its governing body adopt the plan, even when a regional agency has the authority to prepare such plans. *Additional information can be found in the "Local Mitigation Plan Review Guide", Element E: Plan Adoption, dated October 1, 2011, Pages 28-29. Also see the Local Mitigation Plan Handbook dated March 2013, Task 8.* **ESP Response:** Each University is working to adopt the plan. The adoption resolution from Western Carolina University has been attached. 9-2-21 Western Carolina University provided adoption documentation. All participating campuses are approved.			

SECTION 2:
PLAN ASSESSMENT

INSTRUCTIONS: The purpose of the Plan Assessment is to offer the local community more comprehensive feedback to the community on the quality and utility of the plan in a narrative format. The audience for the Plan Assessment is not only the plan developer/local community planner, but also elected officials, local departments and agencies, and others involved in implementing the Local Mitigation Plan. The Plan Assessment must be completed by FEMA. The Assessment is an opportunity for FEMA to provide feedback and information to the community on: 1) suggested improvements to the Plan; 2) specific sections in the Plan where the community has gone above and beyond minimum requirements; 3) recommendations for plan implementation; and 4) ongoing partnership(s) and information on other FEMA programs, specifically RiskMAP and Hazard Mitigation Assistance programs. The Plan Assessment is divided into two sections:

1. Plan Strengths and Opportunities for Improvement
2. Resources for Implementing Your Approved Plan

Plan Strengths and Opportunities for Improvement is organized according to the plan Elements listed in the Regulation Checklist. Each Element includes a series of italicized bulleted items that are suggested topics for consideration while evaluating plans, but it is not intended to be a comprehensive list. FEMA Mitigation Planners are not required to answer each bullet item, and should use them as a guide to paraphrase their own written assessment (2-3 sentences) of each Element.

The Plan Assessment must not reiterate the required revisions from the Regulation Checklist or be regulatory in nature, and should be open-ended and to provide the community with suggestions for improvements or recommended revisions. The recommended revisions are suggestions for improvement and are not required to be made for the Plan to meet Federal regulatory requirements. The italicized text should be deleted once FEMA has added comments regarding strengths of the plan and potential improvements for future plan revisions. It is recommended that the Plan Assessment be a short synopsis of the overall strengths and weaknesses of the Plan (no longer than two pages), rather than a complete recap section by section.

Resources for Implementing Your Approved Plan provides a place for FEMA to offer information, data sources and general suggestions on the overall plan implementation and maintenance process. Information on other possible sources of assistance including, but not limited to, existing publications, grant funding or training opportunities, can be provided. States may add state and local resources, if available.

A. Plan Strengths and Opportunities for Improvement

This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

Element A: Planning Process

Strengths

- The planning process is very robust. There were meetings held for each campus where there were numerous individuals who represented a wide variety of functions within the university.
- The plan specifically states that evaluation and monitoring fell a little short in the past iteration, but that they intend to improve this going forward.

Opportunities for Improvement

- Consider additional meeting opportunities that get other community partners involved, or gain additional feedback from students.

Element B: Hazard Identification and Risk Assessment

Strengths

- Vulnerabilities are identified at the campus level.
- There is a great amount of details cataloged at the building level for each campus. The campus buildings are where classes are held and where students live, so this provides excellent context for the vulnerability of each one.

Opportunities for Improvement

- Consider performing an additional GIS analysis that provides more information on the possible impacts for each hazard.

Element C: Mitigation Strategy

Strengths

- Mitigation actions are divided up by critical facilities. This helps to show exactly what will be conducted and implemented for each building on campus.
- The actions clearly identify which hazards they address.

Opportunities for Improvement

- Some actions are not quite as specific as they could be. For example, any action that says a project will be considered can be improved by stating that the project will be implemented. Additionally, actions that say “should” can be improved by stating how these *will* be implemented. ***Please note,*** identifying an action in the plan does not constitute a commitment but rather an intent.

Element D: Plan Update, Evaluation, and Implementation (*Plan Updates Only*)

Strengths

- The plan review tool completed by the community provides excellent detail about how the previous mitigation actions were updated between plan drafts.
- The plan clearly identifies which hazards were carried over from the last plan, how they changed in priority.

Opportunities for Improvement

- Be more specific about which plans the previous iteration of the HMP were integrated into. This helps show that the plan is being actively used by the campuses.
- Consider including a section in the next plan iteration that describes any success stories about mitigation projects that were implemented after this plan was adopted.

B. Resources for Implementing Your Approved Plan

Region IV Planning Toolkit: This toolkit was produced by Region IV and Resilience Action Partners, the Community Engagement and Risk Communications Contractor. The document was developed for communities writing/implementing their hazard mitigation plan 'In-house' without the use of a contractor. It offers credible data sources, summarized content, and helpful suggestions related to hazard mitigation plans. It is not available online, but can be requested through the State Planning Coordinator as well as the FEMA Planning Team.

Local Mitigation Planning Handbook: This Handbook provides guidance to local governments on developing or updating hazard mitigation plans to meet the requirements under the Code of Federal Regulations (CFR) Title 44 – Emergency Management and Assistance §201.6. Use the Local Plan Guide and Handbook in tandem to understand technical requirements
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=7209

Integrating Mitigation Strategies with Local Planning: This resource provides practical guidance on how to incorporate risk reduction strategies into existing local plans, policies, codes, and programs that guide community development or redevelopment patterns.
http://www.fema.gov/library/viewRecord.do?id=7130

Mitigation Ideas: Communities can use this resource to identify and evaluate a range of potential mitigation actions for reducing risk to natural hazards and disasters.
http://www.fema.gov/media-library/assets/documents/30627?id=6938

Mitigation Assistance Programs: Currently, FEMA administers three programs that provide funding for eligible mitigation projects that reduces disaster losses and protect life and property from future disaster damages. The three programs are the Hazard Mitigation Grant Program (HMGP), the Flood Mitigation Assistance (FMA) Program, and the Pre-Disaster Mitigation (PDM) Program.
http://www.fema.gov/hazard-mitigation-assistance

Integrating Mitigation Strategies with Local Planning: Provides practical guidance on how to incorporate risk reduction strategies into existing local plans, policies, codes, and programs that guide community development or redevelopment patterns.
http://www.fema.gov/library/viewRecord.do?id=7130

State NFIP Coordinators:
http://www.floods.org/index.asp?menuID=274&firstlevelmenuID=185&siteID=1

Mitigation Funding Sources:

Federal Emergency Management Agency

Program	Details	Notes
Hazard Mitigation Grant Program (HMGP)	Provides grants to implement long-term hazard mitigation measures after a major disaster declaration https://www.fema.gov/hazard-mitigation-grant-program	See website
Pre-Disaster Mitigation Program (PDM)	Provides funds for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event https://www.fema.gov/pre-disaster-mitigation-grant-program	See website

Flood Mitigation Assistance (FMA)	Provides funds for projects to reduce or eliminate risk of flood damage to buildings that are insured under the National Flood Insurance Program (NFIP) on an annual basis https://www.fema.gov/flood-mitigation-assistance-program	See website

Environmental Protection Agency
The EPA makes available funds for water management and wetlands protection programs that help mitigate against future costs associated with hazard damage.

Mitigation Funding Sources Program	Details	Notes
Wetland Program Development Grants	Funds for projects that promote research, investigations, experiments, training, demonstrations, surveys, and studies relating to the causes, effects, extent, prevention, reduction, and elimination of water pollution. http://water.epa.gov/grants_funding/	See website

National Oceanic and Atmosphere Administration (NOAA)
NOAA is the major source for mitigation funding related to coastal zone management and other coastal protection projects.

Mitigation Funding Sources Program	Details	Notes
Coastal Services Center Grant Opportunities	Formula and program enhancement grants for implementing and enhancing Coastal Zone Management programs that have been approved by the Secretary of Commerce. http://coast.noaa.gov/funding/?redirect=301ocm	See website.

National Fire Protection Association - Firewise

Mitigation Funding Sources Program	Details	Notes
Firewise Communities Program	Effort to involve homeowners, community leaders, planners, developers, and others in the effort to protect people, property, and natural resources from the risk of wildland fire before a fire starts. http://www.firewise.org	See website

U.S. Department of Agriculture
There are multiple mitigation funding and technical assistance opportunities available from the USDA and its various sub-agencies: the Farm Service Agency, Forest Service, and Natural Resources Conservation Service.

USDA Forest Service National Fire Plan	Funding for organizing, training, and equipping fire districts through Volunteer, State and Rural Fire Assistance programs. Technical assistance for fire related mitigation. http://www.forestsandrangelands.gov/	See website

USDA Natural Resources Conservation Service Watershed Protection and Flood Prevention	Information and funds for landscape planning, soil conservation; flood prevention; conservation, development, utilization and disposal of water; and conservation and proper utilization of land. http://www.nrcs.usda.gov/programs/watershed/index.html	See website

SECTION 3:
MULTI-JURISDICTION SUMMARY SHEET (OPTIONAL)

INSTRUCTIONS: For multi-jurisdictional plans, a Multi-jurisdiction Summary Spreadsheet may be completed by listing each participating jurisdiction, which required Elements for each jurisdiction were 'Met' or 'Not Met,' and when the adoption resolutions were received. This Summary Sheet does not imply that a mini-plan be developed for each jurisdiction; it should be used as an optional worksheet to ensure that each jurisdiction participating in the Plan has been documented and has met the requirements for those Elements (A through E).

MULTI-JURISDICTION SUMMARY SHEET													
#	Jurisdiction Name	Jurisdiction Type (city/borough/ township/ village, etc.)	Plan POC	Mailing Address	Email	Phone	Requirements Met (Y/N)					
							A. Planning Process	B. Hazard Identification & Risk Assessment	C. Mitigation Strategy	D. Plan Review, Evaluation & Implementation	E. Plan Adoption	F. State Require-ments
1	Appalachian State University, pp. A:93-106	University	Nathan Slaughter	2200 Gateway Centre Blvd., Suite 216 Morrisville, NC 27560	nslaughter@espassociates.com	919-678-1070	Y	Y	Y	Y	Y	
2	N. Carolina A&T, pp. B:99-107	University					Y	Y	Y	Y	Y	
3	UNC Asheville, pp. C:117-130	University					Y	Y	Y	Y	Y	
4	UNC Charlotte, pp. D:82-101	University					Y	Y	Y	Y	Y	
5	UNC Greensboro, pp. E:97-119	University					Y	Y	Y	Y	Y	

MULTI-JURISDICTION SUMMARY SHEET													
#	Jurisdiction Name	Jurisdiction Type (city/borough/ township/ village, etc.)	Plan POC	Mailing Address	Email	Phone	Requirements Met (Y/N)					
							A. Planning Process	B. Hazard Identification & Risk Assessment	C. Mitigation Strategy	D. Plan Review, Evaluation & Implementation	E. Plan Adoption	F. State Require-ments
6	UNC School of Arts, pp. F:98-106	University					Y	Y	Y	Y	Y	
7	Western Carolina, pp. G:87-104	University					Y	Y	Y	Y	Y	
8	Winston-Salem, pp. 96-11	University					Y	Y	Y	Y	Y	
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												

MULTI-JURISDICTION SUMMARY SHEET													
#	Jurisdiction Name	Jurisdiction Type (city/borough/ township/ village, etc.)	Plan POC	Mailing Address	Email	Phone	Requirements Met (Y/N)					
							A. Planning Process	B. Hazard Identification & Risk Assessment	C. Mitigation Strategy	D. Plan Review, Evaluation & Implementation	E. Plan Adoption	F. State Require-ments
19												
20												

Appendix B: Planning Process Documentation

This Appendix includes the following planning process documentation:

- Meeting Agendas
- Meeting Sign-In Sheets*
- Time Log for all Campus Staff
- Public Survey Summary
- Neighboring Jurisdiction Outreach Documentation

* Many of the Campus Mitigation Strategy Meetings were conducted via Zoom or Microsoft Teams and no physical sign-in sheets were collected for these meetings. Staff time for those meetings has been documented on the Time Log.

AGENDA

UNC Western Campuses Hazard Mitigation Plan Update
Appalachian State University Kickoff Meeting

January 22, 2020
1:30 PM

1) **Introductions**

2) **Mitigation Refresher**

3) **Icebreaker Exercise**

4) **Project Overview**
   a) Key Objectives
   b) Project Tasks
   c) Project Schedule

5) **Roles & Responsibilities**
   a) ESP Associates
   b) Campus Leads
   c) Participating Stakeholders

6) **Next Steps**
   a) Initiate data collection efforts
   b) Begin public outreach
   c) Discuss next Campus Hazard Mitigation Planning Team meeting

7) **Questions, Issues or Concerns**

UNC Western Campuses Hazard Mitigation Plan Update
App State Kickoff Meeting

January 22, 2020
1:30 - 3:30 PM

Name	Title	Department	Phone Number	E-mail Address
Johnny Brown	Captain	App State Police	262-6436	brownjm@appstate.edu
Shane Robbins	Lieutenant	Boone Police Department	828-268-6921	shane.robbins@townofboone.net
Art Rex	Director	Space Mgt & Plan	828 262-6911	REXAB@APPSTATE.EDU
Emily Bausch	Critical & Crisis Communications Spcst	App State, UComm	828 262 8517	bauschec@appstate.edu
Amy Dellinger Page	Professor of Sociology	Sociology	262-2201	pagead@appstate.edu
Debi Truitte	Emergency Planner	EHS&EM	828 434 0133	truittedp@appstate.edu
John Eckman	AVC Campus Services	Campus Services	828 262 6130	Eckmanjt@appstate.edu
Carolyn Bosley	Leave Mgmt Administrator	Office of Human Resources	828 262 6488	bosleycm@Appstate.edu

UNC Western Campuses Hazard Mitigation Plan Update
App State Kickoff Meeting

January 22, 2020

1:30 - 3:30 PM

Name	Title	Department	Phone Number	E-mail Address
Anthony Love	Research Operations Manager	Dept. of Geological & Environmental Sciences	828-262-6952	loveab@appstate.edu
Mallory Sadler	Chair	Staff Senate	828-262-2198	sadlerml@appstate.edu
Lauren Andersen	Geography Instructor + GIS lab supervisor	Geography + Planning	828-262-6698	andersenlm@appstate.edu
Michael Behrent	Chair Assoc. Professor	Faculty Senate History	828-719-5759	behrentmc@appstate.edu
Tom Kane	Director University Housing	University Housing	828 262 2532	Kanetl
Sharon Bell	AVC Finance	Business Affairs	828 262 6367	Bellsb@appstate.edu
Nick Katers	AVC Facilities	Business Affairs	828-262-6432	katersnw@appstate.edu
Denise Godwin	Risk Manager	OGC	828-262-7031	godwinpd@appstate.edu

UNC Western Campuses Hazard Mitigation Plan Update
App State Kickoff Meeting

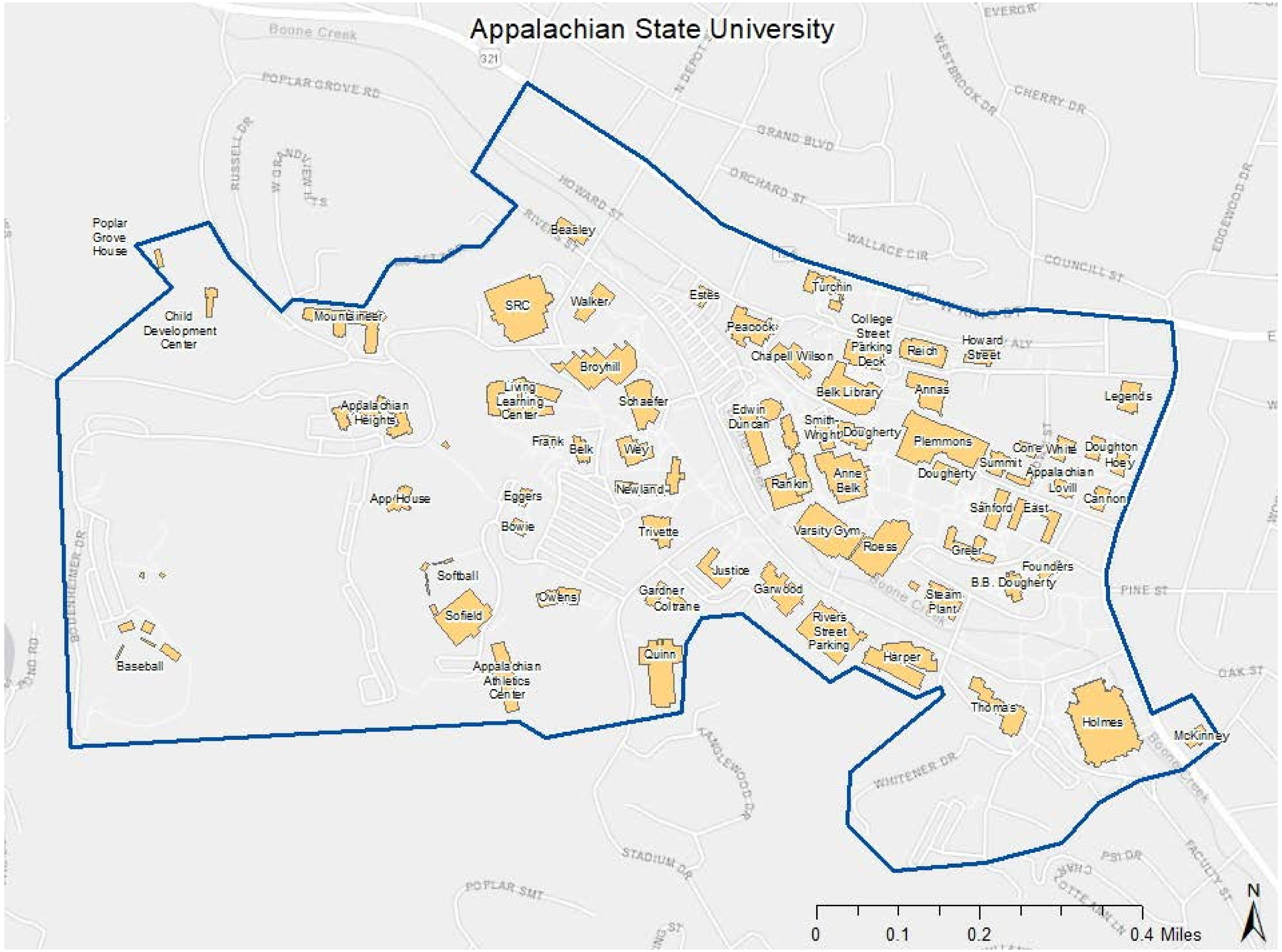
January 22, 2020

1:30 - 3:30 PM

Name	Title	Department	Phone Number	E-mail Address
Jason Marshburn	EHS & EM Director	Environmental Health, Safety, & Emergency Management	828-262-8081	marshburnjs@appstate.edu
Matt Dull	AVC	Student Affairs	2060	dullmc

AGENDA

- Introductions
- Mitigation Recap
- Project Schedule
- Risk Assessment Findings
- Discussion of Capability Assessment
- Mitigation Strategy
- Discussion of Public Involvement Activities
- Next Steps



AGENDA

UNC Western Campuses Hazard Mitigation Plan Update
NC A&T Kickoff Meeting

December 11, 2019
2:00 – 3:00 PM

1) **Introductions**

2) **Mitigation Refresher**

3) **Icebreaker Exercise**

4) **Project Overview**
   a) Key Objectives
   b) Project Tasks
   c) Project Schedule

5) **Roles & Responsibilities**
   a) ESP Associates
   b) Campus Leads
   c) Participating Stakeholders

6) **Next Steps**
   a) Initiate data collection efforts
   b) Begin public outreach
   c) Discuss next Campus Hazard Mitigation Planning Team meeting

7) **Questions, Issues or Concerns**

UNC Western Campuses Hazard Mitigation Plan Update
NC A&T Kickoff Meeting

December 11, 2019
2:00 - 3:00 PM

Name	Title	Department	Phone Number	E-mail Address
Travis Auman	EM Director	UPD	336-285-2405	tauman@ncat.edu
Taylor Jones	EM Coordinator	Guilford County Emergency Services	336-641-2278	Tjones@guilford-es.com
Shanté Griffin	Comm Supv.	UPD	336-285-2424	smgriffin@ncat.edu
Marc Williams	DOS	SA	336-334-7791	MARCWILL@NCAT.EDU
Mike Jackson	Director of Process Improvement	B&F	336-285-2970	mjjacks@ncat.edu
Andy M. Perkins	AVC - Facilities	Facilities	336-285-5501	PERKINS@NCAT.EDU
Vanessa Cofresi	Clery Act Compliance	UPD	336-285-2486	vmcofresi@ncat.edu
Geoff Starnes	Deputy CIO	ITS	336 285 2390	GRStarnes@ncat
David Lennon	Director of Facilities	Facilities	(336) 907-2450	lennond@ncat.edu

UNC Western Campuses Hazard Mitigation Plan Update
NC A&T Kickoff Meeting

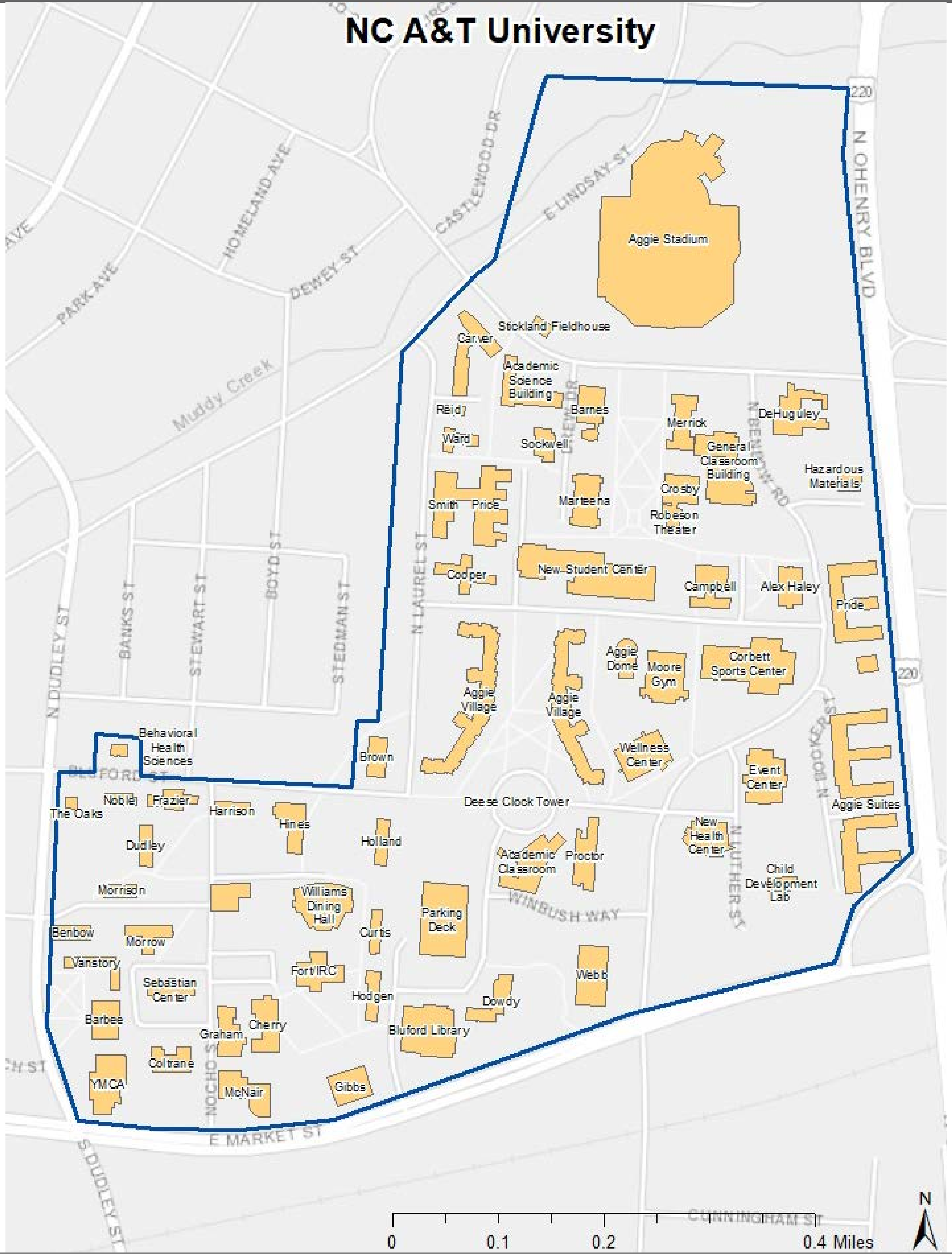
December 11, 2019

2:00 - 3:00 PM

Name	Title	Department	Phone Number	E-mail Address
Louisa Newman	Director EHS	EHS	3363985352	lvthomas@ncat.edu

AGENDA

- Introductions
- Mitigation Recap
- Project Schedule
- Risk Assessment Findings
- Discussion of Capability Assessment
- Discussion of Public Involvement Activities
- Mitigation Strategy
- Next Steps



AGENDA

UNC Western Campuses Hazard Mitigation Plan Update
UNC Asheville Kickoff Meeting

February 18, 2020
11:00 AM

1) **Introductions**

2) **Mitigation Refresher**

3) **Icebreaker Exercise**

4) **Project Overview**
   a) Key Objectives
   b) Project Tasks
   c) Project Schedule

5) **Roles & Responsibilities**
   a) ESP Associates
   b) Campus Leads
   c) Participating Stakeholders

6) **Next Steps**
   a) Initiate data collection efforts
   b) Begin public outreach
   c) Discuss next Campus Hazard Mitigation Planning Team meeting

7) **Questions, Issues or Concerns**

UNC Western Campuses Hazard Mitigation Plan Update
UNC Asheville Kickoff Meeting

February 18, 2020
11:00 AM - Noon

Name	Title	Department	Phone Number	E-mail Address
Melissa Acker	Grounds Manager	Campus Operations	828-251-6699	macker@unca.edu
Suzanne Bryson	Internal Audit Enterprise Risk Management	Internal Audit	828-350-4599	sbryson@unca.edu
Taylor Ledbetter	Facilities Manager - Sherrill Center/Kimmel Arena	Athletics	828-251-6461	tledbett@unca.edu
Kevin Gibson	EH&S Professional	Office of the Deans	828-258-7692	kgibson@unca.edu
Ed Oskins	Director	Trades Manager		Eoskins@unca.edu
Vollie Barnwell	Director	Housing		VBarnwell@unca.edu
David A Weldon	Director	Emergency Management	(828) 545-0151	dweldon@unca.edu

UNC Western Campuses Hazard Mitigation Plan Update
UNC Asheville Kickoff Meeting

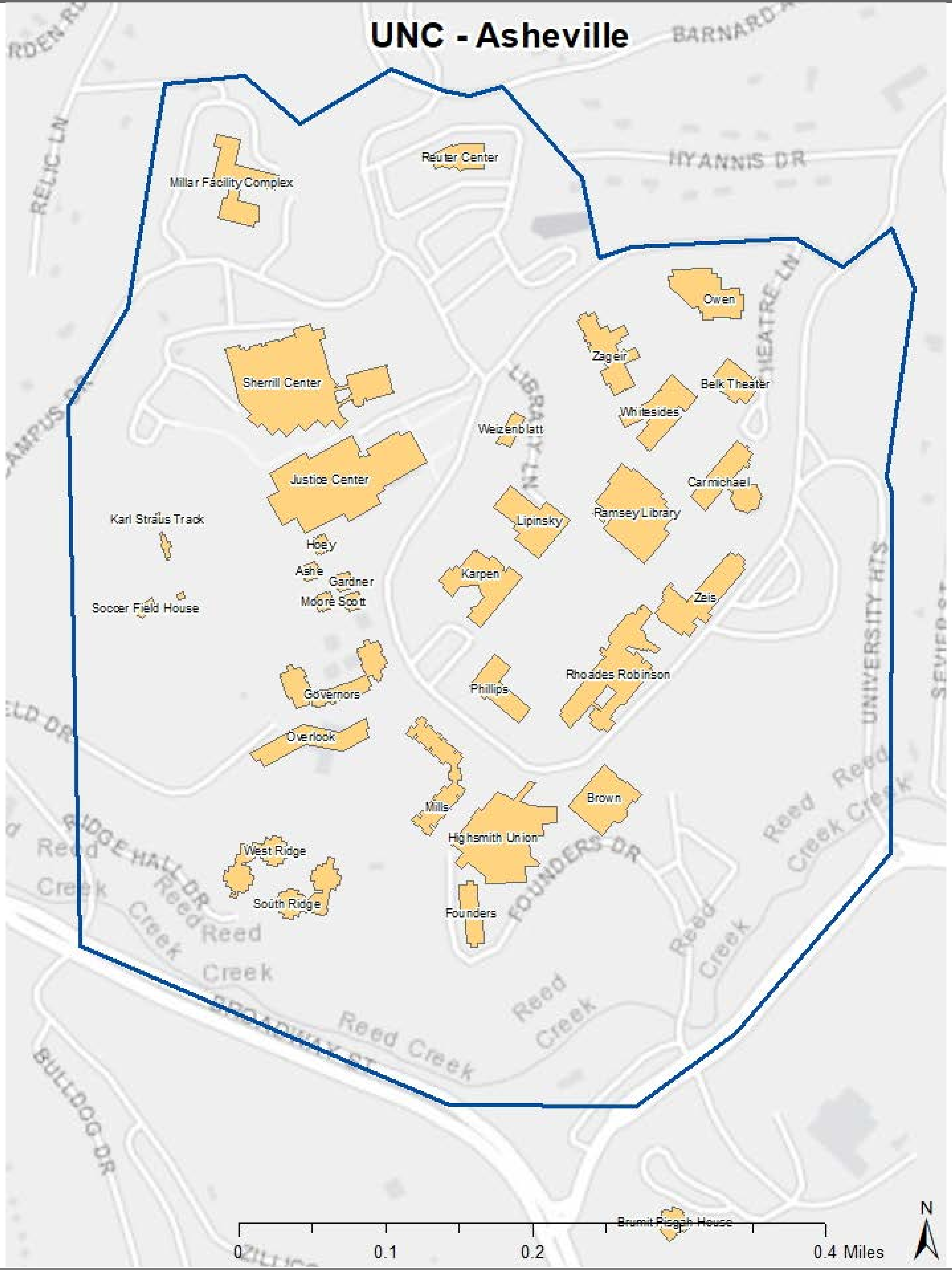
February 18, 2020

11:00 AM - Noon

Name	Title	Department	Phone Number	E-mail Address
Eric Boyce	Police Chief	Public Safety	828-251-6957	EBoyce@unca.EDU
David Todd	AVC Campus Ops.	Campus Ops	828-251-6380	DTODD@unca.EDU

AGENDA

- Introductions
- Mitigation Recap
- Project Schedule
- Risk Assessment Findings
- Discussion of Capability Assessment
- Discussion of Public Involvement Activities
- Mitigation Strategy
- Next Steps



AGENDA

UNC Western Campuses Hazard Mitigation Plan Update
UNC-Charlotte Kickoff Meeting

December 6, 2019
11:00 AM – Noon

1) **Introductions**

2) **Mitigation Refresher**

3) **Icebreaker Exercise**

4) **Project Overview**
   a) Key Objectives
   b) Project Tasks
   c) Project Schedule

5) **Roles & Responsibilities**
   a) ESP Associates
   b) Campus Leads
   c) Participating Stakeholders

6) **Next Steps**
   a) Initiate data collection efforts
   b) Begin public outreach
   c) Discuss next Hazard Mitigation Planning Team meeting

7) **Questions, Issues or Concerns**

UNC Western Campuses Hazard Mitigation Plan Update
UNC-Charlotte Kickoff Meeting

December 6, 2019
11:00 AM - Noon

Name	Title	Department	Phone Number	E-mail Address
Cynthia Stone	Director	SACUM	7-6099	cstone26
Anne Browne	AVC Finance	FS	7-5770	abrown311@uncc.edu
Brad Trahan	lawyer	OLA	7-6117	Brad.Trahan...
Steven Dunham	Chief Risk Officer	DII		steven.dunham@uncc...
Joe Fiorelli	RMI	RMI	7-5711	jfiorel3
Rich Steele	AVC Business Svcs.	Business Affairs	7-5747	rich.steele@uncc.edu
Chris Gonter	Director of EM OEM	OEM	77884	cgonter@uncc.edu
Lee Snodgrass	Facilities Operations Dir	FM	70564	rsnodgra@uncc.edu

UNC Western Campuses Hazard Mitigation Plan Update
UNC-Charlotte Kickoff Meeting

December 6, 2019
11:00 AM - Noon

Name	Title	Department	Phone Number	E-mail Address
Joshua Runfola	Em Planner	OEM	719- 314-9151	Jrunfola@uncc.edu
Stephanie Klein	Lieutenant / EM Liason	PPS	704-687-8300	SKlein5@uncc.edu

AGENDA

UNC Western Campuses Hazard Mitigation Plan Update
UNCG Kickoff Meeting
December 12, 2019
9:00 – 11:00 AM

1) **Introductions**

2) **Mitigation Refresher**

3) **Icebreaker Exercise**

4) **Project Overview**
   a) Key Objectives
   b) Project Tasks
   c) Project Schedule

5) **Roles & Responsibilities**
   a) ESP Associates
   b) Campus Leads
   c) Participating Stakeholders

6) **Next Steps**
   a) Initiate data collection efforts
   b) Begin public outreach
   c) Discuss next Campus Hazard Mitigation Planning Team meeting

7) **Questions, Issues or Concerns**

UNC Western Campuses Hazard Mitigation Plan Update
UNCG Kickoff Meeting

December 12, 2019
9:00 - 11:00 AM

Name	Title	Department	Phone Number	E-mail Address
MIKE ACKERMAN	ASSOCIATE DIR.	REC & WELLNESS	4-3105	maacker2
MARK McKINNEY	DIRECTOR RISK MGT	RISK MGT	4-3700	MAMCKIN3
Tammy Downs	Risk Manager	Risk Mgt	6-1102	tadowns
Julie Voorhees	Proposal Development	ORE	4-3729	jkvoorhe@uncg.edu
Andrew Currin	Grounds Director	Fac Ops	4-4775	ascurrin@uncg.edu
SHERRY WOODY	IT Senior Manager	ITS	4-4077	slwood@uncg.edu
Julie Allen	Paralegal, ~~OGC~~	OGC	4-3938	jrallen9@uncg.edu
Jeanne Madorin	AVC HR	HR	4-5167	j_madori@uncg.edu
Andrew Thurston	EM Coordinator	EM		amthurst@uncg.edu

UNC Western Campuses Hazard Mitigation Plan Update
UNCG Kickoff Meeting

December 12, 2019
9:00 - 11:00 AM

Name	Title	Department	Phone Number	E-mail Address
Zach Smith	Em Director	Emergency Mgmt	336-~~[illegible]~~15-5875	zrsmith3@uncg.edu
Taylor Jones	Em Coordinator	Guilford County ES	336-641-5303	Tjones3@guilford-es.com
Chris Suri	Battalion Chief-Special ops	Greensboro fire	336 430-6011	chris.suri@greensboro-nc.gov
Michael Logue	Director of purchasing	purchasing	334.4104	mflogue@uncg.edu
Jon Soler	Dir Fac Ops	Fac Ops	256-0434	sasoler@uncg.edu
Jim Slone	Dir EHS	EHS	334-4357	Safety@uncg.edu
[illegible]	Utilities Mgr	Fac ops	256-0103	[illegible]@uncg.edu
Sikirat Kazeem	Associate Director [illegible]	Rec Well	334-4014	s_kazeem@uncg.edu
Jill Beville	Director	Rec Well	334-4013	jmbevill@uncg.edu

UNC Western Campuses Hazard Mitigation Plan Update
UNCG Kickoff Meeting

December 12, 2019
9:00 - 11:00 AM

Name	Title	Department	Phone Number	E-mail Address
Sherri MacCheyne	Director Operations	UNW Communications	937 6241	smaccha@uncg.edu
Toni Douglas	Associate General Counsel	Office of General Counsel	334-3757	tgdougla@uncg.edu
Ken Pearce	Director ~~Facilities Design & Construction~~	FDC	334-4447	k_pearce@uncg.edu
ROBERT BARKER	ASSISTANT DEAN DIRECTOR, OSTCR	DEAN OF STUDENTS OFFICE	334-4640	rabarker@uncg.edu
Erin Price-Erwin	Fire + Life Safety Mgr	EHS	334-~~4~~4357	e-price@uncg.edu
STEVE GLIDEWELL	HRL Assit Director Facilit	HRL	376-944-5459	s_glidew@uncg.edu
Shannon Clegg	Sr. Dir Auxiliary Services	Campus Enterprises	336-334-5764	shannon.clegg@uncg.edu
Desiree Coltrane	Director of POCAM	POCAM	336-334-5682	DSWHITEH@uncg.edu
SaQuang Lam	Assistant Director Student Health	SHS	336-334-3085	S_Lam@uncg.edu

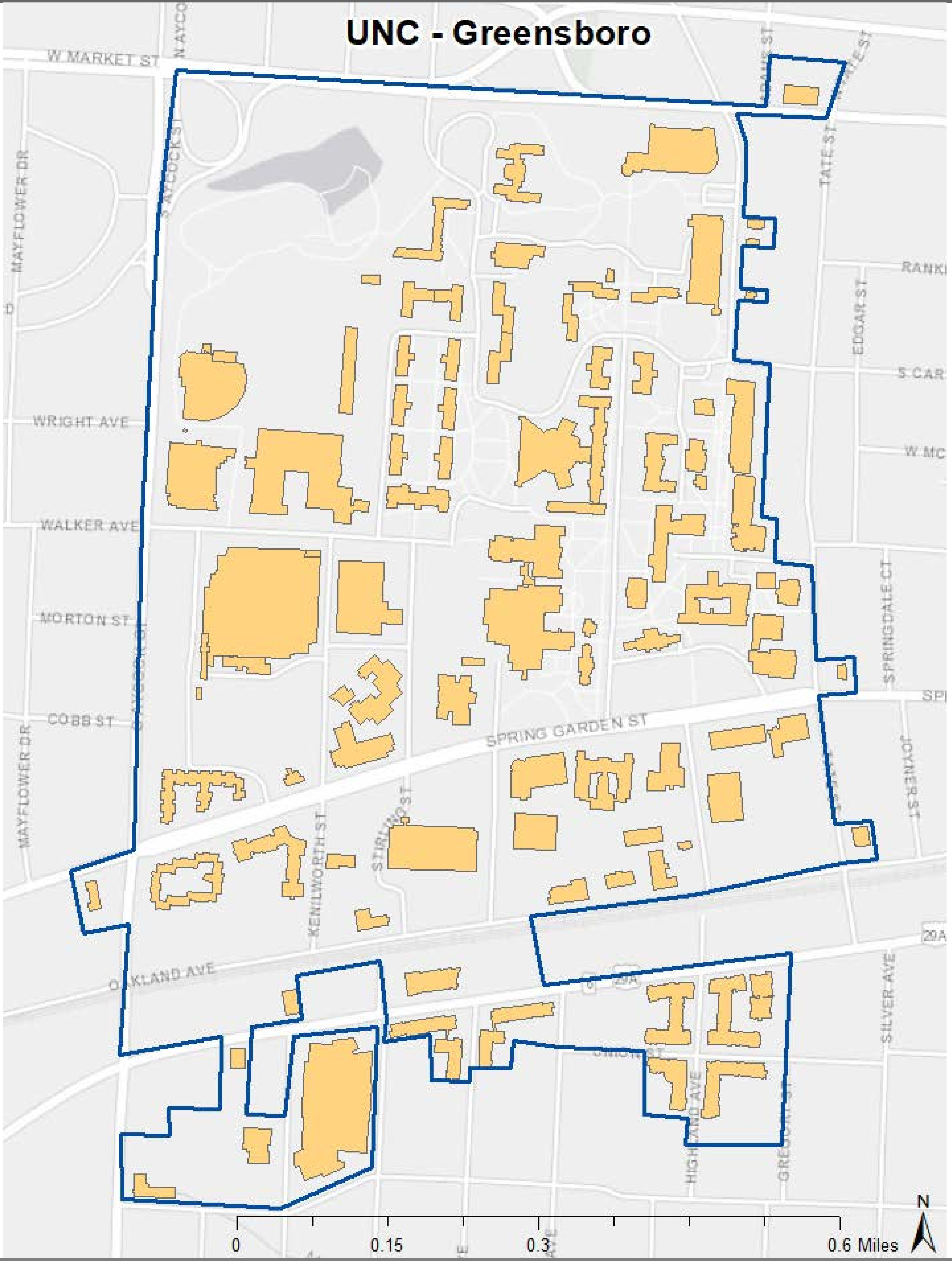
UNC Western Campuses Hazard Mitigation Plan Update
UNCG Kickoff Meeting

December 12, 2019
9:00 - 11:00 AM

Name	Title	Department	Phone Number	E-mail Address
Kenny Stewart	EM Coordinator	UNCG EM	(336)681-3557	Kenny.Stewart@uncg.edu
RON WOLFORD	CAPTAIN	UNCG PD	CELL (336) 201-1955	rewolfor@uncg.edu
PAUL LESTER	CHIEF OF POLICE	UNCG PD	(336) 334-4390	PALESTER@UNCG.EDU
Bryce Porter	CISO	ITS	336-334-4374	brporter@
Kathy Baker	Director	SHS	(336) 334-3147	KABAKER2
Jennifer Whitney	Director SHS-CC	SHS-CC	336-334-5874	jmwhitne@uncg.edu
BRETT CARTER	DEAN	SAF	336-740-4049	bacarte2

AGENDA

- Introductions
- Mitigation Recap
- Project Schedule
- Risk Assessment Findings
- Discussion of Capability Assessment
- Discussion of Public Involvement Activities
- Mitigation Strategy
- Next Steps



AGENDA

UNC Western Campuses Hazard Mitigation Plan Update
UNC School of the Arts Kickoff Meeting

November 15, 2019
10:30 AM – Noon

1) **Introductions**

2) **Mitigation Refresher**

3) **Icebreaker Exercise**

4) **Project Overview**
   a) Key Objectives
   b) Project Tasks
   c) Project Schedule

5) **Roles & Responsibilities**
   a) ESP Associates
   b) Campus Leads
   c) Participating Stakeholders

6) **Next Steps**
   a) Initiate data collection efforts
   b) Begin public outreach
   c) Discuss next Hazard Mitigation Planning Team meeting

7) **Questions, Issues or Concerns**

UNC Western Campuses Hazard Mitigation Plan Update
UNC School of the Arts Kickoff Meeting

November 15, 2019

10:30 AM - Noon

Name	Title	Department	Phone Number	E-mail Address
Clarisse Davis	Emergency Manager	Campus Police	336-770-3321	davisc@uncsa.edu
Robert Reece	EM Coordinator	WS/FC EM	336-414-7542	rreece@cityofws.org
SHERRIE D. FUELL	OPERATIONS CAPTAIN	UNCSA PD	(336)631-1244	fuells@uncsa.edu
MAURA WETZEL	STUDENT BODY PRESIDENT	STUDENT AFFAIRS	443-547-5196	wetzel.md@artist
Angela Mahoney	Director of HR	HR	~~336~~-	mahoneya@uncsa.edu
Karen Beres	Vice Provost & Dean of Academic Affairs	Provost	(336) 631-1546	beresk@uncsa.edu
Jeremy Grice	Director, Client Services	IT	770-1445	gricej@uncsa.edu
Martin Ferrell	Dean, HS Academics	HSAP	336 631-1561	ferrellm@uncsa.edu

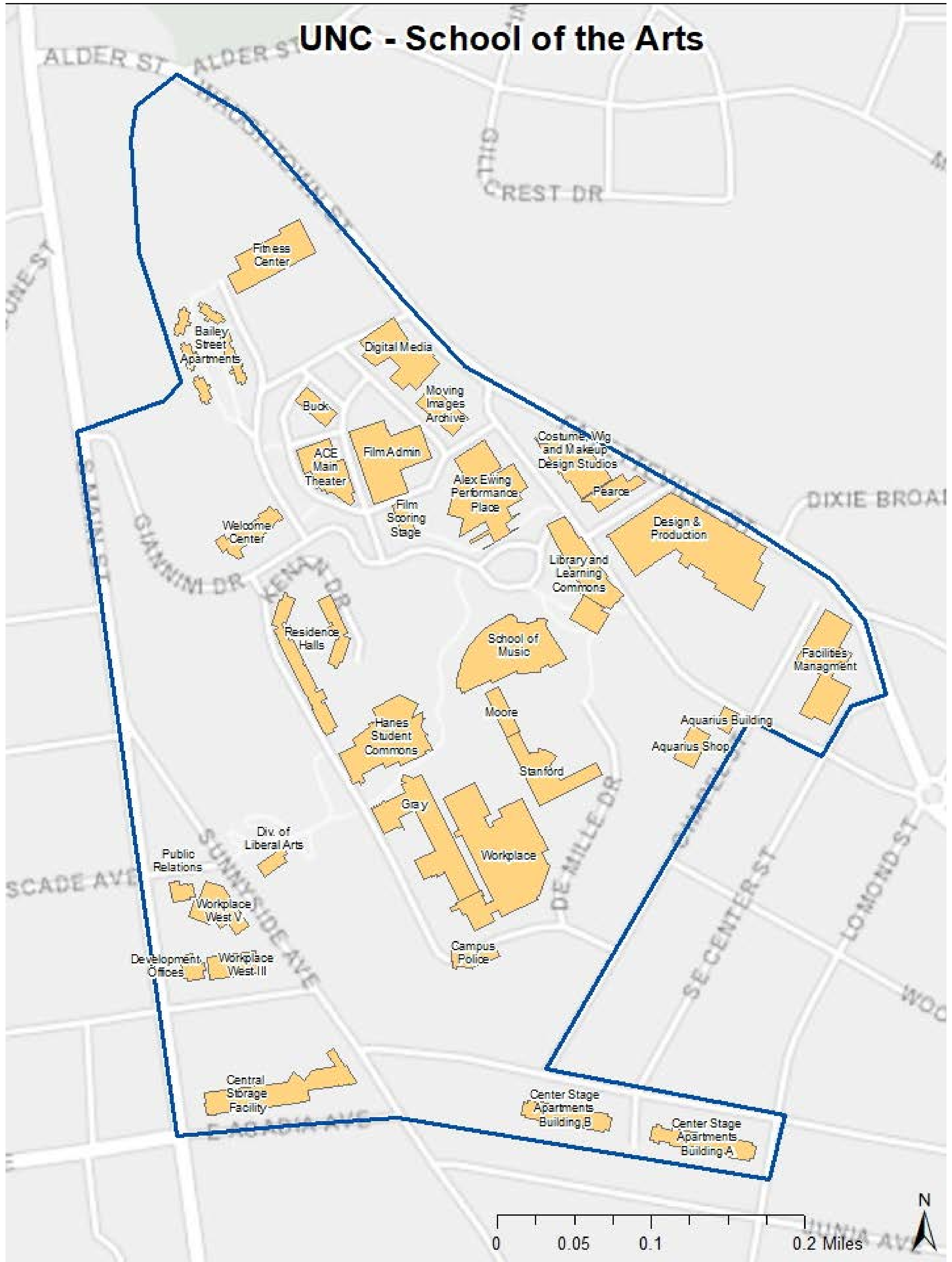
UNC Western Campuses Hazard Mitigation Plan Update
UNC School of the Arts Kickoff Meeting

November 15, 2019
10:30 AM - Noon

Name	Title	Department	Phone Number	E-mail Address
Frank Brinkley	Chief of Police - UNCSA	Police + Public Safety Dept.	336-770-3319	brinkleyf@uncsa.edu
W STEVE MARTIN	AVC-FACILITIES	FAC. MGMT.	336.770.3322	martinw@uncsa.edu

AGENDA

- Introductions
- Mitigation Recap
- Project Schedule
- Risk Assessment Findings
- Discussion of Capability Assessment
- Mitigation Strategy
- Discussion Public Involvement Activities
- Next Steps



AGENDA

UNC Western Campuses Hazard Mitigation Plan Update
Western Carolina University Kickoff Meeting

February 17, 2020
1:30 PM

1) **Introductions**

2) **Mitigation Refresher**

3) **Icebreaker Exercise**

4) **Project Overview**
   a) Key Objectives
   b) Project Tasks
   c) Project Schedule

5) **Roles & Responsibilities**
   a) ESP Associates
   b) Campus Leads
   c) Participating Stakeholders

6) **Next Steps**
   a) Initiate data collection efforts
   b) Begin public outreach
   c) Discuss next Campus Hazard Mitigation Planning Team meeting

7) **Questions, Issues or Concerns**

UNC Western Campuses Hazard Mitigation Plan Update
Western Carolina University Kickoff Meeting

February 17, 2020

1:30 - 2:30 PM

Name	Title	Department	Phone Number	E-mail Address
Shane Stovall	Director	Emergency Services	828-227-3445	sstovall@wcu.edu
Pam Buchanan	Director	Health Services	828-227-3475	pmbuchanan@wcu.edu
[illegible signature]	Director	Safety & Risk	828-227-3568	JMADDY@WCU.EDU
Steve Lillard	Chief	WCU PD	3201	sdlillard@wcu.edu
Bill Studenc	Chief Communications Office	WCU - Com & PR	227.7083	bstudenc@wcu.edu
Lee Smith	Director O&M	Facilities	9435	blsmith@wcu.edu
JOE WALKER	ASSOC VC	"	7441	jwalker@wcu.edu

AGENDA

UNC Western Campuses Hazard Mitigation Plan Update
Winston-Salem State University Kickoff Meeting

December 4, 2019
9:00 – 11:00 AM

1) **Introductions**

2) **Mitigation Refresher**

3) **Icebreaker Exercise**

4) **Project Overview**
   a) Key Objectives
   b) Project Tasks
   c) Project Schedule

5) **Roles & Responsibilities**
   a) ESP Associates
   b) Campus Leads
   c) Participating Stakeholders

6) **Next Steps**
   a) Initiate data collection efforts
   b) Begin public outreach
   c) Discuss next Hazard Mitigation Planning Team meeting

7) **Questions, Issues or Concerns**

UNC Western Campuses Hazard Mitigation Plan Update
Winston-Salem State University Kickoff Meeting

December 4, 2019
9:00 - 11:00 AM

Name	Title	Department	Phone Number	E-mail Address
Kizzy Lea	AVC Business Services	Business Services	336-750-8048	leak@wssu.edu
Jason Stogner	EM Director	Emergency Management	336-750-2863	stognerjk@wssu.edu
Camille Kluttz Leach	Chief of Staff	~~Chief~~ Chancellor	336-750-2041	leachck@wssu.edu
(for Jimmy Norwood Janet DeCreny	Project Manager	Design & Construction	336-750-8954	decrenyja@wssu.edu
Chantal Boucherau	Director	Housing and Residence Life	336-750-8649	bouchereauc@wssu.edu
Patricia D Norris	Chief of Police	Police	336-750-2902	norrispd@wssu.edu
Mary Wymbs	Director, IT	IT	336-750-2232	wymbsm@wssu.edu
Bobby Brown	Capt of Police	Police	336-750-2918	brownbo@wssu.edu
Amir Henry	Deputy Chief	Police	336-750-8033	henryaa@wssu.edu

UNC Western Campuses Hazard Mitigation Plan Update
Winston-Salem State University Kickoff Meeting

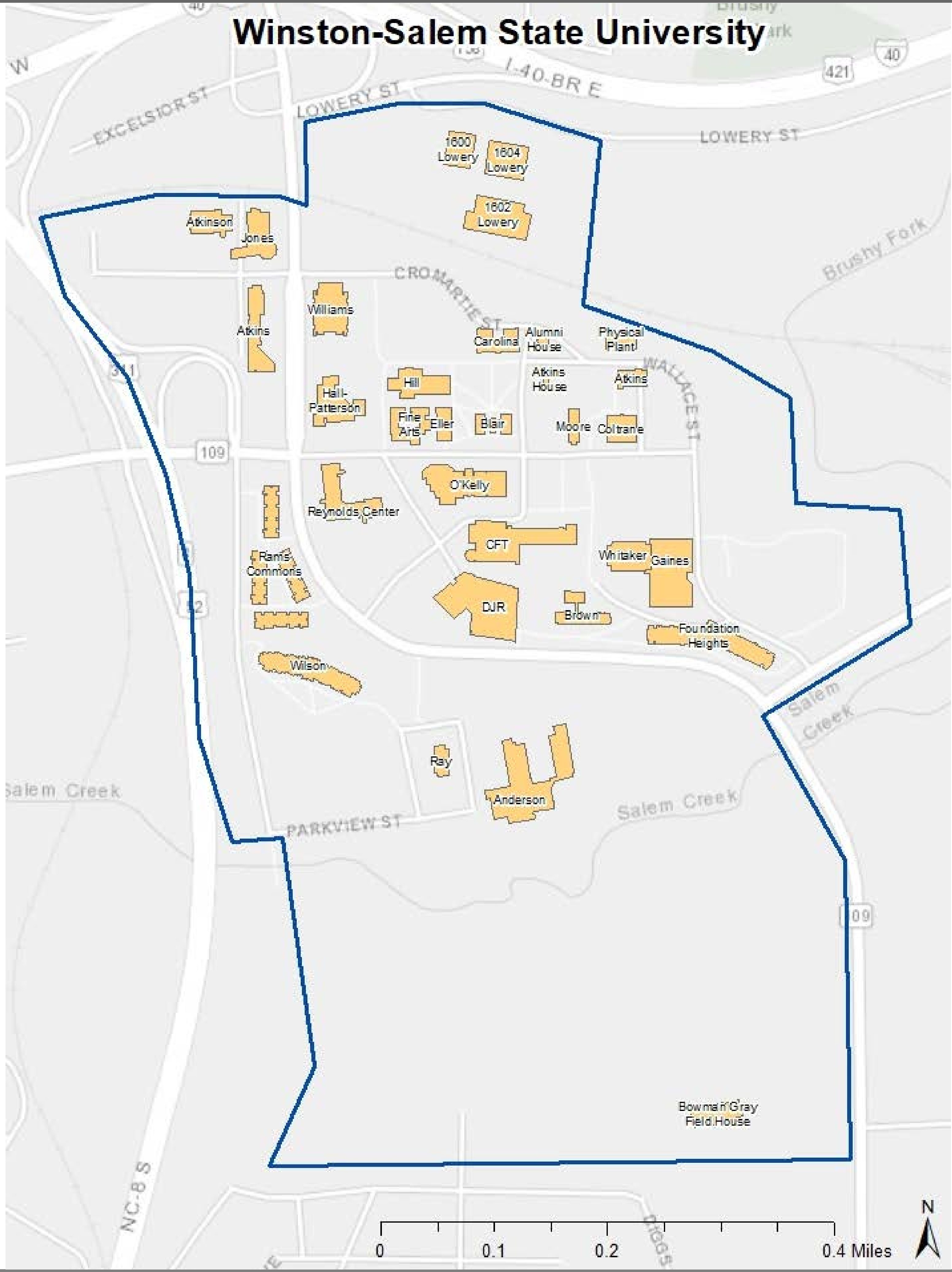
December 4, 2019

9:00 - 11:00 AM

Name	Title	Department	Phone Number	E-mail Address
Jamar Banks	Dean of Students	Dean of Students Office	3352	banksc@wssu.edu
FRANK LORD	CONTROLLER	FINANCIAL SERVICES	2733	lordfe@wssu.edu
Michelle Brock	EM Coordinator	Winston-Salem/Forsyth County Emergency Mgmt	336 917 7074	michelleb@cityofws.org
Calvin Holloway	Interim AVC HR	Human Resources	336-750-8627	hollowayc@wssu.edu
Timothy McMillen	AVC-FACILITIES Mgmt	FACILITIES	336 750 ~~3494~~	mcmullentf@wssu.edu
ERIC STEELMAN	EHS MANAGER	EHS	336-287-1562	STEELMANED@WSSU.EDU

AGENDA

- Introductions
- Mitigation Recap
- Project Schedule
- Risk Assessment Findings
- Discussion of Capability Assessment
- Discussion of Public Involvement Activities
- Mitigation Strategy
- Next Steps



Last Name	First Name	Title	Univeristy	Time for Kickoff Meeting	Time for Mitigation Strategy Meeting	Other Time Donated (Hours)
Andersen	Lauren	Geography Instructor and GIS Lab Supervisor	App State	2		
Bausch	Emily	Critical and Crisis Communications Special	App State	2	1.5	
Behrent	Michael	Chair of Faculty Senate, Assoc Professor	App State	2		
Bell	Sharon	AVC Finance	App State	2	1.5	
Bosley	Carolyn	Leave Management Administrator	App State	2		
Brown	Johnny	Campus Police Captain	App State	2		
Dellinger Page	Amy	Professor of Sociology	App State	2		
Dull	Matt	AVC Student Affairs	App State	2	1.5	
Earp	David	ITS Director	App State		1.5	
Eckman	John	AVC Campus Services	App State	2	1.5	
Farley	Ronnie	University Housing	App State		1.5	
Godwin	Denise	Risk Manager	App State	2	1.5	
Hughes	Craig	ITS	App State		1.5	
Kane	Tom	Director of University Housing	App State	2	1.5	
Katers	Nick	AVC Facilities	App State	2	1.5	
Love	Anthony	Research Operations Manage	App State	2		
Marsh	Taylor		Wat County		1.5	
Marshburn	Jason	EHS & EM Director	App State	2	1.5	4
Miller	Angie	HR Manager	App State		1.5	
Rex	Art	Director of Space Management and Planning	App State	2		
Sadler	Mallory	Chair of Staff Senate	App State	2		
Trivette	Deb	Emergency Planner	App State	2	1.5	
Wilson	Heather		App State		1.5	
Auman	Travis	EM Director	NCA&T	2	2	7
Cofres	Vanessa	Clery Act Compliance	NCA&T	2	2	
Griffin	Shante	Communications Supervisor	NCA&T	2		1
Jackson	Mike	Director of Process Improvement	NCA&T	2	2	1
Lennon	David	Director fo Facilities	NCA&T	2		4
Newman	Louisa	Director EHS	NCA&T	2	2	1
Perkins	Andy	AVC Facilities	NCA&T	2	2	1
Starnes	Geoff	Deputy CIO	NCA&T	2	2	1
Taylor	Jerrell	Building Environment Services Supervisc	NCA&T			1
Williams	Marc	DOS	NCA&T	2	2	1
Davis	Clarisse	Emergency Manager	UNC School of Arts	2	2	8
Beery	Toni	Facilities Management - EHS	UNC School of Arts		2	3
Beres	Karen	Vice Provost & Dean of Academic Affair	UNC School of Arts	2		
Bowman	Chris	Director of Mechnical Maintenance	UNC School of Arts			10
Brinkley	Frank	Chief of Police	UNC School of Arts	2	2	1
Brickhouse	William	Student	UNC School of Arts		2	
Carley	Deb	Student Affairs	UNC School of Arts		2	
Davis	Gary	Public Safety Supervisor	UNC School of Arts		2	
Ferrell	Martin	Dean HS Academic	UNC School of Arts	2	2	1.5
Fuiel	Sherrie	Operations Captain UNCSA PI	UNC School of Arts	2		1.5
Gleghorn	Gregory	Director of Information Security	UNC School of Arts		2	
Grice	Jeremy	Director Client Services IT	UNC School of Arts	2	2	
Harmon	Terry	Chief Information Officer	UNC School of Arts		2	
Johnson	Jared	Technology - Client Services Technician	UNC School of Arts		2	
Jones	Jordan	Grounds Manager	UNC School of Arts		2	
Mahoney	Angela	Director of HR	UNC School of Arts	2		1.5
Martin	Steve	AVC Facilities	UNC School of Arts	2	2	2.5
Reece	Robert	WS Forsyth County EM	WS Forsyth County EI	1.5		
Russel	Amber	Adminstrative Support Specialis	UNC School of Arts		2	
Wetze	Maura	Student Body President 2019-202	UNC School of Arts			1.5
Wilson	Wade	School of Design and Production	UNC School of Arts		2	
Acker	Melissa	Grounds Manager	UNCA	2	2	
Barnwel	Vollie	Director of Housing	UNCA	2	2	1.5
Boyce	Eric	Police Chief	UNCA	2	2	1.5
Bryson	Suzanne	Internal Audit Enterprise Risk Manageme	UNCA	2	2	1.5
Cowdry	Scott	Chief Information Officer	UNCA		2	
Gibson	Kevin	EH&S Professiona	UNCA	2	2	1.5
Holt	Herman	Dean of Nat Sci	UNCA		2	
Kauer	Kim	Enironmental Health and Safety Pro	UNCA		2	
Krumpe	Keith	Sr Admin and Space Planne	UNCA		2	
Ledbetter	Taylor	Facilities Manager - Athletic	UNCA	2		
Oskins	Ed	Director Trades Manager	UNCA	2	2	
Sweeny	Stan	Director of SAIL	UNCA		2	
Todd	David	AVC Campus Operation	UNCA	2	2	1.5
Weldon	David	Director of Emergency Management	UNCA	2	2	5.5
Stovall	Shane	Emergency Services Director	WCU	2		16
Buchanan	Pam	Director of Health Services	WCU	2		
Maddy	Jon	Director of Safety and Risk	WCU	2		
Muller	Brian	Chief Marketing and Communications Strategis	WCU			2
Lillard	Steve	WCU PD	WCU	2		

Studenc	Bil	Chief Communications Office	WCU	2		
Walker	Joe		WCU			2
Swartzentruber	Scott	IT Manager - Networking	WCU			2
Smith	Lee	Director O&M	WCU	2		
Stone	Cynthia	Director of SACUM	UNCC	2.5		
Brown	Anne	AVC Finance	UNCC	2.5		
Dunham	Steven	Chief Risk Officer	UNCC	2.5		
Fiorell	Joe	RMI	UNCC	2.5		
Martin	Kevin	Emergency Preparedness Coordinato	UNCC			40
Gonyar	Chris	Director of EM	UNCC	2.5		4
Kleir	Stephanie	Lieutenant/EM Liaison	UNCC	2.5		
Snodgrass	Lee	Facilities Operations Directo	UNCC	2.5		
Steele	Rich	AVC Business Service	UNCC	2.5		
Trahan	Brad	Office of Legal Affairs	UNCC	2.5		
Ackerman	Mike	Associate Director Rec and Wellne	UNCG	2	2	
Allen	Julie	Paralegal	UNCG	2	2	
Baber	Kathy	Director SHS	UNCG	2	2	
Barker	Robert	Assistant Dean - Dean of Students Offic	UNCG	2	2	
Barnett	Raina	Senior Associate Registra	UNCG		2	
Beck	Joshua	Engineering Superviso	UNCG		2	2
Beville	Jil	Director Rec and Wellnes	UNCG	2	2	
Carter	Brett	Dean SAF	UNCG	2	2	
Clegg	Shannon	Sr. Director Auxilary Services	UNCG	2	2	
Coltrane	Desiree	Director of POCAN	UNCG	2		
Currir	Andrew	Grounds Director	UNCG	2	2	
Douglas	Toni	Associate General Counse	UNCG	2		
Downs	Tammy	Risk Manager	UNCG	2	2	
Bloss	Eden	Senior Director, Media Services	UNCG		2	
Friedman	Dave	Engineering Superviso	UNCG		2	
Goble	Lisa	Research and Economic Development Director	UNCG		2	
Glidewel	Steve	HRL Assistant Director of Facilitie	UNCG	2	2	
Hawks	Dicky	Facilities Operations Directo	UNCG	2	2	
Jasso	Christophe	Public Safety Supervisor	UNCG	2	2	
Johnsor	Tim	Housing and Residence Life Directo	UNCG		2	2
Kapileshwar	Sameer	Facilities Operations Directo	UNCG		2	2
Kazeem	Sikirat	Associate Director Rec and Wellne	UNCG	2	2	
Aguilar	Jennifer	Associate Athletic Directo	UNCG		2	
Lam	Saquang	Student Health Services	UNCG	2	2	
Lester	Paul	Chief of Police	UNCG	2		
Littlefielc	Kimberly	AVC Research and Economic Developmen	UNCG		2	
Logan	Michael	Director of Purchasing	UNCG	2	2	
MacCheyne	Sherri	Director of Operations	UNCG	2	2	
Madorin	Jeanne	AVC HR	UNCG	2	2	
Martinez	Mary	Research Operations Manage	UNCG		2	
McKinney	Mark	Director of Risk Managemen	UNCG	2	2	2
McCloy	Jay	Assistant Director Health and Spo	UNCG		2	
Pearce	Ken	Director Facilities Design and Constructio	UNCG	2		1
Porter	Bryce	CISO	UNCG	2		
Price-Erwin	Erin	Fire and Life Safety Manager	UNCG	2	2	
Slone	Tim	Director EHS	UNCG	2	2	2
Smith	Zach	EM Director	UNCG	2	2	32.5
Soter	Jon	Director of Facilities Operation	UNCG	2	2	2
Stewart	Kenny	EM Coordinator	UNCG	2	2	2
Thurston	Andrew	EM Coordinator	UNCG	2	2	2
Voorhees	Julie	Proposal Development	UNCG	2	2	
Whitney	Jennifer	Director SHS-CC	UNCG	2	2	
Wolforc	Ron	UNCG PD Captain	UNCG	2		
Woody	Sherry	IT Senior Manager	UNCG	2	2	
Lea	Kizzy	AVC Business Service	WSSU	2		
Banks	Jamar	Dean of Students	WSSU	2		
Berry	Carolyn	Associate Provost - Academic Affair	WSSU		1.5	
Bouchereau	Chantal	Director Housing and Residence Life	WSSU	2	1.5	
Brown	Bobby	Police Chief	WSSU	2		
Conner	Shanoya	AD of Housing and Residence Lif	WSSU		1.5	
Dubose	James	Associate Athletic Directo	WSSU		1.5	
Fair-Reese	Kimberly	Exec Director for University Donor Events	WSSU		1.5	
Graves	Cornelius	Director of External Relation	WSSU		1.5	
Henry	Amir	Deputy Chief	WSSU	2	1.5	
Holloway	Calvin	Interim AVC HR	WSSU	2		
Ingram	Frank	Associate Dean STEM Research and Academic Initi	WSSU		1.5	
Isom	Sarah	University Program Specialist	WSSU		1.5	
Jones	Darryl	Director of Systems Operation	WSSU		1.5	
Leach	Camille Klutz	Chief of Staff	WSSU	2		
Lee	Joel	Asst VC Enrollment Service	WSSU		1.5	
Lord	Frank	Controller	WSSU	2		

McMullen	Timothy	AVC - Facilities Managemen	WSSU	2	1.5		
Norwood	Jimmy	Director of Design and Constructio	WSSU		1.5		
Rusere	Wilbourne	Associate Vice Chancellor for Finance and Adm	WSSU		1.5		
Steelman	Eric	EH&S Manager	WSSU	2	1.5		
Stogner	Jason	EM Director	WSSU	2	1.5	4	
Thomas	Etienne	Director of Athletic	WSSU		1.5		
Thompson-Willia	Karen	Director of Student Health Service	WSSU		1.5		
Tilford	Terri	Director of Counselin	WSSU		1.5		
White	Kelly	Deputy Director Public Safety	WSSU		1.5		
Wiley	Latoya	Director of Budget and Analys	WSSU		1.5		
Wymbs	Mary	IT Director	WSSU	2			Total Donated Hours
				212	200	185	597

Nathan Slaughter

From: Nathan Slaughter
Sent: Thursday, May 27, 2021 8:29 AM
To: jcemergencymgt@jacksonnc.org; will.holt@watgov.org; augustv@cityofws.org; emergencymanagement@guilford-es.com; Taylor.Jones@buncombecounty.org; CharMeckEM@charlottenc.gov
Subject: NOTIFICATION: UNC Western Campuses Hazard Mitigation Plan

Importance: Low

Good morning

You are receiving this email because you represent a neighboring jurisdiction and an important partner stakeholder to the University of North Carolina System. The 8 campuses that comprise the Western Region of the UNC System have been working to complete an update to the Region's *Hazard Mitigation Plan* as required by the Federal Emergency Management Agency (FEMA). The purpose of this plan is to identify and assess the hazard risks the campuses face and determine strategies for how to best minimize or manage those risks and reduce vulnerability.

The participating campuses include the following:

- Appalachian State University,
- North Carolina Agricultural and Technical University,
- University of North Carolina at Asheville,
- University of North Carolina at Charlotte,
- University of North Carolina at Greensboro,
- University of North Carolina School of the Arts,
- Western Carolina University, and
- Winston-Salem State University.

Upon completion, the plan will represent a comprehensive update of the *Hazard Mitigation Plan* for the UNC Western 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 data or information related to hazards for the campuses to consider as they update their hazard mitigation plan. Should you have any relevant data, please let me know so I can coordinate data transfer.

I serve as the Project Manager for the update of the plan. Please let me know if you would like to contribute information or if you would like to review a copy of the draft plan once it is available.

Thank you for your attention and should you have any questions about the *UNC Western Campuses Hazard Mitigation Plan*, please do not hesitate to contact me.

Nathan Slaughter, AICP, CFM
Department Manager – Hazard Mitigation
ESP Associates, Inc.
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Morrisville, NC 27560
www.espassociates.com

nslaughter@espassociates.com
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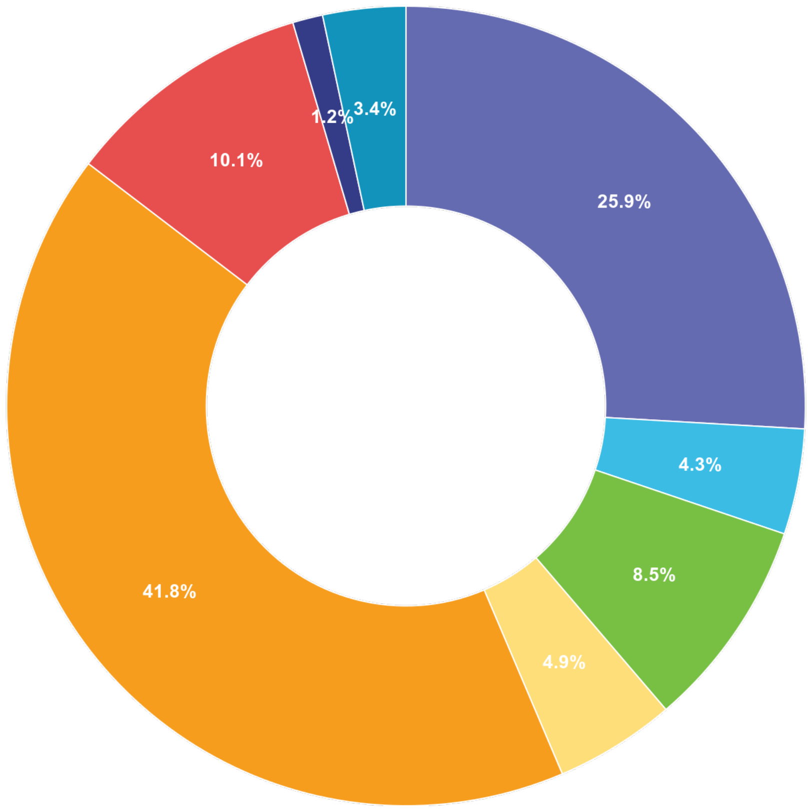
919.678.1070 | Office
919.244.9536 | Cell

UNC Western Campuses Hazard Mitigation Plan Update

The University of North Carolina System is working to become less vulnerable to disasters, and your input is important to us!

Q1 What university/campus are you associated with?

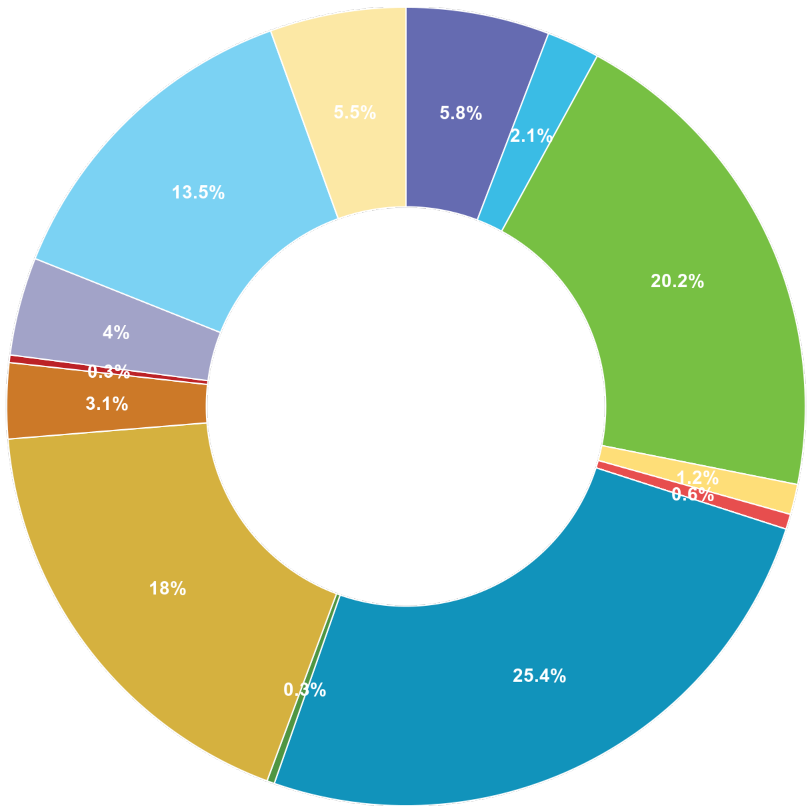


Answered: 328 **Unanswered:** 2

Choice	Total
Appalachian State University	85
North Carolina Agricultural and Technical State University	14
UNC Asheville	28
UNC Charlotte	16
UNC Greensboro	137
UNC School of the Arts	33

Choice	Total
Western Carolina University	4
Winston-Salem State University	11

Q2 What hazard do you feel poses the greatest risk to your campus?

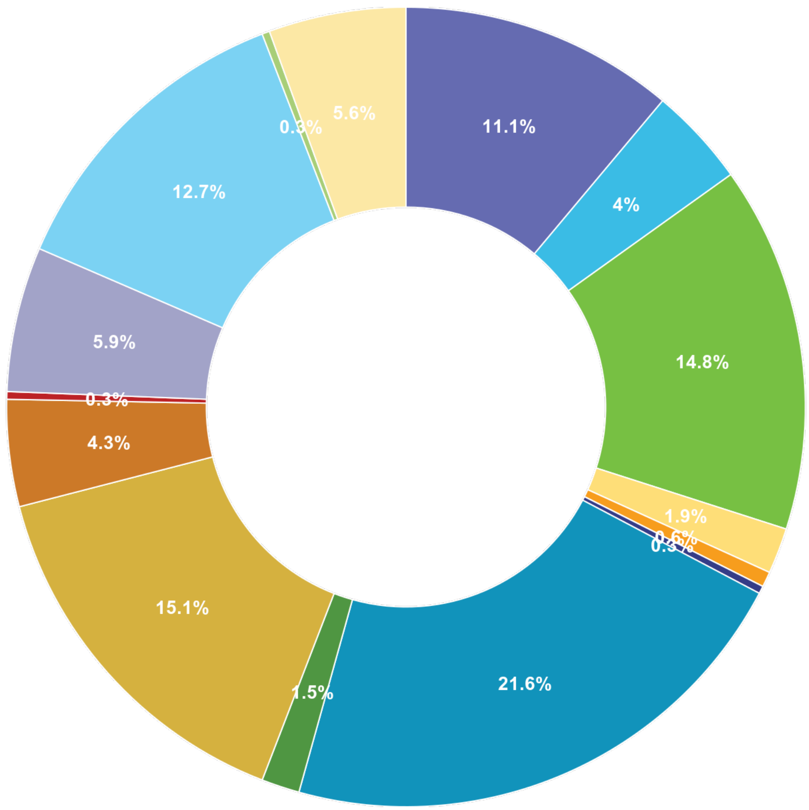


Answered: 327 **Unanswered:** 3

Choice	Total
Flood	19
Hurricane/Coastal Hazards	7
Severe Winter Weather	66
Excessive Heat	4
Wildfire	0
Dam Failure	2

Choice	Total
Drought	0
Tornadoes/Thunderstorm	83
Geological Hazards (Landslide, Sinkholes, Earthquakes)	1
Infectious Diesease	59
Hazardous Substances (HAZMAT, Hazardous Chemicals, Oil Spills)	10
Radiological Emergency (Fixed Nuclear Facilities)	1
Terrorism	13
Cyber	44
Electromagnetic Pulse	0
Other	18

Q3 What hazard do you feel poses the second greatest risk to your campus?



Answered: 324 **Unanswered:** 6

	Choice	Total
	Flood	36
	Hurricane/Coastal Hazards	13
	Severe Winter Weather	48
	Excessive Heat	6
	Wildfire	2
	Dam Failure	0

Choice	Total
Drought	1
Tornadoes/Thunderstorm	70
Geological Hazards (Landslide, Sinkholes, Earthquakes)	5
Infectious Diesease	49
Hazardous Substances (HAZMAT, Hazardous Chemicals, Oil Spills)	14
Radiological Emergency (Fixed Nuclear Facilities)	1
Terrorism	19
Cyber	41
Electromagnetic Pulse	1
Other	18

Q4 Describe any specific hazard issues/problem areas that you would like the planning committee to consider.

Tuesday, May 11, 2021, 6:32 PM UTC

The worst hazard is aging water and electrical failure because of aging infrastructure.

Tuesday, May 11, 2021, 5:32 PM UTC

Hardening networks against ransomware attacks. Training staff about the risks of social engineering.

Tuesday, May 11, 2021, 5:28 PM UTC

Multi-day loss of potable water in the area. Extended power grid failure/ransom attack.

Tuesday, May 11, 2021, 5:28 PM UTC

Cyber attack, including taking over/taking down UNC Charlotte's network

Severe weather, including flooding from thunderstorms

Tuesday, May 11, 2021, 5:27 PM UTC

Inclement weather and infectious disease

Answered: 140   **Unanswered:** 190

Q5 Share any specific buildings/locations on campus that may be at heightened risk or should be prioritized for mitigation.

Wednesday, May 12, 2021, 7:37 PM UTC

Edwin Duncan for flood protection

Tuesday, May 11, 2021, 5:32 PM UTC

Cameron, Reese, and King buildings for leaks.

Tuesday, May 11, 2021, 5:28 PM UTC

Dining Halls, FMPPS, RUPs

Tuesday, May 11, 2021, 5:28 PM UTC

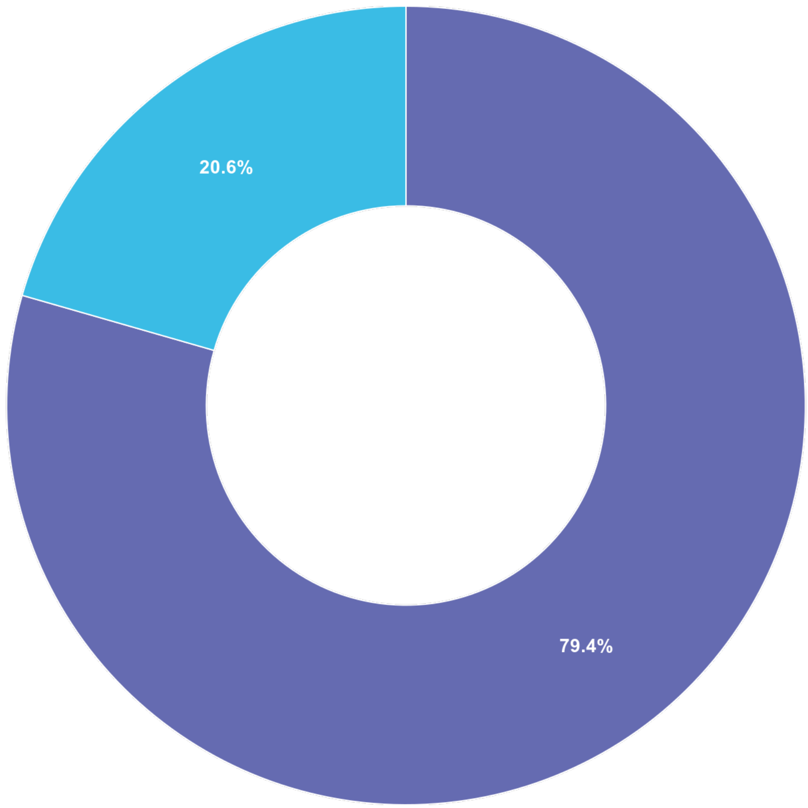
For severe weather impacts, the modular units behind Facilities Management.

Sunday, May 9, 2021, 4:01 PM UTC

NA

Answered: 156 **Unanswered:** 174

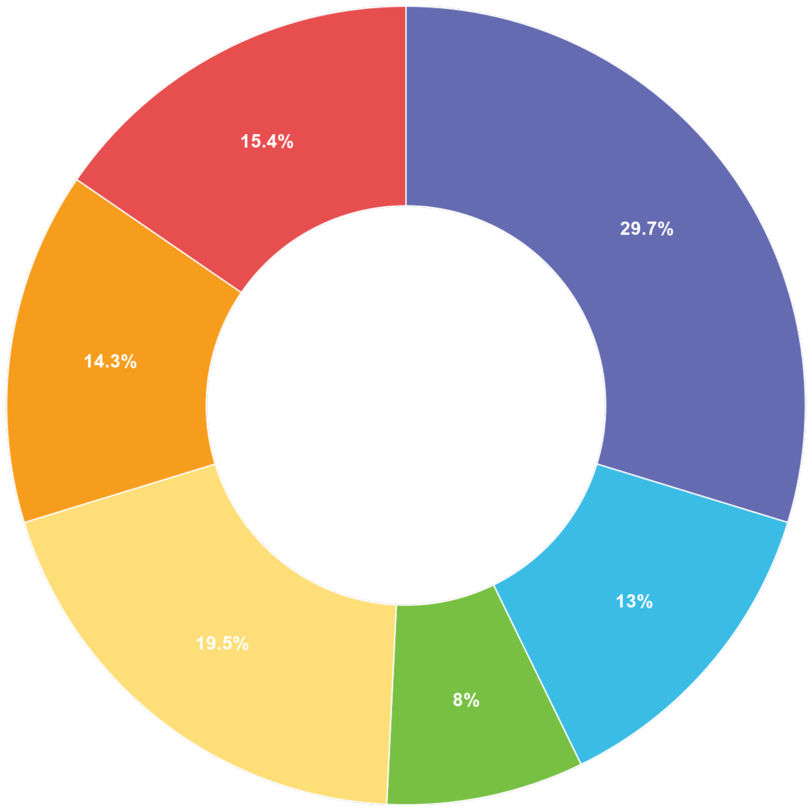
Q6 Do you know what office to contact regarding risks from hazards on campus?



Answered: 326 **Unanswered:** 4

Choice	Total
Yes	259
No	67

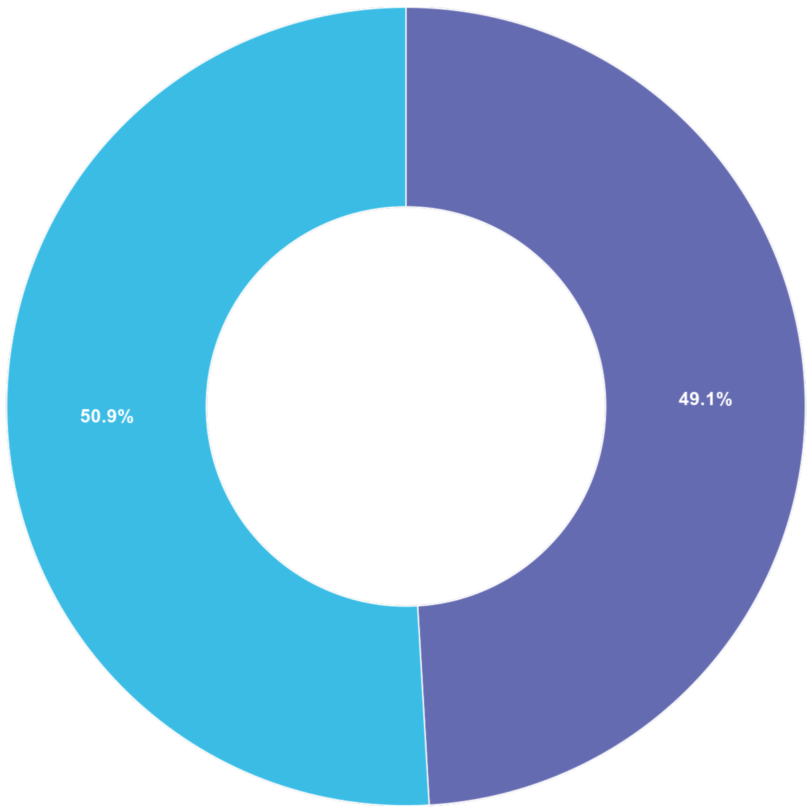
Q7 Which mitigation technique(s) do you feel would be most effective for your campus?



Answered: 319 **Unanswered:** 11

Choice	Total
Prevention (Campus Planning, Strong Building Codes , etc)	212
Property Protection (Retrofitting, insurance, Physical Protection of Buildings, etc)	93
Natural Resource Protection (Preserving Open Spaces, Erosion Control, etc)	57
Emergency Services (Hazard Warning Systems, Electronic Notification Systems)	139
Structural Projects (Drainage Improvements, Stormwater retention/detention, etc)	102
Public Information and Outreach (public education, signage, outreach booths, etc)	110

Q8 Are you interested in learning more about how your campus is working to reduce vulnerability to future hazard events?



Answered: 324 **Unanswered:** 6

Choice	Total
Yes	159
No thank you	165