



# Eno-Haw Regional Hazard Mitigation Plan



September 2020

wood.

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# 1 Introduction

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Section 1 provides a general introduction to hazard mitigation and an introduction to the Eno-Haw Regional Hazard Mitigation Plan. This section contains the following subsections:

- ▶ 1.1 Background
- ▶ 1.2 Purpose and Authority
- ▶ 1.3 Scope
- ▶ 1.4 References
- ▶ 1.5 Plan Organization

## 1.1 BACKGROUND

This document comprises a Hazard Mitigation Plan for the Eno-Haw region of North Carolina.

Each year in the United States, natural and human-caused hazards take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. These monies only partially reflect the true cost of disasters because additional expenses incurred by insurance companies and non-governmental organizations are not reimbursed by tax dollars. Many natural hazards are predictable, and much of the damage caused by hazard events can be reduced or even eliminated.

Hazards are a natural part of the environment that will inevitably continue to occur, but there is much we can do to minimize their impacts on our communities and prevent them from resulting in disasters. Every community faces different hazards, has different resources to draw upon in combating problems, and has different interests that influence the solutions to those problems. Because there are many ways to deal with hazards and many agencies that can help, there is no one solution for managing or mitigating their effects. Planning is one of the best ways to develop a customized program that will mitigate the impacts of hazards while accounting for the unique character of a community.

A well-prepared hazard mitigation plan will ensure that all possible activities are reviewed and implemented so that the problem is addressed by the most appropriate and efficient solutions. It can also ensure that activities are coordinated with each other and with other goals and activities, preventing conflicts and reducing the costs of implementing each individual activity. This plan provides a framework for all interested parties to work together toward mitigation. It establishes the vision and guiding principles for reducing hazard risk and proposes specific mitigation actions to eliminate or reduce identified vulnerabilities.

In an effort to reduce the nation's mounting natural disaster losses, the U.S. Congress passed the Disaster Mitigation Act of 2000 (DMA 2000) to invoke new and revitalized approaches to mitigation planning. Section 322 of DMA 2000 emphasizes the need for state and local government entities to closely coordinate on mitigation planning activities and makes the development of a hazard mitigation plan a specific eligibility requirement for any local government applying for federal mitigation grant funds. These funds include the Hazard Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation (PDM) program, and the Flood Mitigation Assistance (FMA) Program, all of which are administered by the Federal Emergency Management Agency (FEMA) under the Department of Homeland Security. Communities with an adopted and federally approved hazard mitigation plan thereby become pre-positioned and more apt to receive available mitigation funds before and after the next disaster strikes.



## SECTION 1: INTRODUCTION

This plan was prepared in coordination with FEMA Region IV and the North Carolina Division of Emergency Management (NCEM) to ensure that it meets all applicable federal and state planning requirements. A Local Mitigation Plan Review Tool, found in Appendix A, provides a summary of FEMA’s current minimum standards of acceptability and notes the location within this plan where each planning requirement is met.

### 1.2 PURPOSE AND AUTHORITY

This plan was developed in a joint and cooperative manner by members of a Hazard Mitigation Planning Committee (HMPC) which included representatives of County, City, and Town departments, federal and state agencies, citizens, and other stakeholders. This plan will ensure all jurisdictions in the Eno-Haw region remain eligible for federal disaster assistance including the FEMA HMGP, PDM, and FMA programs.

This plan has been prepared in compliance with Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act or the Act), 42 U.S.C. 5165, enacted under Section 104 of the Disaster Mitigation Act of 2000, (DMA 2000) Public Law 106-390 of October 30, 2000, as implemented at CFR 201.6 and 201.7 dated October 2007.

This plan will be adopted by each participating jurisdiction in accordance with standard local procedures. Copies of adoption resolutions are provided in Section 9 Plan Adoption.

### 1.3 SCOPE

This document comprises a Regional Hazard Mitigation Plan for the Eno-Haw region. The planning area includes all incorporated municipalities and unincorporated areas in the region. All participating jurisdictions are listed in Table 1.1.

**Table 1.1 – Participating Jurisdictions in the Eno-Haw Regional Hazard Mitigation Plan**

<b>Alamance County</b>	
City of Burlington	City of Graham
City of Mebane	Town of Elon
Town of Green Level	Town of Haw River
Town of Ossipee	Town of Swepsonville
Village of Alamance	
<b>Durham County</b>	
City of Durham	
<b>Orange County</b>	
Town of Carrboro	Town of Chapel Hill
Town of Hillsborough	
<b>Person County</b>	
City of Roxboro	

The focus of this plan is on those hazards deemed “high” or “moderate” priority hazards for the planning area, as determined through the risk and vulnerability assessments. Lower priority hazards will continue to be evaluated but will not necessarily be prioritized for mitigation in the action plan.

The Eno-Haw region followed the planning process prescribed by the FEMA, and this plan was developed under the guidance of an HMPC comprised of representatives of County, City, and Town departments; citizens; and other stakeholders. The HMPC conducted a risk assessment that identified and profiled hazards that pose a risk to the planning area, assessed the planning area’s vulnerability to these hazards, and examined each participating jurisdiction’s capabilities in place to mitigate them. The hazards profiled in this plan include:

## SECTION 1: INTRODUCTION

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- ▶ Natural Hazards:
  - Dam Failure
  - Drought
  - Earthquake
  - Extreme Heat
  - Flood
  - Hurricane & Tropical Storm
  - Landslide
  - Severe Weather (Thunderstorm Wind, Lightning, & Hail)
  - Severe Winter Storm
  - Tornado
  - Wildfire
- ▶ Technological / Human-Caused Hazards:
  - Civil Unrest
  - Critical Infrastructure Failure
  - Cyber Threat
  - Hazardous Materials Incidents
  - Infectious Disease
  - Radiological Emergency
  - Terrorism / Mass Casualty

### 1.4 REFERENCES

The following FEMA guides and reference documents were used to prepare this document:

- ▶ FEMA 386-1: Getting Started. September 2002.
- ▶ FEMA 386-2: Understanding Your Risks: Identifying Hazards and Estimating Losses. August 2001.
- ▶ FEMA 386-3: Developing the Mitigation Plan. April 2003.
- ▶ FEMA 386-4: Bringing the Plan to Life. August 2003.
- ▶ FEMA 386-5: Using Benefit-Cost Review in Mitigation Planning. May 2007.
- ▶ FEMA 386-6: Integrating Historic Property and Cultural Resource Considerations into Hazard Mitigation Planning. May 2005.
- ▶ FEMA 386-7: Integrating Manmade Hazards into Mitigation Planning. September 2003.
- ▶ FEMA 386-8: Multijurisdictional Mitigation Planning. August 2006.
- ▶ FEMA 386-9: Using the Hazard Mitigation Plan to Prepare Successful Mitigation Projects. August 2008.
- ▶ FEMA. Local Mitigation Planning Handbook. March 2013.
- ▶ FEMA. Local Mitigation Plan Review Guide. October 1, 2011.
- ▶ FEMA National Fire Incident Reporting System 5.0: Complete Reference Guide. January, 2008.
- ▶ FEMA Hazard Mitigation Assistance Unified Guidance. June 1, 2010.
- ▶ FEMA. Integrating Hazard Mitigation into Local Planning: Case Studies and Tools for Community Officials. March 1, 2013.
- ▶ FEMA. Mitigation Ideas. A Resource for Reducing Risk to Natural Hazards. January 2013.

Additional sources used in the development of this plan, including data compiled for the Hazard Identification and Risk Assessment, are listed in Appendix D.



### 1.5 PLAN ORGANIZATION

The Eno-Haw Regional Hazard Mitigation Plan is organized into the following sections:

- ▶ Section 2: Planning Process
- ▶ Section 3: Planning Area Profile
- ▶ Section 4: Hazard Identification & Risk Assessment
- ▶ Section 5: Capability Assessment
- ▶ Section 6: Mitigation Strategy
- ▶ Section 7: Mitigation Action Plans
- ▶ Section 8: Plan Maintenance
- ▶ Section 9: Plan Adoption
- ▶ Appendix A: Local Plan Review Tool
- ▶ Appendix B: Planning Process Documentation
- ▶ Appendix C: Mitigation Alternatives
- ▶ Appendix D: References

## 2 Planning Process

**Requirement §201.6(b): An open public involvement process is essential to the development of an effective plan. To develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:**

- 1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
- 2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and nonprofit interests to be involved in the planning process; and
- 3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

**Requirement §201.6(c)(1): The plan shall include the following:**

- 1) Documentation of the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

This section provides a review of the planning process followed for the development of the Eno-Haw Regional Hazard Mitigation Plan. It consists of the following sub-sections:

- ▶ 2.1 Purpose and Vision
- ▶ 2.2 History of Hazard Mitigation Planning
- ▶ 2.3 Preparing the Plan
- ▶ 2.4 Hazard Mitigation Planning Committee
- ▶ 2.5 Meetings and Workshops
- ▶ 2.6 Involving the Public
- ▶ 2.7 Outreach Efforts
- ▶ 2.8 Involving the Stakeholders
- ▶ 2.9 Documentation of Plan Progress

### 2.1 PURPOSE AND VISION

As defined by FEMA, “hazard mitigation” means any sustained action taken to reduce or eliminate the long-term risk to life and property from a hazard event. Hazard mitigation planning is the process through which hazards are identified, likely impacts determined, mitigation goals set, and appropriate mitigation strategies determined, prioritized, and implemented.

The purpose of the Eno-Haw Regional Hazard Mitigation Plan is to identify, assess, and mitigate hazard risk to better protect the people and property within Alamance, Durham, Orange, and Person Counties from the effects of natural and human-caused hazards. This plan documents progress on existing hazard mitigation planning efforts, updates the previous plan to reflect current conditions in the Region including relevant hazards and vulnerabilities, increases public education and awareness about the plan and planning process, maintains grant eligibility for participating jurisdictions, maintains compliance with state and federal requirements for local hazard mitigation plans, and identifies and outlines strategies the Counties and participating jurisdictions will use to decrease vulnerability and increase resiliency.

The Eno-Haw Regional Hazard Mitigation Planning Committee (HMPC) met on October 8, 2019 and representatives discussed their vision for the planning area in terms of hazard mitigation planning. The committee was asked to consider what the successful implementation of the plan would achieve, what outcomes the plan would generate, and what the Region will look like in five years as a way to brainstorm a vision statement for the plan. The HMPC developed and discussed a list of ideas that were consolidated into the following statement and set of key principles that they agreed should define and guide the planning process and the planning area’s approach to hazard mitigation.



## SECTION 2: PLANNING PROCESS

The Eno Haw Region will continue to build community resiliency through comprehensive, sustainable practices that identify and reduce risk to natural hazards in order to protect the health, safety, quality of life, environment and economy of the Alamance, Durham, Orange, and Person county area.

This vision is underpinned by the following key principles which describe how the Eno-Haw Region HMPC hopes to characterize the future of the community.

**Resilience:** The Eno-Haw Region will make socially, financially, and environmentally sustainable decisions to incorporate an all-hazards mitigation approach into existing planning frameworks, such as land use planning and capital improvements programming. In both pre-disaster and post-hazard periods, the Region will be adaptable and strategic in planning for reduced risk and greater resilience.

**Coordination:** Communities in the Eno-Haw Region will work within their own jurisdictions, throughout the region, and with regional neighbors to ensure that mitigation decisions are coordinated, resources are optimized, and planning decisions involve all the key parties.

**Responsible:** The Eno-Haw Region will take a strategic, all-hazards approach to mitigation in order to make fiscally responsible, practical decisions that maximize benefits. Communities will be good stewards of the Region's many environmental, historic, and cultural resources.

**Efficient:** The Eno-Haw Region communities and residents will be prepared for hazard events and ready to take timely and strategic action on post-event response and recovery efforts. Throughout preparedness, response, and recovery processes, the Region will recognize the importance of responsiveness to residents' needs and prioritize clear communication with residents.

### 2.2 WHAT'S CHANGED IN THE PLAN

This plan is an update to the 2015 Eno-Haw Regional Hazard Mitigation Plan, which included participation from Alamance, Durham, and Orange Counties and their incorporated jurisdictions. The previous plan was approved by FEMA on August 2, 2015. This plan update also includes Person County and the City of Roxboro, which joined the Eno-Haw Region after previously developing their own plan, the Person County-City of Roxboro Hazard Mitigation Plan, which was approved by FEMA on April 20, 2015.

This hazard mitigation plan update involved a comprehensive review and update of each section of the existing plans and an assessment of the success of the Counties and participating municipalities in evaluating, monitoring and implementing the mitigation strategy outlined in their existing plans. Only the information and data still valid from the existing plans was carried forward as applicable into this update.

The following requirements were addressed during the development of this new regional plan update:

- ▶ Consider changes in vulnerability due to action implementation;
- ▶ Document success stories where mitigation efforts have proven effective;
- ▶ Document areas where mitigation actions were not effective;
- ▶ Document any new hazards that may arise or were previously overlooked;
- ▶ Incorporate new data or studies on hazards and risks;
- ▶ Incorporate new capabilities or changes in capabilities;
- ▶ Incorporate growth and development-related changes to inventories; and
- ▶ Incorporate new action recommendations or changes in action prioritization.

Section 4.2 provides a comparison of the hazards addressed in the 2018 State of North Carolina HMP, the 2015 Eno-Haw plan, and the 2015 Person County-Roxboro plan and provides the final decision made by the HMPC as to which hazards should be included in the updated 2020 Eno-Haw Regional Plan.

## SECTION 2: PLANNING PROCESS

In addition to the specific changes in hazard analyses identified in Section 4.2, the following items were also addressed in this 2020 plan update:

- ▶ GIS was used, to the extent data allowed, to analyze the priority hazards as part of the vulnerability assessment.
- ▶ Assets at risk to identified hazards were identified by property type and values of properties based on NCEM's IRISK Database.
- ▶ A discussion on climate change and its projected effect on specific hazards was included in each hazard profile in the risk assessment.
- ▶ The discussion on growth and development trends was enhanced utilizing 2018 American Community Survey data.
- ▶ Enhanced public outreach and agency coordination efforts were conducted throughout the plan update process in order to meet the more rigorous requirements of the 2017 CRS Coordinator's Manual, in addition to DMA requirements.

### 2.3 PREPARING THE PLAN

The planning process for preparing the Eno-Haw Regional Hazard Mitigation Plan was based on DMA planning requirements and FEMA's associated guidance. This guidance is structured around a four-phase process:

- 1) Planning Process;
- 2) Risk Assessment;
- 3) Mitigation Strategy; and
- 4) Plan Maintenance.

Into this process, the planning consultant integrated a more detailed 10-step planning process used for FEMA's Community Rating System (CRS) and Flood Mitigation Assistance programs. Thus, the modified 10-step process used for this plan meets the requirements of six major programs: FEMA's Hazard Mitigation Grant Program; Pre-Disaster Mitigation Program; Community Rating System; Flood Mitigation Assistance Program; Severe Repetitive Loss Program; and new flood control projects authorized by the U.S. Army Corps of Engineers.

Table 2.1 shows how the 10-step CRS planning process aligns with the four phases of hazard mitigation planning pursuant to the Disaster Mitigation Act of 2000.

**Table 2.1 – Mitigation Planning and CRS 10-Step Process Reference Table**

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

## SECTION 2: PLANNING PROCESS

In addition to meeting DMA and CRS requirements, this plan also meets the recommended steps for developing a Community Wildfire Protection Plan (CWPP). Table 2.2 below outlines the recommended CWPP process and the CRS step and sections of this plan that meet each step.

**Table 2.2 – Community Wildfire Protection Plan Process Reference**

CWPP Process	CRS Step	Fulfilling Plan Section
Convene decision makers	Step 1	Section 2 – HMPC
Involve Federal agencies	Step 3	Section 2 – Involving Stakeholders
Engage interested parties (such as community representatives)	Step 1, 2, and 3	Section 2 – HMPC, Involving the Public, Involving Stakeholders
Establish a community base map		Section 4 – Wildfire
Develop a community risk assessment, including fuel hazards, risk of wildfire occurrence, homes, business and essential infrastructure at risk, other community values at risk, local preparedness, and firefighting capability	Step 4 and 5	Section 4 – Wildfire Section 5 – Capability
Establish community hazard reduction priorities and recommendations to reduce structural ignitability	Step 6, 7, and 8	Section 6 – Mitigation Strategy Section 7 – Mitigation Action Plans
Develop an action plan and assessment strategy	Step 8 and 10	Section 7 – Mitigation Action Plans Section 8 – Plan Maintenance
Finalize the CWPP	Step 9	Section 9 – Plan Adoption

The process followed for the preparation of this plan, as outlined in Table 2.1 above, is as follows:

### 2.3.1 Phase I – Planning Process

#### Planning Step 1: Organize to Prepare the Plan

With the region’s commitment to participate in the DMA planning process, community officials worked to establish the framework and organization for development of the plan. An initial meeting was held with key community representatives to discuss the organizational aspects of the plan development process. The region’s effort to reorganize and coordinate for the plan update was led by each County’s emergency management director. Consultants from Wood Environment and Infrastructure Solutions, Inc. assisted by leading the Counties through the planning process and preparing the plan document.

#### Planning Step 2: Involve the Public

Public involvement in the development of the plan was sought using various methods, as detailed in Section 2.6.

#### Planning Step 3: Coordinate

As this plan update combines the Eno-Haw region and the Person County-Roxboro jurisdictions, the participating communities established a new HMPC to lead the planning effort. More details on the HMPC are provided in Section 2.4. Stakeholder coordination was incorporated into the formation of the HMPC and was sought through additional outreach methods. These efforts are detailed in Section 2.8.

#### *Coordination with Other Community Planning Efforts and Hazard Mitigation Activities*

In addition to stakeholder involvement, coordination with other community planning efforts was also seen as paramount to the success of this plan. Mitigation planning involves identifying existing policies, tools, and actions that will reduce a community’s risk and vulnerability to hazards. The Eno-Haw region’s participating jurisdictions use a variety of planning mechanisms, such as Comprehensive Plans, subdivision regulations, building codes, and ordinances to guide growth and development. Integrating existing planning efforts, mitigation policies, and action strategies into this plan establishes a credible and

## SECTION 2: PLANNING PROCESS

comprehensive plan that ties into and supports other community programs. As detailed in Table 2.3, the development of this plan incorporated information from existing plans, studies, reports, and initiatives as well as other relevant data from neighboring communities and other jurisdictions.

These and other documents were reviewed and considered, as appropriate, during the collection of data to support the planning process and plan development, including the hazard identification, vulnerability assessment, and capability assessment. The Hazard Identification and Risk Assessment can be found in Section 4 and the Capability Assessment can be found in Section 5.

**Table 2.3 – Summary of Existing Studies and Plans Reviewed**

Resource Referenced	Use in this Plan
Local Comprehensive Plans	The Alamance County Land Development Plan, Orange County Comprehensive Plan, Durham Comprehensive Plan, and Person County Land Use Plan were referenced in the Planning Area Profile in Section 3. Comprehensive plans were also incorporated into Mitigation Action Plans where applicable in Section 7 and referenced in the Capability Assessment in Section 5.
Local Ordinances (Flood Damage Prevention Ordinances, Subdivision Ordinances, Zoning Ordinances, etc)	Local ordinances were referenced in the Capability Assessment in Section 5 and where applicable for updates or enforcement in Mitigation Action Plans in Section 7.
Triangle Regional Resilience Partnership Resilience Assessment	The Technical Report was used in the preparation of the HIRA in Section 4 and reviewed for the development of the Mitigation Strategy in Sections 6 and 7.
Alamance County and Incorporated Areas Flood Insurance Study (FIS), Revised 11/17/2017; Durham County and Incorporated Areas FIS, Revised 10/19/2018; Orange County and Incorporated Areas FIS, Revised 10/19/2018; Person County and Incorporated Areas FIS, Revised 11/17/2017;	The FIS reports were referenced in the preparation of flood hazard profile in Section 4.
Eno-Haw Regional Hazard Mitigation Plan, 2015; Person-Roxboro Hazard Mitigation Plan, 2015	The previous plans were referenced in compiling the Planning Area Profile in Section 3, the Hazard Identification and Risk Assessment in Section 4, and in reporting on implementation status and developing the Mitigation Action Plans in Section 2 and Section 7, respectively.

### 2.3.2 Phase II – Risk Assessment

#### Planning Steps 4 and 5: Identify/Assess the Hazard and Assess the Problem

The HMPC completed a comprehensive effort to identify, document, and profile all hazards that have, or could have, an impact on the planning area. Geographic information systems (GIS) were used to display, analyze, and quantify hazards and vulnerabilities. A draft of the risk and vulnerability assessment was made available on the plan website for the HMPC, stakeholders, and the public to review and comment.

The HMPC also conducted a capability assessment to review and document the planning area's current capabilities to mitigate risk from and vulnerability to hazards. By collecting information about existing government programs, policies, regulations, ordinances, and emergency plans, the HMPC could assess those activities and measures already in place that contribute to mitigating some of the risks and vulnerabilities identified. A more detailed description of the risk assessment process and the results are included in Section 4 Risk Assessment.

### 2.3.3 Phase III – Mitigation Strategy

#### Planning Steps 6 and 7: Set Goals and Review Possible Activities

Wood facilitated brainstorming and discussion sessions with the HMPC that described the purpose and process of developing a vision for the planning process and setting planning goals and objectives, a comprehensive range of mitigation alternatives, and a method of selecting and defending recommended mitigation actions using a series of selection criteria. This information is included in Section 6 Mitigation Strategy.

#### Planning Step 8: Draft an Action Plan

A complete first draft of the plan was prepared based on input from the HMPC regarding the draft risk assessment and the goals and activities identified in Planning Steps 6 and 7. This draft was shared for HMPC, stakeholder, and public review and comment via the plan website. HMPC, public, and stakeholder comments were integrated into the final draft for NCEM and FEMA Region IV to review and approve, contingent upon final adoption by the Counties and their participating jurisdictions.

### 2.3.4 Phase IV – Plan Maintenance

#### Planning Step 9: Adopt the Plan

To secure buy-in and officially implement the plan, the plan will be reviewed and adopted by all participating jurisdictions. Resolutions will be provided in Section 9.

#### Planning Step 10: Implement, Evaluate and Revise the Plan

Implementation and maintenance of the plan is critical to the overall success of hazard mitigation planning. Up to this point in the planning process, the HMPC's efforts have been directed at researching data, coordinating input from participating entities, and developing appropriate mitigation actions. Section 8 Plan Maintenance provides an overview of the overall strategy for plan implementation and maintenance and outlines the method and schedule for monitoring, updating, and evaluating the plan. The Section also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

## 2.4 HAZARD MITIGATION PLANNING COMMITTEE

The HMPC guided the development of this Hazard Mitigation Plan. The Committee's representatives included representatives of County, City, and Town departments, federal and state agencies, citizens, and other stakeholders.

To form the planning committee, the County Emergency Managers coordinated with County, City, and Town officials to designate representatives for each jurisdiction. Each community was asked to designate a primary and secondary contact for the HMPC. Communities were also asked to identify local stakeholder representatives to participate on the HMPC alongside the County, City, and Town officials to improve the integration of stakeholder input into the plan. The HMPC was comprised of a CRS Steering Committee and a Working Group. Table 2.4 and Table 2.5 detail the HMPC members and the agencies and jurisdictions they represented.

The formal HMPC meetings followed the 10 CRS Planning Steps. Agendas, minutes, and sign-in sheets for the HMPC meetings are included in Appendix B. The meeting dates and topics discussed are summarized in Section 2.5 Meetings and Workshops. All HMPC meetings were open to the public.

The DMA planning regulations and guidance stress that each local government seeking FEMA approval of their mitigation plan must participate in the planning effort in the following ways:

- Participate in the process as part of the HMPC;

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- Detail where within the planning area the risk differs from that facing the entire area;
- Identify potential mitigation actions; and
- Formally adopt the plan.

For the Eno-Haw Regional HMPC, “participation” meant the following:

- ▶ Providing facilities for meetings;
- ▶ Attending and participating in the HMPC meetings;
- ▶ Collecting and providing requested data (as available);
- ▶ Managing administrative details;
- ▶ Making decisions on plan process and content;
- ▶ Identifying mitigation actions for the plan;
- ▶ Reviewing and providing comments on plan drafts;
- ▶ Informing the public, local officials, and other interested parties about the planning process and providing opportunity for them to comment on the plan;
- ▶ Coordinating, and participating in the public input process; and
- ▶ Coordinating the formal adoption of the plan by local governing bodies.

Detailed summaries of HMPC meetings are provided under Meetings and Workshops, including meeting dates, locations, and topics discussed. During the planning process, the HMPC members communicated through face-to-face meetings, email, and telephone conversations. This continued communication ensured that coordination was ongoing throughout the entire planning process despite the fact that not all HMPC members could be present at every meeting. Additionally, draft documents were distributed via the plan website so that the HMPC members could easily access and review them and provide comments.

The HMPC was comprised of two groups, a CRS Steering Committee, which led the planning and decision-making efforts throughout the planning process, and a Working Group comprised of additional local staff, which provided information to the CRS Steering Committee. The CRS Steering Committee is the group responsible for the 10-Step CRS planning process outlined in the 2017 CRS Coordinator’s Manual.

**Table 2.4 – CRS Steering Committee**

Jurisdiction	Member Name	Title/Department/Agency
Alamance County	Debbie Hatfield	EM Coordinator
Alamance County	Yancy King	Asst. EM Coordinator
City of Burlington	Roger Manuel	EM Coordinator
City of Burlington	Mike Nunn	Planning Director
Town of Elon	Steve Floyd	Retired Fire Chief
Durham County	Leslie B. O'Connor	Division Chief of Emergency Management
Durham County	Ari Schein	Durham County EM
Durham County	Kay Jowers	Duke University
Durham County	Diana Graham	Resident/Stakeholder
Durham County	Sharlene Simon	Resident/Stakeholder
City of Durham	Graham Summerson	Public Works
City of Durham	Stephan Windsor	City-County Planning Department
City of Durham	April Johnson	Preservation Durham
City of Durham	Michelle Hartman	Duke University
City of Durham	Haley Schomburg	Resident/Stakeholder
City of Durham	Sara Feusen	Resident/Stakeholder
Orange County	Kirby Saunders	EM Coordinator
Orange County	Sarah Pickhardt	EM Planner
Orange County	Darrell Jeter	UNC Director of Emergency Management and Planning



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Jurisdiction	Member Name	Title/Department/Agency
Orange County	Thomas Gambill	CERT Council Member
Orange County	Kelly Ferrell	American Red Cross
Orange County	Danielle Stone	American Red Cross
Orange County	Jeanne Van Vlandren	American Red Cross
Orange County	Meredith McMonigle	Family Success Alliance
Town of Chapel Hill	Vence Harris	Emergency Management Coordinator
Town of Chapel Hill	Kelly Drayton	Emergency Management Planner
Town of Chapel Hill	Pamela Schultz	Citizens Stormwater Advisory Board Member
Town of Carrboro	Susanna Williams	Fire Chief/Emergency Manager
Town of Carrboro	Patricia McGuire	Planning Director
Person County	Doug Young	Director, Emergency Services Dept.
Person County	Lori Oakley	Planning Director
Person County	Treco Lea-Jeffers	Resident/Stakeholder

The working group supported the overall HMP process by providing information and data to the CRS Steering Committee for consideration.

**Table 2.5 – Working Group**

Jurisdiction	Member Name	Title/Department/Agency
Alamance County	Yancy King	Asst. EM Coordinator
Alamance County	Alan Byrd	First Call
Alamance County	Brad Bailey	Bat. Chief, City of Burlington
City of Burlington	Mike Nunn	Planning Director
City of Graham	Tommy Cole	Fire Chief
City of Graham	Nathan Page	Planning Director
City of Mebane	Bob Louis	Fire Chief
City of Mebane	Montrena W. Hadley	Planning Officer
City of Mebane	Kyle Smith	Utilities Director
Town of Elon	Alva Sizemore	Fire Chief
Town of Elon	Pamela Graham	Planning Director
Town of Green Level	Dylan Galloway	Town Administrator
Town of Green Level	Rodney Gunn	Public Works Director
Town of Haw River	Sean Tencer	Town Manager
Town of Haw River	Jamie Joseph	Fire Chief
Town of Haw River	Buddy Boggs	Mayor
Town of Haw River	Lee Lovette	Mayor Pro-Tem
Town of Ossipee	Edward Lipscomb	Fire Chief
Town of Ossipee	Justin Newton	Deputy Fire Chief
Town of Swepsonville	Tim Albritton	Fire Chief
Town of Swepsonville	Steve Couturier	Deputy Fire Chief
Village of Alamance	Ben York	Town Manager
Durham County	Ryan Eaves	Stormwater & Erosion Control, Division Manager
Durham County	McKenzie Gentry	Stormwater & Erosion Control, Stormwater Manager
City of Durham	Stephan Windsor	City-County Planning Department
City of Durham	Maie Armstrong	City-County Planning Department
Orange County	Brennan Bouma	Sustainability Coordinator
Orange County	Michael Harvey	Planning and Zoning Supervisor
Orange County	Perdita Holtz	Planning Systems Coordinator
Orange County	Sasha Godwin	EM Intern

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Jurisdiction	Member Name	Title/Department/Agency
Orange County	Ashley Moncado	Orange County Planning
Town of Carrboro	Marty Roupe	Development Review Administrator
Town of Carrboro	Brad Harvey	Interim Fire Chief
Town of Carrboro	Laura Janway	Environmental Planner
Town of Chapel Hill	Chris Roberts	Town Engineer
Town of Chapel Hill	Sue Burke	Stormwater Manager
Town of Chapel Hill	John Richardson	Resiliency/Sustainability Officer
Town of Hillsborough	Jerry Wagner	Fire Marshall/Emergency Manager
Town of Hillsborough	Justin Snyder	Planning Department
Person County	Kayla DiCristina	Planner
City of Roxboro	Lauren Johnson	Planning Director

### 2.5 MEETINGS AND WORKSHOPS

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

Table 2.6 summarizes the key meetings and workshops held by the HMPC during the development of the plan. In many cases, routine discussions and additional meetings were held by local staff to accomplish planning tasks specific to their department or agency. For example, completing the Local Capability Self-Assessment or seeking approval of specific mitigation actions for their department or agency to undertake and include in their Mitigation Action Plan. These meetings were informal and are not documented here.

Public meetings are summarized in subsection 2.6.

**Table 2.6 – Summary of HMPC Meetings**

Meeting Title	Meeting Topic	Meeting Date	Meeting Location
HMPC Mtg. #1 – Project Kick-Off	1) Introduction to DMA, CRS, and FMA requirements and the planning process 2) Review of HMPC responsibilities and the project schedule.	July 11, 2019 2 p.m.	Whitted Human Services Building, Room 230, 300 West Tryon Street, Hillsborough
HMPC Mtg. #2	1) Review and update plan goals and objectives 2) Brainstorm a vision statement 3) Report on status of actions from the 2015 plan 4) Complete the capability self-assessment	October 8, 2019 1 p.m.	Whitted Human Services Building, Room 230, 300 West Tryon Street, Hillsborough
HMPC Mtg. #3	1) Review Draft Hazard Identification & Risk Assessment (HIRA) 2) Draft objectives and Mitigation Action Plans	November 26, 2019 1 p.m.	Whitted Human Services Building, Room 230, 300 West Tryon Street, Hillsborough
HMPC Mtg. #4	1) Review the Draft Hazard Mitigation Plan 2) Solicit comments and feedback	May 20, 2020 2 p.m.	Zoom Video Conference Call

### 2.6 INVOLVING THE PUBLIC

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

Public involvement in the development of the plan was sought using various methods including open public meetings, an interactive plan website, a public participation survey, and by making copies of draft plan documents available for public review online and at government offices. Additionally, all HMPC meetings were made open to the public.

All public meetings were advertised on the plan website and on local community websites, where possible. Copies of meeting announcements are provided in Appendix B. The public meetings held during the planning process are summarized in Table 2.7.

**Table 2.7 – Summary of Public Meetings**

Meeting Title	Meeting Topic	Meeting Date	Meeting Location
Public Meeting #1	1) Introduction to DMA, CRS, and FMA requirements and the planning process 2) Review of HMPC responsibilities and the project schedule.	July 11, 2019 5:30 p.m.	Whitted Human Services Building, Room 230, 300 West Tryon Street, Hillsborough
Public Meeting #2	1) Review “Draft” Hazard Mitigation Plan 2) Solicit comments and feedback	May 28, 2020 5 p.m.	Zoom Video Conference Call

### 2.7 OUTREACH EFFORTS

The HMPC agreed to employ a variety of public outreach methods including established public information mechanisms and resources within the community. The table below details public outreach efforts employed during the preparation of this plan.

**Table 2.8 – Public Outreach Efforts**

Location	Date	Event/Message
Plan website	Ongoing	Meeting announcements, meeting materials, and description of hazards; contact information provided to request additional information and/or provide comments
Local community websites	July 2019	Public Meeting #1 announcements posted with summary of the plan purpose and process
Facebook	July 2019	Public Meeting #1 streamed live on Durham City/County Emergency management’s Facebook page.
Local community websites	July 2019	Link to the plan website shared to expand reach
Public survey	May 2019 – March 2020	Survey hosted online and made available via shareable link
Plan website - HIRA draft	11/26/2019	Draft HIRA made available for review and comment online
Plan website - Draft Plan	5/20/2020	Full draft plan made available for review and comment online
Local community websites	May 2020	Public Meeting #2 announcements posted with request for comments on the draft plan
Mitigation Flyer	Ongoing	An informational flyer was made available online

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Public involvement activities for this plan update included press releases, creation of a website for the plan, a public survey, and the collection of public and stakeholder comments on the draft plan.

A public outreach survey was made available in July 2019 and remained open for response until March 2020. The public survey requested public input into the Hazard Mitigation Plan planning process and the identification of mitigation activities to lessen the risk and impact of future hazard events. The survey is shown in Appendix B. The survey was available in hard copy at the first public meeting and online on the plan website. In total, 348 responses were received via the online survey.

The following is a list of high-level summary results derived from survey responses:

- ▶ 92% of responses came from residents of Orange County.
- ▶ Over 93% of respondents own their home, which indicates ability of those engaged in the mitigation process to implement mitigation on their own properties.
- ▶ Over 86% of respondents feel somewhat prepared or very prepared for a hazard event.
- ▶ 77% of respondents do not know where evacuation centers or storm shelters are located; 95.4% say they are able to evacuate or take shelter if necessary.
- ▶ Over 44% of respondents do not know where to get more information on hazard risk and preparedness. More outreach may be needed and it may be beneficial to pursue new methods of outreach.
- ▶ Hurricane was rated the most significant hazard, followed by tornado, severe weather, and extreme heat. Landslide was rated the least significant hazard, followed by earthquake and dam failure.
- ▶ Approximately half of the respondents reported taking steps to mitigate risk at home. Many reported preparedness actions such as emergency kits and supplies and evacuation plans. Some residents reported backup generators. Few respondents noted property protection actions; therefore, these may be important ideas to promote in outreach.
- ▶ Respondents favored natural resource protection, emergency services, and structural projects for mitigation; least favored option was property protection for individual homes.
- ▶ Text message and email were the most preferred methods of communication for information on hazard events.

Detailed survey results are provided in Appendix B.

### 2.8 INVOLVING THE STAKEHOLDERS

In addition to representatives of each participating jurisdiction, the Hazard Mitigation Planning Committee included a variety of stakeholders. Stakeholders on the HMPC included representatives from the Duke University, Preservation Durham, University of North Carolina, American Red Cross, and local CERT and Citizens Stormwater Advisory Boards. Input from additional stakeholders, including neighboring communities, was solicited through invitations to the open public meetings and distribution of the public survey. However, if any additional stakeholders of other agencies and organizations participated through the public survey, that information is unknown due to the anonymous nature of the survey.

### 2.9 DOCUMENTATION OF PLAN PROGRESS

Progress on the mitigation strategy developed in the previous plan is documented in this plan update. Table 2.9 below details the status of mitigation actions from the previous plan. More detail on these actions is provided in Section 5: Mitigation.

**Table 2.9 – Status of Previous Mitigation Actions**

Jurisdiction	Completed	Deleted	Carried Forward
Alamance County	8	0	24
City of Burlington	0	0	19
City of Graham	1	3	17
City of Mebane	7	4	14
Town of Elon	1	2	19
Town of Green Level	0	2	14
Town of Haw River	1	3	18
Town of Mebane	8	6	16
Town of Ossipee	0	1	12
Town of Swepsonville	0	3	16
Village of Alamance	0	0	13
Durham County	0	14	3
City of Durham	0	10	3
Orange County	2	0	12
Town of Carrboro	0	1	9
Town of Chapel Hill	2	5	14
Town of Hillsborough	2	1	3
Person County	2	4	14
City of Roxboro	1	9	13
<b>Total</b>	<b>35</b>	<b>68</b>	<b>253</b>

Table 2.10 on the following pages details all completed and deleted actions from the 2015 plan.

Community capability continues to improve with the implementation of new plans, policies, and programs that help to promote hazard mitigation at the local level. The current state of local capabilities for the participating jurisdictions is captured in Section 5 Capability Assessment. The participating jurisdictions continue to demonstrate their commitment to hazard mitigation and have proven this by reconvening the HMPC to update this multi-jurisdictional plan and by continuing to involve the public in the hazard mitigation planning process.

Moving forward, information in this plan will be used to help guide and coordinate mitigation activities and decisions for local plans and policies in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to communities and their residents by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruptions. This plan identifies activities that can be undertaken by both the public and the private sectors to reduce safety hazards, health hazards, and property damage.

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**Table 2.10 – Completed and Deleted Actions from the 2015 Eno-Haw Regional HMP and 2015 Person-Roxboro HMP**

2015 Action #	Description	2020 Status	Status Comments/Explanation
<b>Alamance County</b>			
6	Maintain contact with the North Carolina Cooperative Extension Service through the local County agency regarding problems related to agriculture damage.	Completed	
7	Maintain hazard mitigation plan and floodplain information on the County website ( <a href="http://www.alamance-nc.com">www.alamance-nc.com</a> )	Completed	
15	Continue to expand the County's Geographic Information System (GIS) capabilities to include maintaining Elevation Certificates in a computer database	Completed	
16	Continue Alamance County's participation in the National Flood Insurance Program (NFIP) so citizens are eligible for flood insurance.	Completed	County participates
17	Join the National Flood Insurance Program (NFIP).	Completed	All county municipalities with the exception of Ossipee participate in the NFIP
18	Consider joining the NFIP's Community Rating System (CRS).	Completed	This action was deferred in 2015 due to lack of personnel.
28	Review all fire districts coverage to ensure that there are adequate quantities of water for firefighting purposes and that all water points are maintained on a regular basis.	Completed	This is required for ISO ratings
29	Meet annually with State Forester for Alamance County to improve coordination of wildfire control and response.	Completed	This is done monthly at the Arson Task Force Meetings.
<b>City of Graham</b>			
5	Maintain hazard mitigation plan and floodplain information on the County website ( <a href="http://www.alamance-nc.com">www.alamance-nc.com</a> ).	Deleted	This action is handled by Alamance County
6	Maintain shelter agreements with the American Red Cross	Deleted	The City will continue to coordinate with Alamance County Emergency Management on sheltering. Alamance County EM now manages their own shelters.
13	Develop specific regulations that prohibit dumping in the county's watersheds	Completed	Landfills prohibited in the zoning jurisdiction of Graham by City Charter.
15	Maintain GIS system at <a href="http://www.alamance-nc.com">www.alamance-nc.com</a> . From this site anyone from a private citizen, builder, insurance company, etc. can see if a property is located in the 1-percent-annual-chance (100-year) floodplain.	Deleted	This effort is handled by Alamance County.
<b>City of Mebane</b>			
5	Maintain Hazard Mitigation Plan and Floodplain Information on the County Website	Completed	Added to City's Website



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2015 Action #	Description	2020 Status	Status Comments/Explanation
7	Review Methods of School Construction to Ensure All New Schools are Constructed to Maximum Cost Feasible Standards so that they can be used as Shelters.	Deleted	No new public schools planned in next 5 years.
8	Review Subdivision Regulations and Make Appropriate Changes to Encourage Placing Lots in Flood Prone Areas and Reduce Impervious Cover	Completed	Covered under the UDO
9	Discourage Development in Flood Zones	Completed	Covered under the UDO
10	Look for Opportunities to Acquire or Relocate Structures Vulnerable to Floods	Deleted	Complete for City Owned Structures
12	Propose a Policy Prohibiting the Development of Critical Public Facilities in the 100 Year Floodplain in Cases where Alternatives Exist	Completed	Covered under the UDO
15	Develop Specific Regulations that Prohibit Dumping in the County's Watersheds	Completed	Covered under the UDO and code of ordinances.
16	Maintain Documents about Flood Insurance, Flood Protection, Floodplain Management, and Natural and Beneficial Functions of Floodplains at the Local Libraries and Government Offices	Completed	On website and materials available at public buildings.
17	Maintain GIS System on County's Website for Public to View 100 Year Floodplain	Completed	Performed by the County
18	Monitor Recreational Facilities Located in the Floodplain and Evaluate Flood Resistance of County Structures	Deleted	Minimal facilities in flood plain.
21	Educate Citizens to Listen for the Watches and Warnings Issued by the National Weather Service	Deleted	Performed by media and weather radios
<b>Town of Elon</b>			
6	Maintain shelter agreements with the American Red Cross	Deleted	Elon will follow Alamance Co. EM lead on sheltering.
16	Monitor recreational facilities located in the floodplain and evaluate flood resistance of county structures.	Deleted	The Town of Elon currently has no recreational facilities located in any floodplain. The Town of Elon Public Works along with the Towns TRC will revisit the need for this action if there is potential for new recreational construction in or near any potential flood plain.
1 (2015)	Purchase a generator for Town Hall.	Completed	The Town of Elon installed a generator hook up at Town Hall to be able to continue needed services in case of power blackout/failure. Elon Public Works Department is in charge of securing the generator for this hookup. Town FD buildings are already generator equipped.
<b>Town of Green Level</b>			
3	Maintain hazard mitigation plan and floodplain information on the County website ( <a href="http://www.alamance-nc.com">www.alamance-nc.com</a> ).	Deleted	This action is handled by Alamance County

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2015 Action #	Description	2020 Status	Status Comments/Explanation
6	Maintain shelter agreements with the American Red Cross	Deleted	The Town will continue to coordinate with Alamance County Emergency Management on sheltering.
<b>Town of Haw River</b>			
5	Maintain hazard mitigation plan and floodplain information on the County website ( <a href="http://www.alamance-nc.com">www.alamance-nc.com</a> ).	Deleted	This action is handled by Alamance County
6	Maintain shelter agreements with the American Red Cross	Deleted	The Town will continue to coordinate with Alamance County Emergency Management on sheltering.
9	Propose a policy prohibiting the development of critical public facilities in the 100-year floodplain in cases where viable alternatives exist. Presently, most critical facilities located in the floodplain are waste pump stations because they must be located at low elevations because the handle gravity flowing sewage.	Completed	Completed with adoption of the Flood Damage Prevention Ordinance in 2017. The Town of Haw River Public Works along with the Town Engineer (Alley, Williams, Carmen, and King) and the Town Manager coordinate an inventory of all public facilities and identify the facilities that are within the 100 year floodplain-if any.
12	Develop specific regulations that prohibit dumping in the county's watersheds	Deleted	This action would have a limited area of impact and is not currently a priority.
<b>Town of Ossipee</b>			
3	Maintain hazard mitigation plan and floodplain information on the County website ( <a href="http://www.alamance-nc.com">www.alamance-nc.com</a> ).	Deleted	This action is handled by Alamance County
4	Expand the County's Geographic Information System (GIS) capabilities to include maintaining Elevation Certificates in a computer database	Deleted	Not a local priority.
<b>Town of Sweetsville</b>			
5	Maintain hazard mitigation plan and floodplain information on the County website ( <a href="http://www.alamance-nc.com">www.alamance-nc.com</a> ).	Deleted	This action is handled by Alamance County
6	Maintain shelter agreements with the American Red Cross	Deleted	The Town will continue to coordinate with Alamance County Emergency Management on sheltering.
10	Expand the County's Geographic Information System (GIS) capabilities to include maintaining Elevation Certificates in a computer database	Deleted	This is a County responsibility
<b>Durham County</b>			
1	Continued enforcement of Flood Damage Prevention Ordinance	Deleted	Not an actual project
2	Continued participation in the NFIP CRS program.	Deleted	Not an actual project
3	Continued enforcement of Subdivision Ordinance	Deleted	Not an actual project
4	Continued enforcement of County Zoning Ordinance	Deleted	Not an actual project
5	Continued enforcement of County Soil Erosion and Sedimentation Control Ordinance.	Deleted	Not an actual project

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2015 Action #	Description	2020 Status	Status Comments/Explanation
6	Continued enforcement of Safe and Sanitary Housing Ordinance.	Deleted	Not an actual project
7	Continued enforcement of Fire Prevention/Hazardous Materials Permitting and Storage regulations	Deleted	Not an actual project
8	Continue tree-trimming programs for storm damage prevention.	Deleted	Not an actual project
9	Continued implementation of Stormwater Management Plan	Deleted	Not an actual project
10	Continued implementation of Comprehensive Plan.	Deleted	Not an actual project
11	Continue all aspects of Floodplain Management Program	Deleted	Not an actual project
12	Continued enforcement of state building codes and more stringent local building requirements.	Deleted	Not an actual project
13	Look for opportunities to mitigate repetitive loss structures.	Deleted	Not an actual project
14	Continue all-hazards public information campaign.	Deleted	Not an actual project
<b>City of Durham</b>			
1	Continued enforcement of Flood Damage Prevention Ordinance	Deleted	Not an actual project
2	Continued enforcement of Subdivision Ordinance	Deleted	Not an actual project
3	Continued enforcement of city zoning ordinance	Deleted	Not an actual project
4	Continued enforcement of soil erosion and sedimentation control ordinance.	Deleted	Not an actual project
5	Continued enforcement of Safe and Sanitary Housing Ordinance.	Deleted	Not an actual project
6	Continued enforcement of Fire Prevention/Hazardous Materials Permitting and Storage regulations	Deleted	Not an actual project
7	Continue all aspects of Floodplain Management Program	Deleted	Not an actual project
8	Continue tree-trimming programs for storm damage prevention.	Deleted	Not an actual project
9	Continue enforcement of state building codes and more stringent local building requirements	Deleted	Not an actual project
10	Look for opportunities to mitigate repetitive loss structures.	Deleted	Not an actual project
<b>Orange County</b>			
1	Orange County continues to work with State and Federal agencies to complete new floodplain mapping within its jurisdiction. Orange County development regulations do not permit new structures to be constructed in floodplain areas.	Completed	The majority of Orange county has a FIRM effective date of November 17, 2017. panels near Durham County have an effective date of October 19, 2018. FEMA updated those panels more recently which is why we have 2 effective dates in the County.

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2015 Action #	Description	2020 Status	Status Comments/Explanation
11	Explore the possibility of retrofitting existing critical facilities with back-up generators.	Completed	Orange County has 20 County facilities with generators installed and functional. All major facilities as well as Community centers: In 2015-2016 two generators were added to Seymour Center and Whitted Health Department Facilities. In 2017-2018 six more were added to Animal Services, Cedar Grove Community Center, Rogers Rd. Community Center, Efland Community Center, Hillsborough Commons, and Passmore Center. Additionally, there is now a portable generator that can support activities in the field.
<b>Town of Carrboro</b>			
5 (2015)	Seek funding to install backup generators or quick connect hook ups for mobile generators on any newly constructed county/town critical facilities	Deleted	See the description for Item #4. Already covered by another ongoing action.
<b>Town of Chapel Hill</b>			
17	Encourage the creation of a stormwater utility to manage these problems.	Completed	Completed in 2004
6	Use Purchase Developments Rights, and explore Transfer of Development Rights	Completed	While TDR is not utilized often, it's in the Town's Code of Ordinances as an option (LUMO Section 3.9.2 Transfer of Development Rights).
7	Encourage landowner compacts.	Deleted	This is not a practice the town uses. Delete
8	Encourage development of selected "opportunity areas" to achieve Comprehensive Plan objectives.	Deleted	The Town is undertaking an evaluation of its future land use map and development through an initiative called "Charting Our Future" ( <a href="http://chartingourfuture.info/">http://chartingourfuture.info/</a> ).
12	Prepare and adopt small area plans to implement Comprehensive Plan concepts.	Deleted	The Town is undertaking an evaluation of its future land use map and development through an initiative called "Charting Our Future" ( <a href="http://chartingourfuture.info/">http://chartingourfuture.info/</a> ).
4	Develop an area-wide map of potential conservation lands.	Deleted	We may do a map of Town owned Open Space, but we have no plans to do the analysis necessary for a conservation map, whether that is conservation for hazard mitigation or other purposes
18	Creation of a Community Facilities Plan to outline plans for providing police, fire, wastewater services, etc to area where growth is expected to occur.	Deleted	

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2015 Action #	Description	2020 Status	Status Comments/Explanation
<b>Town of Hillsborough</b>			
7.2.2	Seek funding to retrofit critical facilities and Town-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, 320 or 361 compliant safe rooms, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	Deleted	The town has down some of the measures, such as generator installs, yet most of these items are more applicable to new construction, which makes this goal a constantly moving target.
7.2.3	Seek funding to install backup generators or quick-connect hook ups for mobile generators on any newly constructed town critical facilities	Completed	This was completed in 2018 after the renovation of the Town Annex. Moving forward, this is a code requirement, not a goal.
7.1.5	Provide preparedness and mitigation information via TV segments on Channel 18	Completed	This was completed in 2017. The public access channel is no longer in service as of 2018. Currently the town utilizes its social media platforms to communicate preparedness and prevention information to the public.
<b>Person County</b>			
P-2	Develop a policy to minimize public services to proposed new structures that will be located in 100-year floodplain areas.	Deleted	Not feasible or necessary.
P-5	Review and revise the Planning Ordinance to allow for clustering of residential lots.	Complete	Person County's Zoning Ordinance currently contains provisions for clustering of residential lots
ES-16	Maintain/improve shelter capacities with alternative power/heat sources.	Deleted	This is a repeated action.
PI-9	Policy and procedures related to storm damage and disconnected utility services: 1) inform public via television, radio and newspaper of the necessary steps to have utilities restored; 2) restrict travel as necessary while collecting damage assessment data; 3) conduct inspections on first come, first serve basis; 4) work overtime to expedite utility reconnections.	Deleted	Combined with ongoing public education action. The City and County will add and maintain information on inclement weather related damages to their website and local newspaper when a significant event occurs.
PI-17	Create and maintain a zoning map (digital) that can be easily reproduced/updated for staff and public use	Complete	Person County has an interactive GIS map
PI-18	The Person County Assistant Manager/Engineer will assist the Planning Department and citizens when necessary to evaluate drainage, erosion, and flooding.	Deleted	County Engineer position eliminated
<b>City of Roxboro</b>			
P-2	Review policy to minimize public services to proposed new structures that will be located in 100-year floodplain areas.	Deleted	No service extensions scheduled through 2016, per old plan.
P-3	Review and Revise the Floodplain Ordinance to raise the minimum flood protection above the current highest grade of 2'.	Deleted	Incomplete. No interest to impose further restrictions on development at this time.

## SECTION 2: PLANNING PROCESS

2015 Action #	Description	2020 Status	Status Comments/Explanation
P-4	Consider adopting a UDO	Completed	Completed in 2017.
P-7	Policy and Procedures related to storm damage and disconnected utility services.	Deleted	Combined with ongoing public outreach effort. Handled in conjunction with appropriate departments
P-9	Consider prohibiting the subdivision of residentially zoned property that creates new buildable lots within floodplain or flood hazard areas.	Deleted	No interest to impose further restrictions on development at this time.
P-10	Consider strengthening the water and sewer extension ordinance to prohibit services to new development within flood hazard areas.	Deleted	Incomplete. There is little support or interest in completely restricting all development within the floodplain, as much of the flood hazard areas for the City of Roxboro are located along 501 (our major transportation corridor).
PP-15	Implement a Residential Rental Registration Program	Deleted	Incomplete. No interest expressed at this time. Attempted previously, was not successfully sustainable.
PP-16	Conduct educational workshops and prepare informational brochures re: Min Housing Standards	Deleted	Lack of staffing ability and/or funding may be the driving factor. Fairly benign to the public, unsure if any perceivable benefit to be gained from the added expense and staff time.
NR-17	Work with US Army Corps of Engineers on wetlands protection	Deleted	Lack of staffing, lack of funding
PI-23	Update flood hazard maps to reflect new subdivisions and changes to corporate limits.	Deleted	Currently working on updates to ordinance and adoption of new maps. This action is combined with existing ongoing action



## 3 Planning Area Profile

This section provides a general overview of the current conditions in the Eno-Haw region and its participating municipalities. It consists of the following sub-sections:

- ▶ 3.1 Geography and Environment
- ▶ 3.2 Population and Demographics
- ▶ 3.3 Historic Properties
- ▶ 3.4 Housing
- ▶ 3.5 Infrastructure
- ▶ 3.6 Current and Future Land Use
- ▶ 3.7 Employment and Industry

### 3.1 GEOGRAPHY AND ENVIRONMENT

The Eno-Haw region, which contains Alamance, Durham, Orange, and Person Counties, is located in north central North Carolina in the piedmont. A location map is provided in Figure 3.1.

The planning area comprises a total land area of approximately 1,499 square miles, the sum of the total area of each participating county. Note that several jurisdictions extend into neighboring counties that are not participants of this plan. The full extent of these jurisdictions is including in the planning area and scope of this plan. The total land area of each participating jurisdiction is listed in Table 3.1.

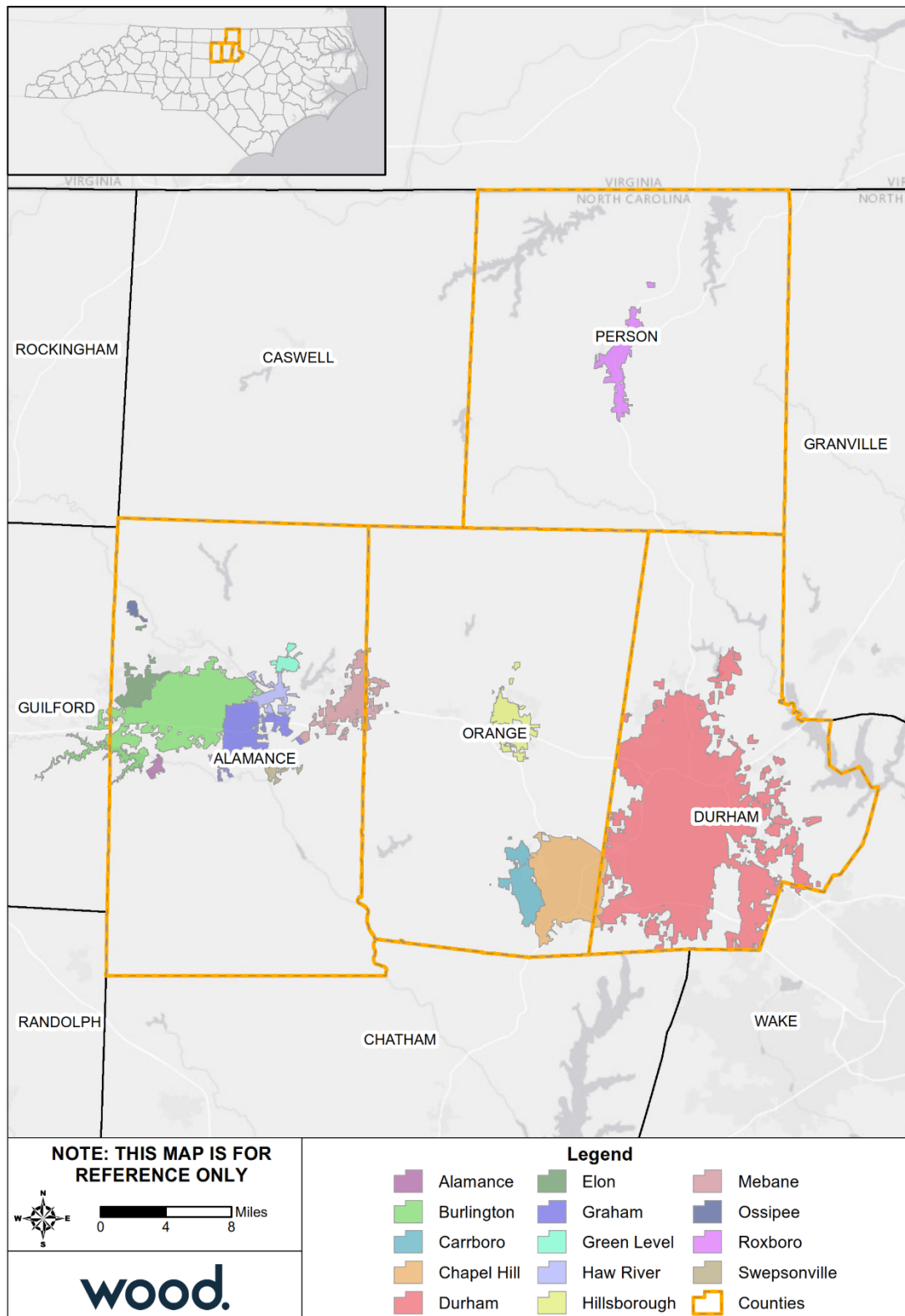
**Table 3.1 – Total Land Area of Participating Jurisdictions**

Jurisdiction	Total Area (sq. mi.)
<b>Alamance County</b>	<b>423.3</b>
City of Burlington*	25.4
City of Graham	9.7
City of Mebane*	8.5
Town of Elon	3.9
Town of Green Level	1.4
Town of Haw River	2.9
Town of Ossipee	0.6
Town of Swepsonville	1.5
Village of Alamance	0.8
<b>Durham County</b>	<b>286.3</b>
City of Durham*	108.3
<b>Orange County</b>	<b>397.4</b>
Town of Carrboro	6.5
Town of Chapel Hill*	21.3
Town of Hillsborough	4.6
<b>Person County</b>	<b>392.1</b>
City of Roxboro	6.4
<b>Region Total</b>	<b>1,499.2</b>

Source: US Census Bureau, [www.data.census.gov](http://www.data.census.gov)

\*These jurisdictions extend into neighboring counties

Figure 3.1 – Eno-Haw Region Location Map

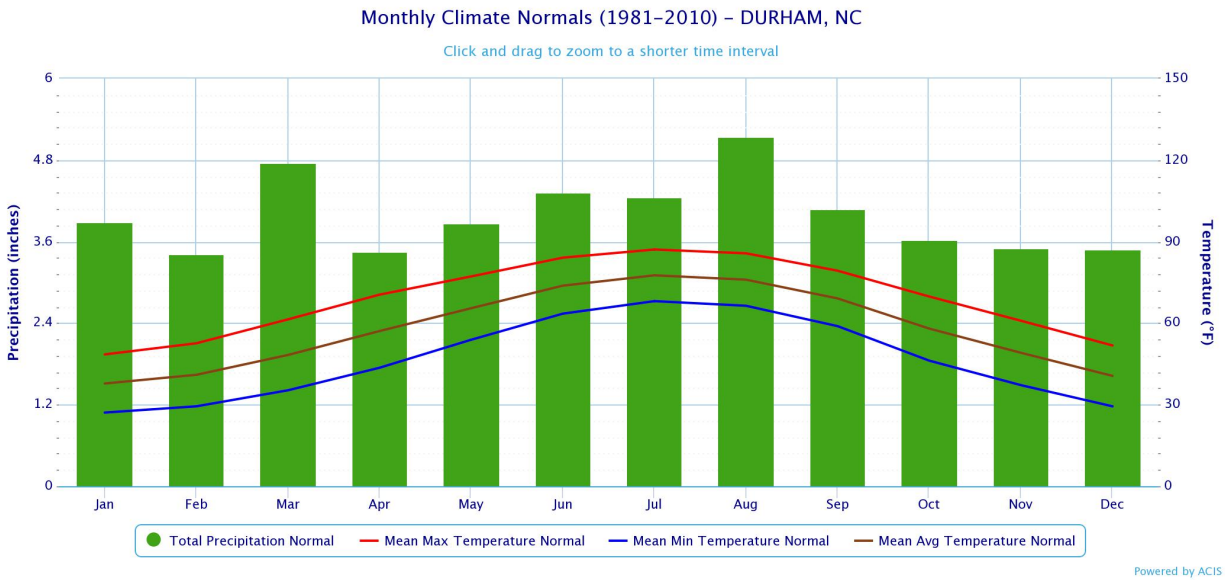


Source: U.S. Census Bureau

## SECTION 3: PLANNING AREA PROFILE

According to the Köppen climate classification system, the Eno-Haw region has a humid subtropical climate characterized by mild winters and hot humid summers with significant precipitation even during the driest month. The region experiences an average annual high temperature of 69.1°F and an average annual low of 46.6°F. Average annual rainfall is approximately 47.8 inches and average annual snowfall is 1.9 inches. Figure 3.2 shows the average monthly precipitation for the Durham weather station, which approximates temperature and precipitation of the region.

**Figure 3.2 – Average Monthly Temperature and Precipitation**



Source: Northeast RCC CLIMOD 2.

As shown in the map of HUC-8 watersheds in Figure 3.3, the majority of the Eno Haw region is split between the Haw River Basin, the Upper Neuse River Basin, and the Lower Dan River Basin.

### Wetlands

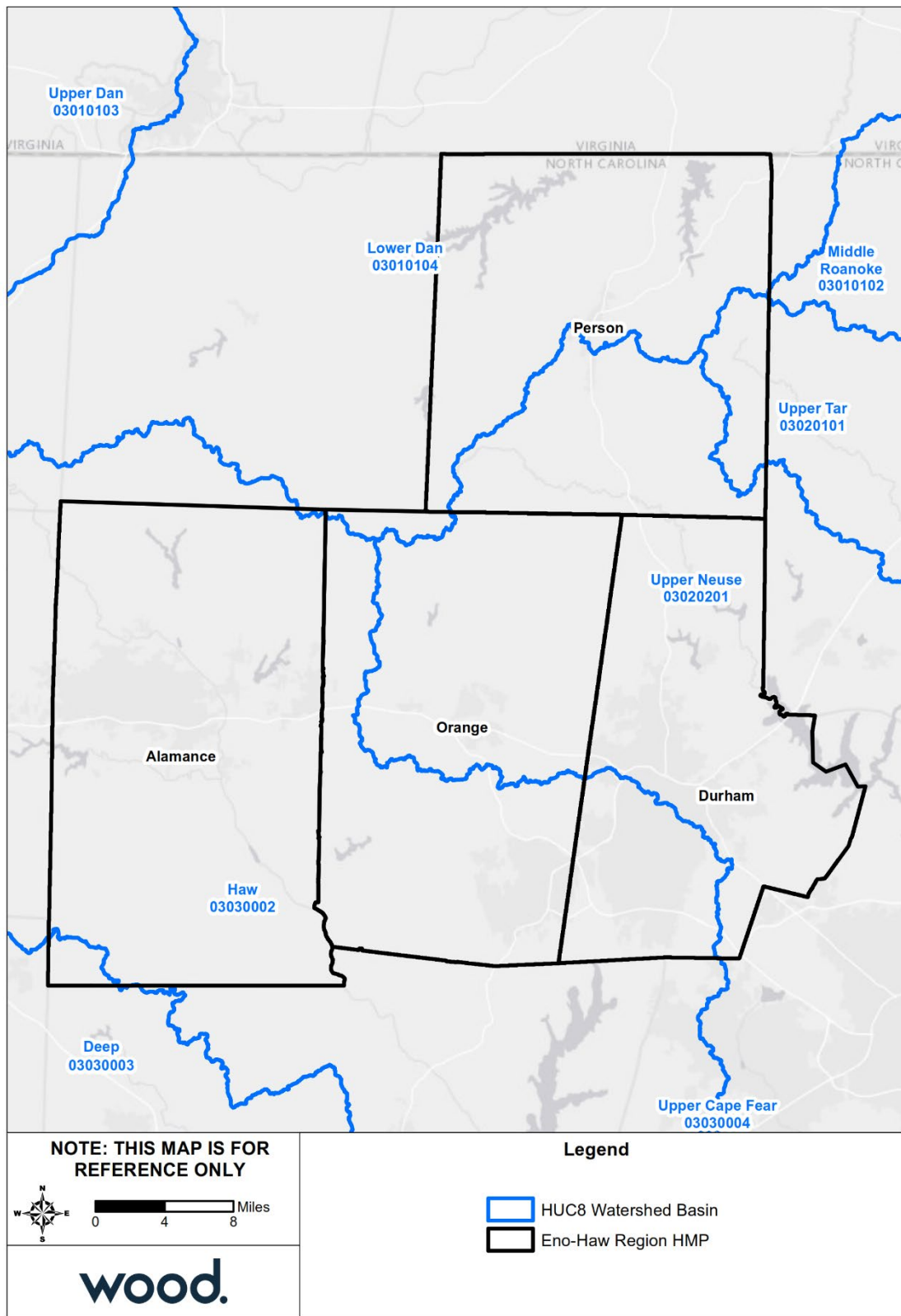
According to data from the U.S. Fish and Wildlife Service's National Wetlands Inventory, there are approximately 49,490 acres of wetlands in the region. Wetland areas are shown in Figure 3.4.

**Natural and Beneficial Wetland Functions:** The benefits of wetlands are hard to overestimate. They provide critical habitat for many plant and animal species that could not survive in other habitats. They are also critical for water management as they absorb and store vast quantities of storm water, helping reduce floods and recharge aquifers. Not only do wetlands store water like sponges, they also filter and clean water as well, absorbing toxins and other pollutants.

### Parks, Preserve, and Conservation

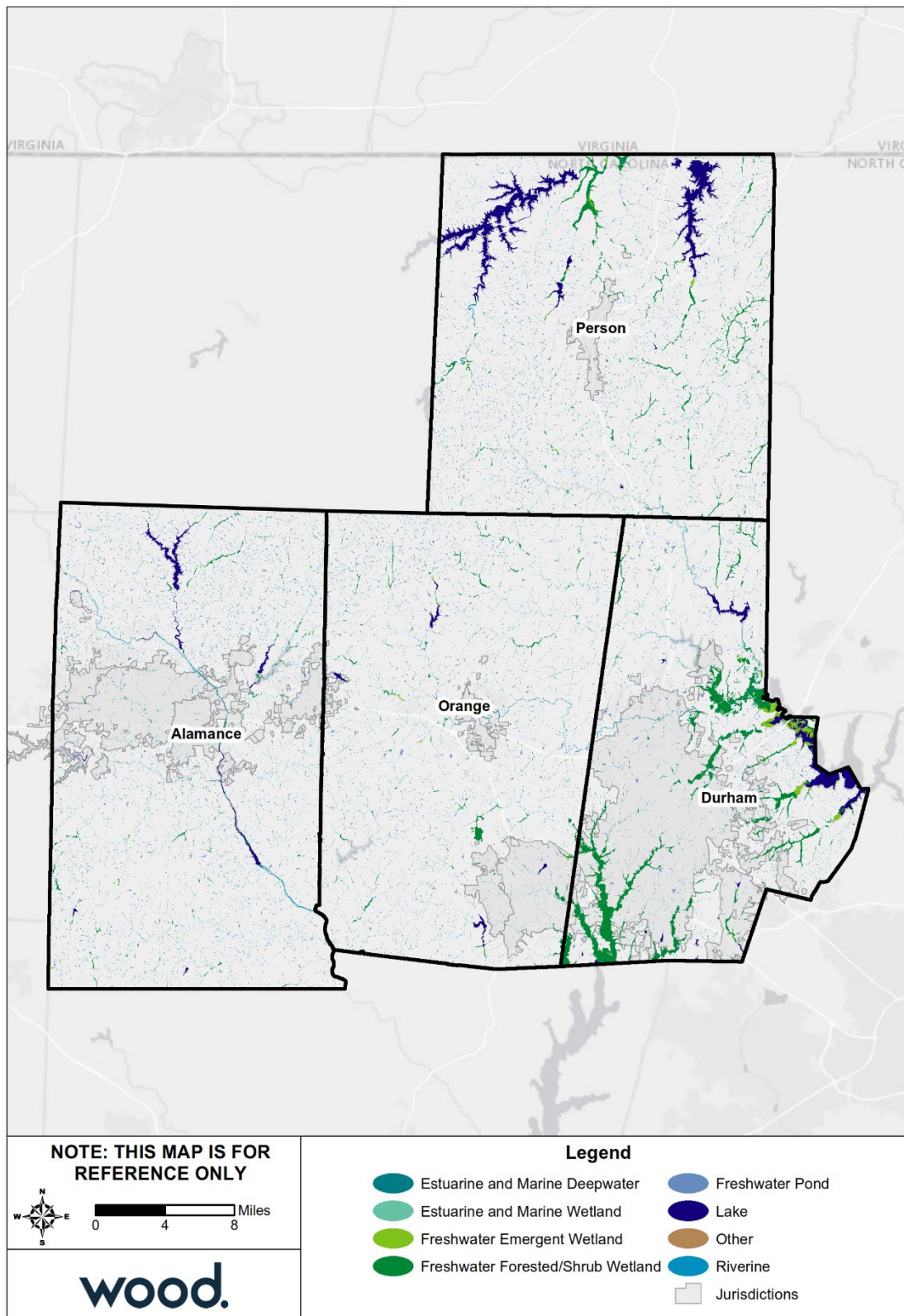
The Eno Haw region is home to many parks, preserves, and other natural areas including three state parks: Eno River State Park in Durham and Orange Counties, Falls Lake State Recreation Area located partially in Durham County, and Oconeechee Mountain State Park in Orange County. The Mountains-to-Sea State Trail also runs through Alamance, Orange, and Durham Counties.

Figure 3.3 – HUC-8 Drainage Basins



Source: USDA Natural Resources Conservation Service

Figure 3.4 – Wetland Areas by Type



Source: U.S. Fish & Wildlife Service National Wetlands Inventory

Eno-Haw

Regional Hazard Mitigation Plan  
2020



## SECTION 3: PLANNING AREA PROFILE

### Threatened and Endangered Species

The U.S. Fish and Wildlife Service maintains a regular listing of threatened species, endangered species, species of concern, and candidate species for counties across the United States. Table 3.2 below lists the species identified as threatened, endangered, or other classification and which county they are found in.

**Table 3.2 – Threatened and Endangered Species, Eno-Haw Region**

Group	Common Name	Scientific Name	Federal Status	County
Amphibians	Neuse River waterdog	Necturus lewisi	Proposed Threatened	D, O, P
Birds	Red-cockaded woodpecker	Picoides borealis	Endangered	O
Clams	Dwarf wedgemussel	Alasmidonta heterodon	Endangered	D, O, P
Clams	Green floater	Lasmigona subviridis	Under Review	D, O, P
Clams	Atlantic pigtoe	Fusconaia masoni	Proposed Threatened	A, D, O, P
Clams	Yellow lance	Elliptio lanceolata	Threatened	P
Fishes	Cape Fear shiner	Notropis mekistocholas	Endangered	A, O
Fishes	Carolina madtom	Noturus furiosus	Proposed Endangered	D, O, P
Flowering Plants	Smooth coneflower	Echinacea laevigata	Endangered	D
Flowering Plants	Michaux's sumac	Rhus michauxii	Endangered	D
Mammals	Little brown bat	Myotis lucifugus	Under Review	D

Source: U.S. Fish & Wildlife Service (<https://www.fws.gov/endangered/>)

Key: A = Alamance County; D = Durham County; O = Orange County; P = Person County

## 3.2 POPULATION AND DEMOGRAPHICS

The Eno-Haw region has experienced significant population growth over the last several decades. According to U.S. Census data from the Decennial Census and the American Community Survey (ACS) 5-Year Estimates, from 2000 to 2018, the region's total population increased by nearly 28 percent, which equates to an average annual growth rate of about 1.5 percent. Overall population density in the region increased from approximately 378.6 persons per square mile in 2010 to 433.1 persons per square mile in 2018. Table 3.3 provides population counts from 2000, 2010, and 2018 for each of the participating counties. Population statistics for participating jurisdictions are included in each jurisdiction's annex. Figure 3.5 on the following page shows 2017 population density by census tract in persons per square mile.

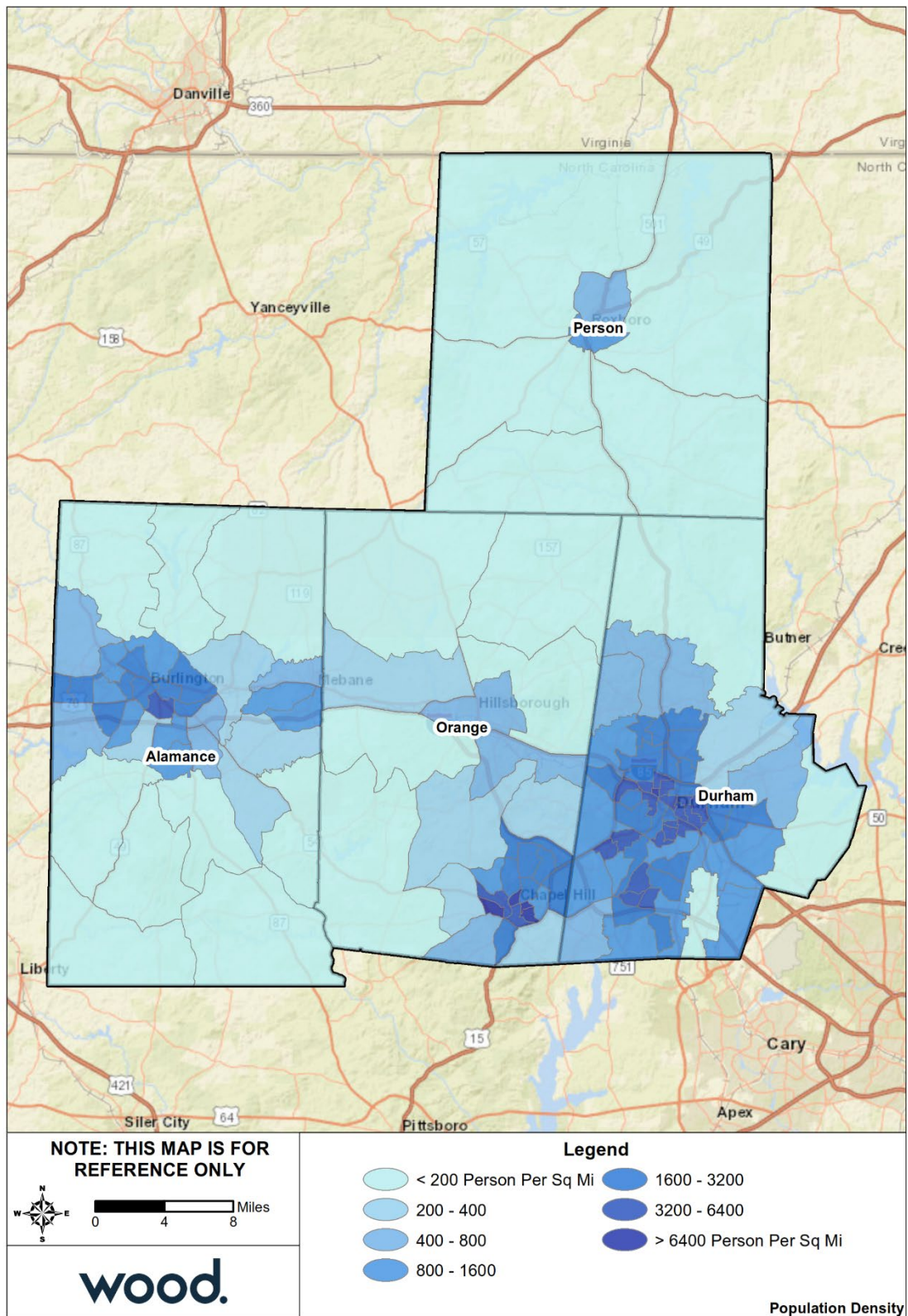
**Table 3.3 – Eno-Haw Region Population Counts**

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
Alamance County	130,800	146,902	160,576	13,674	9.3%
Durham County	223,314	257,466	306,457	48,991	19.0%
Orange County	118,227	124,244	142,938	18,694	15.0%
Person County	35,623	39,022	39,305	283	0.7%
<b>Region Total</b>	<b>507,964</b>	<b>567,634</b>	<b>649,276</b>	<b>81,642</b>	<b>14.4%</b>

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2018 5-Year Estimates



Figure 3.5 – Population Density, 2017



Source: U.S. Census Bureau, American Community Survey 2013-2017 5-Year Estimates

## SECTION 3: PLANNING AREA PROFILE

Table 3.4 details demographic and social characteristics of each of the participating counties compared to the State of North Carolina overall according to the 2018 ACS 5-Year Estimates. Per this data, Alamance County and Person Counties have older populations than the state average, and a greater proportion of individuals with disabilities. Alamance, Durham, and Orange Counties have a greater percentage of individuals who speak English less than very well. Educational attainment is higher than the state average in Durham and Orange Counties but lower in Alamance and Person Counties.

**Table 3.4 – Eno Haw Region Demographic Summary, 2018**

Demographic & Social Characteristics	Alamance County	Durham County	Orange County	Person County	North Carolina
Median Age	39.5	35.2	34.7	43.2	38.6
% of Population Under 5 years old	5.8	6.7	4.6	5.2	5.9
% of population Over 65 years old	16.4	12.1	12.8	18.4	15.5
% of Population Over 25 with high school diploma	85.5%	88.4%	92.7%	86.3%	87.4%
% of Population Over 25 with bachelor's degree or higher	24.0%	47.5%	57.6%	15.3%	30.5%
% with Disability	14.3	10.0	8.8	18.8	13.6
% Speak English less than "very well"	5.5	8.7	5.9	1.6	4.6

Source: US Census Bureau, American Community Survey 2014-2018 5-Year Estimates

The racial characteristics of the participating counties, compared to the state average, are presented in Table 3.5. Alamance, Orange, and Person Counties are a majority White, while Durham County has no racial majority, with a greater proportion of Hispanic and African American individuals. Compared to the state average, Alamance and Durham Counties have larger Hispanic populations, Durham and Person Counties have larger African American populations, and Durham and Orange Counties have larger Asian populations.

**Table 3.5 – Eno-Haw Region Racial Demographics, 2018**

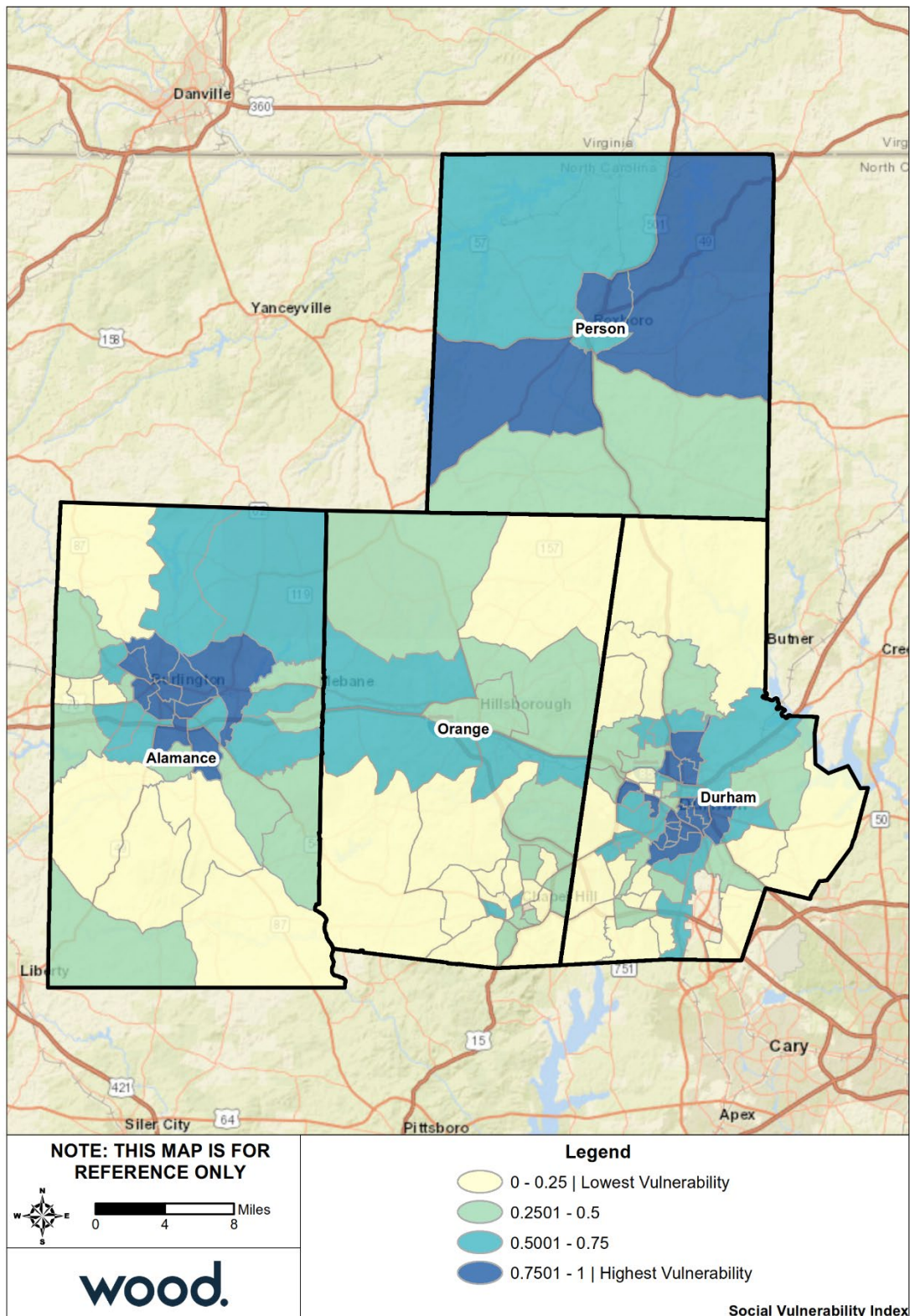
Demographics	Alamance County	Durham County	Orange County	Person County	North Carolina
Total Population	160,576	306,457	142,938	39,305	10,155,624
White, not Hispanic	64.6%	42.2%	69.3%	66.4%	63.3%
Hispanic or Latino	12.4%	13.4%	8.4%	4.2%	9.2%
Black or African American	19.0%	36.5%	11.2%	26.7%	21.10%
Asian	1.5%	4.9%	7.7%	0.4%	2.8%
American Indian and Alaska Native	0.3%	0.2%	0.5%	0.4%	1.1%
Native Hawaiian and Other Pacific Islander	0.0%	0.0%	0.0%	0.0%	0.1%
Some other race	0.2%	0.3%	0.2%	0.1%	0.2%
Two or more races	2.0%	2.4%	2.7%	1.9%	2.2%

Source: US Census Bureau, American Community Survey 2014-2018 5-Year Estimates

Figure 3.6 displays social vulnerability information for the Eno-Haw Region by census tract according to 2016 data and analysis by the Centers for Disease Control and Prevention (CDC). The CDC's Social Vulnerability Index (SVI) indicates the relative vulnerability within census tracts based on 15 social factors: poverty, unemployment, income, education, age, disability, household composition, minority status, language, housing type, and transportation access. Higher social vulnerability is an indicator that a community may be limited in its ability to respond to and recover from hazard events. Therefore, using this SVI information can help the Region and jurisdictions to prioritize pre-disaster aid, allocate emergency preparedness and response resources, and plan for the provision of recovery support.



Figure 3.6 – Social Vulnerability Index by Census Tract, 2016



Source: Centers for Disease Control and Prevention (CDC) / Agency for Toxic Substances and Disease Registry (ATSDR) / Geospatial Research, Analysis, and Services Program (GRASP).

### 3.3 HISTORIC PROPERTIES

As of January 8, 2020, the Eno-Haw region had 217 listings on the National Register of Historic Places including 68 in Alamance County, 85 in Durham County, 52 in Orange County, and 12 in Person County, detailed in Table 3.6. Of the 217 total listings in the region, 57 listings are Historic Districts. Listing on the National Register signifies that these structures and districts have been determined to be worthy of preservation for their historical or cultural values. Additionally, seven of these properties are also listed as National Historic Landmarks; four are located in Durham County and three are located in Orange County.

**Table 3.6 – National Register of Historic Places Listings in the Eno-Haw Region**

Ref#	Property Name	Listed Date	City
<b>Alamance County</b>			
70000435	Alamance Battleground State Historic Site	2/26/1970	Alamance
07000821	Alamance Mill Village Historic District	8/16/2007	Alamance
77000988	Holt, L. Banks, House	4/18/1977	Alamance
84000301	Altamahaw Mill Office	11/20/1984	Altamahaw
87001099	Bellemont Mill Village Historic District	7/1/1987	Bellemont
87000454	Kernodle--Pickett House	3/23/1987	Bellemont
84001906	Alamance Hotel	5/31/1984	Burlington
70000436	Allen House	2/26/1970	Burlington
84001909	Atlantic Bank and Trust Company Building	5/31/1984	Burlington
09000599	Beverly Hills Historic District	8/5/2009	Burlington
90001320	Downtown Burlington Historic District	9/6/1990	Burlington
00000393	East Davis Street Historic District	4/20/2000	Burlington
84001914	Efird Building	5/31/1984	Burlington
84001917	First Baptist Church	5/31/1984	Burlington
84001919	First Christian Church of Burlington	5/31/1984	Burlington
93001197	Fogleman, Polly, House	11/22/1993	Burlington
84001920	Holt-Frost House	5/31/1984	Burlington
84001921	Horner Houses	5/31/1984	Burlington
84001922	Lakeside Mills Historic District	5/31/1984	Burlington
16000585	May Hosiery Mills Knitting Mill	8/26/2016	Burlington
86003438	McCray School	12/4/1986	Burlington
82003420	Menagerie Carousel	8/30/1982	Burlington
84001924	Moore-Holt-White House	5/31/1984	Burlington
01001427	South Broad--East Fifth Streets Historic District	12/31/2001	Burlington
80002800	Southern Railway Passenger Station	5/23/1980	Burlington
79001653	St. Athanasius Episcopal Church and Parish House and the Church of the Holy Comforter	5/29/1979	Burlington
84001926	Stagg House	5/31/1984	Burlington
87000457	Sunny Side	3/23/1987	Burlington
88001594	US Post Office	9/23/1988	Burlington
84000359	West Davis Street-Fountain Place Historic District	11/5/1984	Burlington
16000219	Western Electric Company--Tarheel Army Missile Plant	5/2/2016	Burlington
84001930	Windsor Cotton Mills Office	5/31/1984	Burlington
88000166	Elon College Historic District	3/22/1988	Elon College
94000130	Johnston Hall	3/7/1994	Elon College

### SECTION 3: PLANNING AREA PROFILE

Ref#	Property Name	Listed Date	City
79001654	Glencoe Mill Village Historic District	2/16/1979	Glencoe
10001055	Glencoe School	12/27/2010	Glencoe
79001655	Alamance County Courthouse,	5/10/1979	Graham
86003455	Cedarock Park Historic District	12/4/1986	Graham
83001834	Graham Historic District	4/7/1983	Graham
06000687	Morrow, William P., House	8/9/2006	Graham
99000698	North Main Street Historic District	6/10/1999	Graham
14000291	Oneida Cotton Mills and Scott--Mebane Manufacturing Company Complex	6/9/2014	Graham
100001627	Granite Mill	9/18/2017	Haw River
82003421	Holt, Charles T., House	6/1/1982	Haw River
87001850	Scott, Kerr, Farm	10/31/1987	Haw River
01001025	Cates, Charles F. and Howard, Farm	9/24/2001	Mebane
93001194	Cook, William, House	11/22/1993	Mebane
86003451	Cooper School	12/15/1986	Mebane
84001912	Cross Roads Presbyterian Church & Cemetery and Stainback Store	5/22/1984	Mebane
10001054	Durham Hosiery Mill No. 15	12/27/2010	Mebane
83001835	Griffis-Patton House	3/17/1983	Mebane
93001195	Guy, Thomas, House	11/22/1993	Mebane
78001926	Hawfields Presbyterian Church	12/15/1978	Mebane
87000411	Henderson Scott Farm Historic District	9/16/1987	Mebane
11000952	Mebane Commercial Historic District	12/22/2011	Mebane
11000953	Old South Mebane Historic District	12/22/2011	Mebane
13000933	Old South Mebane Historic District (Boundary Increase)	12/16/2013	Mebane
82003422	White Furniture Company	7/29/1982	Mebane
91001745	Woodlawn School	11/29/1991	Mebane
98000546	Saxapahaw Spinning Mill, Former	5/20/1998	Saxapahaw
93001198	Thompson, James Monroe, House	11/22/1993	Saxapahaw
93001193	Braxton, Hiram, House	11/22/1993	Snow Camp
87000456	Friends Spring Meeting House	3/19/1987	Snow Camp
93001196	McBane, Camilus, House	11/22/1993	Snow Camp
89000497	Snow Camp Mutual Telephone Exchange Building	6/9/1989	Snow Camp
93001192	Spoon, A. L., House	11/22/1993	Snow Camp
85003083	Kerr--Patton House	12/5/1985	Thompson
94000022	McCauley--Watson House	2/4/1994	Union Ridge
<b>Durham County</b>			
11000955	Hampton--Ellis Farm	12/22/2011	Bahama
72000960	Hardscrabble	1/20/1972	Bahama
100000896	Little River High School	4/17/2017	Bahama
04001287	Poland, George, House	12/4/2004	Bahama
99001684	Tilley, Marcus, House	1/14/2000	Bahama
89001418	Umstead, Adolphus W., House	9/14/1989	Bahama
14000983	Umstead, D.C., Store and House	12/2/2014	Bahama
75001257	Leigh Farm	9/5/1975	Chapel Hill
85000118	Little Creek Site (31 DH 351)	1/11/1985	Chapel Hill
85001554	Meadowmont	7/11/1985	Chapel Hill
00001163	American Tobacco Company Manufacturing Plant	9/29/2000	Durham

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Ref#	Property Name	Listed Date	City
79003330	Bassett House	11/29/1979	Durham
70000452	Bennett Place State Historic Site	2/26/1970	Durham
12001157	Biddle, Mary Duke, Estate	1/9/2013	Durham
90000350	Blacknall, Richard D., House	3/1/1990	Durham
99001619	Bright Leaf Historic District	12/30/1999	Durham
74001346	Bull Durham Tobacco Factory	9/10/1974	Durham
82003448	Bullington Warehouse	8/30/1982	Durham
10000631	Burch Avenue Historic District	9/3/2010	Durham
11000508	Carr, John C. and Binford, House	8/5/2011	Durham
00000394	City Garage Yard and Fire Drill Tower	5/3/2000	Durham
00000991	Clark and Sorrell Garage	8/16/2000	Durham
85002438	Cleveland Street District	9/20/1985	Durham
100003295	College Heights Historic District	1/28/2019	Durham
79003331	Cranford-Wannamaker House	11/29/1979	Durham
79003332	Crowell House	11/29/1979	Durham
79003333	Dillard-Gamble Houses	1/19/1979	Durham
77000998	Downtown Durham Historic District	11/1/1977	Durham
66000590	Duke Homestead and Tobacco Factory	11/13/1966	Durham
85001781	Duke Memorial United Methodist Church	8/11/1985	Durham
85001793	Durham Cotton Mills Village Historic District	8/9/1985	Durham
78001944	Durham Hosiery Mill	11/14/1978	Durham
13001115	Durham Hosiery Mills Dye House	1/22/2014	Durham
85003055	Durham Hosiery Mills No. 2--Service Printing Company Building	11/27/1985	Durham
04001393	East Durham Historic District	12/23/2004	Durham
85001775	Emmanuel AME Church	8/9/1985	Durham
85001778	Ephphatha Church	8/9/1985	Durham
84002724	Erwin Cotton Mills Company Mill No. 1 Headquarters Building	11/20/1984	Durham
73001337	Fairtosh Plantation	4/3/1973	Durham
05000348	Forbus, Wiley and Elizabeth, House	4/28/2005	Durham
05001476	Forest Hills Historic District	12/28/2005	Durham
13000204	Foster and West Geer Streets Historic District	4/23/2013	Durham
85001791	Golden Belt Historic District	8/9/1985	Durham
96000816	Golden Belt Historic District (Boundary Increase)	7/30/1996	Durham
82003449	Greystone	6/1/1982	Durham
78001945	Hill, John Sprunt, House	1/30/1978	Durham
13001026	Hillside Park High School	12/30/2013	Durham
85002437	Holloway Street District	9/20/1985	Durham
09000263	Holloway Street Historic District (Boundary Increase)	4/30/2009	Durham
08000814	Holloway, Kinchen, House	8/29/2008	Durham
09001105	Hope Valley Historic District	12/11/2009	Durham
78001946	Horton Grove Complex	3/17/1978	Durham
03000340	Lakewood Park Historic District	5/1/2003	Durham
08000774	Liberty Warehouse Nos. 1 and 2	8/6/2008	Durham
89000446	Mangum, Bartlett, House	5/25/1989	Durham
85001792	Morehead Hill Historic District	8/9/1985	Durham
04000567	Morehead Hill Historic District (Boundary Increase)	6/2/2004	Durham
86000676	North Carolina Central University	3/28/1986	Durham



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Ref#	Property Name	Listed Date	City
75001258	North Carolina Mutual Life Insurance Company Building	5/15/1975	Durham
98001573	North Durham County Prison Camp (Former)	12/31/1998	Durham
85001338	North Durham-Duke Park District	6/20/1985	Durham
85001777	O'Brien, William Thomas, House	8/9/1985	Durham
100000866	Pauli Murray Family Home	12/23/2016	Durham
85001782	Pearl Mill Village Historic District	8/9/1985	Durham
79003334	Pegram House	11/29/1979	Durham
85001780	Powe House	8/9/1985	Durham
09000601	Russell School	8/5/2009	Durham
85001779	Scarborough House	8/9/1985	Durham
12000345	Scott and Roberts Dry Cleaning Plant, Office, and Store	6/20/2012	Durham
85002429	Smith Warehouse	9/16/1985	Durham
76001319	St. Joseph's African Methodist Episcopal Church	8/11/1976	Durham
73001338	Stagville	5/25/1973	Durham
10001093	Stokesdale Historic District	12/28/2010	Durham
86000672	Trinity Historic District	3/26/1986	Durham
07001372	Trinity Historic District (Boundary Increase II)	1/9/2008	Durham
04000568	Trinity Historic District (Boundary Increase)	6/4/2004	Durham
03000804	Venable Tobacco Company Prizery and Receiving Room	8/21/2003	Durham
85001847	Venable Tobacco Company Warehouse	8/9/1985	Durham
84002259	Watts and Yuille Warehouses	4/5/1984	Durham
80002824	Watts Hospital	4/2/1980	Durham
01000427	Watts--Hillandale Historic District	4/25/2001	Durham
86000680	West Durham Historic District	3/26/1986	Durham
85001776	West Point on the Eno	8/9/1985	Durham
12001088	Wright's Automatic Machinery Company	12/26/2012	Durham
<b>Orange County</b>			
98000995	Jordan, Dr. Arch, House	8/6/1998	Caldwell
76001332	Alberta Mill Complex	1/19/1976	Carrboro
85001339	Carrboro Commercial Historic District	6/20/1985	Carrboro
01000016	Hogan, Thomas and Mary, House	1/26/2001	Carrboro
86001625	Lloyd, Thomas F., Historic District	8/14/1986	Carrboro
98000389	Cedar Grove Rural Crossroads Historic District	4/23/1998	Cedar Grove
13000206	Pope, Capt. John S., Farm	4/23/2013	Cedar Grove
05000325	Beta Theta Pi Fraternity House	4/20/2005	Chapel Hill
99000867	Carolina Inn	8/6/1999	Chapel Hill
71000604	Chapel Hill Historic District	12/16/1971	Chapel Hill
15000165	Chapel Hill Historic District (Boundary Increase and Additional Documentation)	4/16/2015	Chapel Hill
90000364	Chapel Hill Town Hall	3/20/1990	Chapel Hill
72000980	Chapel of the Cross	2/1/1972	Chapel Hill
93000807	Gimghoul Neighborhood Historic District	8/5/1993	Chapel Hill
96000186	Hogan, Alexander, Plantation	3/4/1996	Chapel Hill
100001633	Nash, Arthur C. and Mary S.A., House	10/26/2017	Chapel Hill
94000570	Old Chapel Hill Cemetery	6/3/1994	Chapel Hill
66000596	Old East, University of North Carolina	10/15/1966	Chapel Hill
71000605	Playmakers Theatre	6/24/1971	Chapel Hill



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Ref#	Property Name	Listed Date	City
89001039	Rocky Ridge Farm Historic District	8/8/1989	Chapel Hill
07001501	Rocky Ridge Farm Historic District (Boundary Increase)	1/30/2008	Chapel Hill
98001528	West Chapel Hill Historic District	12/31/1998	Chapel Hill
98001528	West Chapel Hill Historic District	5/9/2019	Chapel Hill
99001391	Faucette, David, House	11/22/1999	Efland
100002051	North Carolina Industrial Home for Colored Girls	1/25/2018	Efland
71000606	Ayr Mount	8/26/1971	Hillsborough
03000858	Bellevue Manufacturing Company	8/28/2003	Hillsborough
70000465	Burwell School	9/15/1970	Hillsborough
99000481	Cabe--Pratt--Harris House	4/22/1999	Hillsborough
72000981	Commandant's House	11/9/1972	Hillsborough
71000607	Eagle Lodge	4/16/1971	Hillsborough
11000622	Eno Cotton Mill	9/1/2011	Hillsborough
88001175	Faucett Mill and House	8/4/1988	Hillsborough
71000608	Hazel-Nash House	3/31/1971	Hillsborough
73001362	Heartsease	4/11/1973	Hillsborough
73001363	Hillsborough Historic District	10/15/1973	Hillsborough
02000436	Holden--Roberts Farm	5/2/2002	Hillsborough
94000184	Jackson, Jacob, Farm	3/17/1994	Hillsborough
01001187	Montrose	10/28/2001	Hillsborough
72000982	Moorefields	4/25/1972	Hillsborough
09000637	Murphey School	8/20/2009	Hillsborough
71000609	Nash Law Office	9/28/1971	Hillsborough
71000610	Nash-Hooper House	11/11/1971	Hillsborough
02000435	Occoneechee Speedway	5/2/2002	Hillsborough
71000611	Old Orange County Courthouse	6/24/1971	Hillsborough
88002026	Rigsbee's Rock House	10/20/1988	Hillsborough
71000612	Ruffin-Roulhac House	8/5/1971	Hillsborough
71000613	Sans Souci	8/26/1971	Hillsborough
78001968	St. Mary's Chapel	7/12/1978	Hillsborough
71000614	St. Matthew's Episcopal Church and Churchyard	6/24/1971	Hillsborough
79001740	Paisley-Rice Log House	1/31/1979	Mebane
78001969	Bingham School	1/18/1978	Oaks
<b>Person County</b>			
82003496	Holloway-Walker Dollarhite House	6/1/1982	Bethel Hill
83001902	Henry-Vernon House	2/3/1983	Bushy Fork
80002893	Burleigh	5/1/1980	Concord
74001369	Waverly Plantation	10/9/1974	Cunningham
88000698	Holloway--Jones--Day House	6/9/1988	Roxboro
06000229	House on Wagstaff Farm	4/5/2006	Roxboro
05000267	Long, James A. and Laura Thompson, House	4/6/2005	Roxboro
05001031	Merritt--Winstead House	9/15/2005	Roxboro
79001744	Person County Courthouse	5/10/1979	Roxboro
84002415	Roxboro Commercial Historic District	3/1/1984	Roxboro
09000660	Roxboro Cotton Mill	8/27/2009	Roxboro
82003497	Roxboro Male Academy and Methodist Parsonage	7/29/1982	Roxboro

Source: National Parks Service, National Register of Historic Places, January 2020

### 3.4 HOUSING

Table 3.7 provides details on housing characteristics in the Eno-Haw Region according to data from the 2018 ACS 5-Year Estimates and the 2010 Census.

**Table 3.7 – Eno Haw Region Housing Characteristics, 2018**

Housing Characteristics	Alamance County	Durham County	Orange County	Person County	North Carolina
Housing Units (2010)	66,576	120,217	55,597	18,193	4,327,528
Housing Units (2018)	69,749	133,429	57,502	18,428	4,573,066
Housing Units Percent Change (2010-2018)	4.8%	11.0%	3.4%	1.3%	5.7%
Housing Occupancy Rate	91.8%	92.5%	91.4%	85.4%	85.7%
% Owner-occupied	65.0%	53.8%	61.9%	75.2%	65.0%
Average Household Size	2.43	2.37	2.51	2.46	2.52
% of Housing Units with no Vehicles Available	5.3%	8.0%	5.0%	7.8%	5.9%
% of Housing Units that are mobile homes	12.0%	1.4%	8.3%	22.6%	13.0%
Median Home Value	\$147,800	\$209,300	\$292,500	\$117,100	\$165,900

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2014-2018 5-Year Estimates

As of 2018, there are 279,108 housing units in the Eno-Haw region, of which approximately 91.6 percent are occupied. Compared to the state, housing occupancy rates are greater in the Eno-Haw region, with Alamance, Durham, and Orange Counties exceeding the state average. Approximately 40.3% of housing units are renter-occupied. A high percentage of renters is an indicator of higher pre- and post-disaster vulnerability because, according to Cutter, et al. (2003), renters often do not have the financial resources of homeowners, are more transient, are less likely to have information about or access to recovery aid following a disaster and are more likely to require temporary shelter following a disaster.

Compared to the state average, housing growth has been slow in most of the region with the exception of Durham County, where total housing units have increased by 11 percent compared to 2010 counts.

The average median home value in the Eno-Haw region is \$191,675, which is approximately 15.5% higher than the state average. However, this value is skewed high by Durham and Orange Counties. Compared to the state average, median home value is 26 percent higher in Durham County and 76 percent higher in Orange County. Conversely, median home value is 11 percent lower than the state average in Alamance County and 29 percent lower in Person County.

Householders of approximately 7.3 percent of occupied housing units have no vehicle available to them; these residents may have difficulty in the event of an evacuation.

Nearly 6.9 percent of housing units in the Eno-Haw region are mobile homes, which can be more vulnerable to certain hazards, such as tornadoes and wind storms, especially if they aren't secured with tie downs.

### 3.5 INFRASTRUCTURE

#### 3.5.1 Transportation

Major highways located in the Eno-Haw region include: I-40, I-85, I-540/NC 540, US 15, US 70, US 158, US 501, NC 49, NC 54, NC 55, NC 57, NC 62, NC 86, NC 87, NC 98, NC 147, NC 157, and NC 751.

Air travel is serviced primarily by Raleigh-Durham International Airport (RDU), 12 miles southeast of Durham, which enplaned over 7.1 million passengers in 2019. RDU is partially owned by the City of

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Durham and Durham County. Non-stop daily service is provided to 61 destinations in the United States and international service is available to 10 destinations.

Amtrak operates a daily train between Charlotte and New York City (the Carolinian) which stops at the Durham Transit Station in downtown Durham and the Depot in the City of Burlington. The State of North Carolina, in cooperation with Amtrak, operates two additional daily trains between Raleigh and Charlotte which also stop in Durham and Burlington. Amtrak currently does not stop in Orange County, but all local county jurisdictions, in early 2008, indicated their support for a train station to be located in Hillsborough and the Town of Hillsborough requested North Carolina Department of Transportation Rail Division, North Carolina Railroad, and the National Railroad Passenger Corporation (Amtrak) to consider adding a stop in Hillsborough.

National bus service is provided by Greyhound and Megabus at several stops in Alamance County and the Durham Transit Station in downtown Durham.

### Alamance County

In addition to RDU, air travel for Alamance County is provided by Piedmont Triad International Airport (PTI), located in Guilford County 34 miles west of Burlington. PTI offers non-stop daily service to 14 destinations.

City of Burlington is working to provide a municipal bus service for the citizens of Burlington with designated stops in portions of the county. GoTriangle and Piedmont Area Regional Transportation began operating a weekday bus service in the Town of Mebane on Monday, with a stop at the park-and-ride lot at Alamance Regional Medical Center's MedCenter Mebane location, 3940 Arrowhead Blvd., and at City Hall, 106 E. Washington Street. The City of Graham is also served by GoTriangle and Piedmont Area Regional Transportation which also operates weekday service to citizens of Graham with transportation to Chapel Hill and Greensboro areas.

As of 2018, an estimated 85.5 percent of commuters drove alone to work, while 9.1 percent carpooled and only 0.2 percent used public transportation.

### Durham County

Most travel in Durham County is by private vehicle. Important arteries for traffic include NC 147, which connects Duke University, downtown, and Research Triangle Park (RTP), U.S. 15-501 between Durham and Chapel Hill, I-85, connecting Durham to Virginia and western North Carolina cities, and I-40 running across southern Durham County between RTP and Chapel Hill. The I-40 corridor has been the main site of commercial and residential development in Durham since its opening in the early 1990s. In 2018, an estimated 77 percent of commuters drove alone to work, 10.1 carpooled, and 3.4 percent used public transportation.

The City of Durham maintains an extensive network of bicycle routes and trails and has been recognized with a Bicycle Friendly Community Award. The American Tobacco Trail begins in downtown and continues south through RTP and ends in Wake County.

GoTriangle offers scheduled, fixed-route regional and commuter bus service between Raleigh and the region's other principal cities of Durham, Cary, and Chapel Hill, as well as to and from RDU, RTP, and several of the region's larger suburban communities. Go Triangle also coordinates an extensive vanpool and rideshare program that serves the region's larger employers and commuter destinations. GoDurham provides municipal bus service. Duke University also maintains its own transit system, Duke Transit, which operates more than 30 buses with routes throughout the campus and health system.

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### Orange County

As of 2018, an estimated 67.4 percent of commuters drove alone to work, 7.1 percent carpooled, another 7.1 percent used public transportation, and 6.1 percent walked.

GoTriangle provides regional bus service linking the Town of Chapel Hill to Research Triangle Park, Raleigh-Durham International Airport, Duke University, NC State University, and other key regional locations. GoTriangle also contracts with Orange Public Transportation (OPT) to provide service between the Towns of Hillsborough and Chapel Hill. In addition, GoTriangle has a vanpool program for commuters that have a greater than 20-mile round-trip.

### Person County

As of 2018, an estimated 85.6 percent of commuters drove alone to work, while 10.6 percent carpooled and only 0.2 percent used public transportation.

Rail transportation is provided by Norfolk and Western. Motor freight coming into and going out of Person-Roxboro has decreased significantly. Motor freight coming into and going out of Person-Roxboro is handled by a number of carriers including Motor Freight Carriers, Walker Transfer Co., Spector, Freight, Branch, Pilot, Estes, Carolina Freight Carriers and UPS. Air transportation is provided locally at the Person-Roxboro Executive Airport located just west off US 501 south of the City of Roxboro.

### 3.5.2 Utilities

Electric power for the region is provided by Duke Power. In unincorporated Alamance, Orange, and Person Counties, Piedmont Electric Membership Corporation is the electric provider. Natural gas is provided by Dominion Energy (formerly Public Service of North Carolina) for all areas and by Piedmont Natural Gas for Alamance County.

In Alamance County, municipal water service is provided by the Cities of Burlington, Elon, and Graham, the Town of Haw River, the Graham Water System, Mebane Water System, and the Orange-Alamance Water System. The City of Durham provides water, sewer, and stormwater service to City residents. In Orange County, water and sewer services are provided by the Town of Hillsborough and Orange Water and Sewer Authority. In Person County, the City of Roxboro provides water and sewer service.

## 3.6 CURRENT AND FUTURE LAND USE

### Alamance County

The Alamance County Planning Department oversees a number of community activities and the enforcement of many County regulations including: Subdivision Administration, Historic Properties, Comprehensive Planning, Water and Sewer Projects, Community Development, E-911 Addressing, Watershed Protection, and all matters relating to land development in rural Alamance County. The Alamance County Land Development Plan was adopted in August 2007 and spans a 20-year planning period of 2006-2026. The plan is available at: <https://www.alamance-nc.com/planning/wp-content/uploads/sites/21/2013/10/Land-Development-Plan.pdf>

### Durham County

Durham City-County Planning Department is responsible for planning activities throughout the City and County. Durham has a Comprehensive Plan adopted in 2008 but has begun the process of developing a new comprehensive plan that is expected to be adopted in 2022.

The existing plan still guides where and how private development should occur. It guides how the City and County should provide public facilities and services to support future growth. The Plan is long range

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in scope, focusing on the ultimate needs of the community rather than the pressing concerns of today. The Land Use Element and Future Land Use Map is available along with the complete Comprehensive Plan and maps on the City's website at: <https://durhamnc.gov/346/Comprehensive-Plan>

Durham's Future Land Use Map is shown in Figure 3.7 on the following page. The Future Land Use Map accounts for mitigation to some degree in the delineation of its Recreation and Open Space land use category, which includes special flood hazard areas, public land around reservoirs, and other conservation land and sensitive areas. In addition to the land use categories, Durham identifies Development Tiers to define the character and intensity of development planned throughout the city and county.

### Orange County

The Orange County Comprehensive Plan is an official public document that provides the framework for long range decision making in the community. The Plan serves to guide the County's growth and development through the year 2030 by addressing the multitude of issues facing the county. The Comprehensive Plan includes components related to hazard mitigation including land use, environmental protection, and public safety. In addition, the adopted Plan serves as the statutory basis for many of Orange County's land use regulations, as well as the application of zoning districts. The Orange County Comprehensive Plan can be found at: <http://www.orangecountync.gov/1242/2030-Comprehensive-Plan>

Orange County's Future Land Use Map is shown in Figure 3.8 on the following page. Orange County identifies 10-year and 20-year transition areas for growth, but also has a significant area in the southeastern quadrant of the county around the Towns of Chapel Hill and Carrboro designated as rural buffer area.

The Orange County Unified Development Ordinance provides regulations to encourage compatible development within the county in a manner which will promote the health, safety, and general welfare of Orange County and its residents. Regulations contained in the Unified Development Ordinance strive to prevent and mitigate negative impacts from natural hazards throughout the county. The Orange County Unified Development Ordinance can be found at: <https://www.orangecountync.gov/973/Code-of-Ordinances>

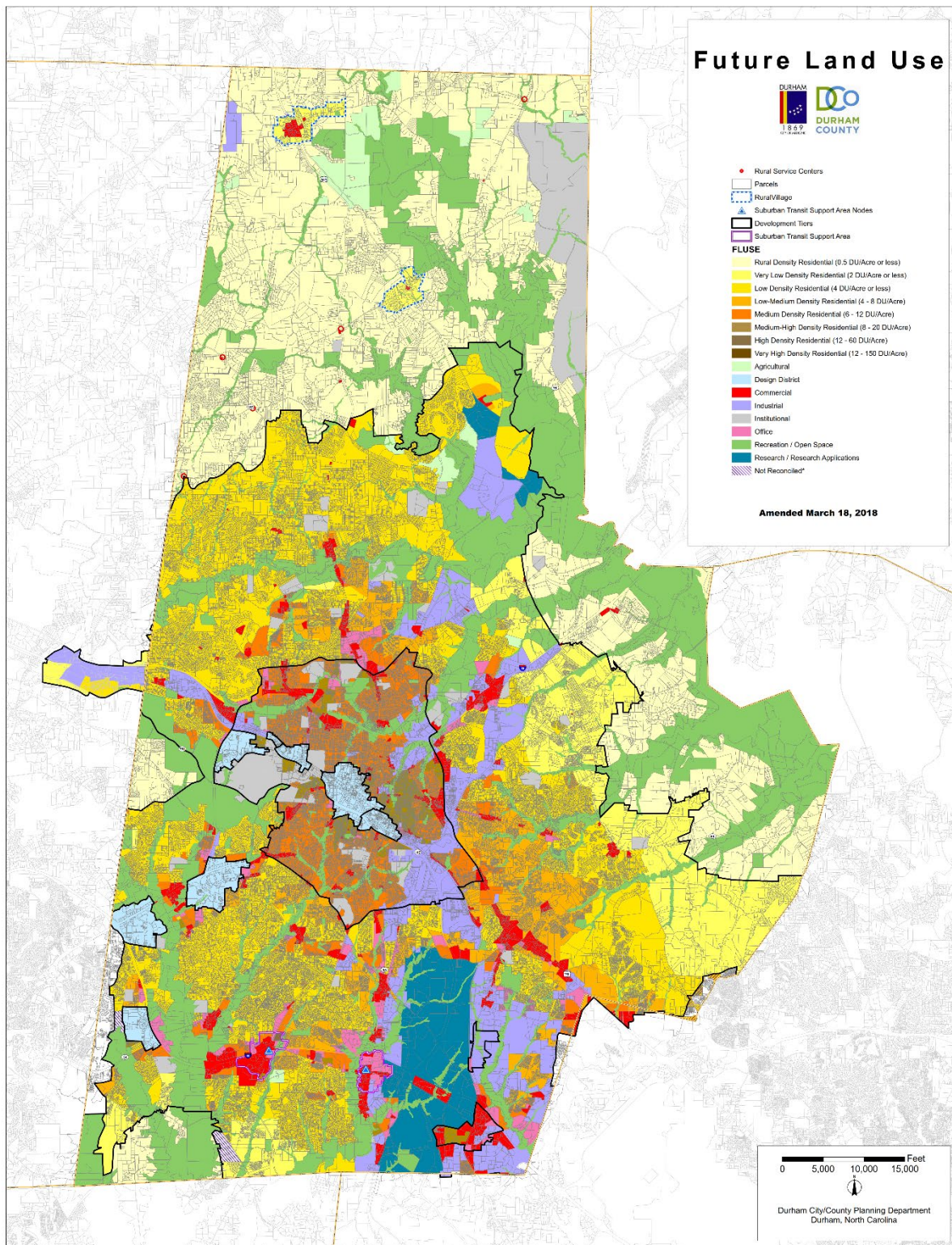
### Person County

Land uses within the City vary from an urban core of Office/Institutional, Public Facilities and Commercial along Main Street, to Residential development scattered throughout the planning jurisdiction. Other land uses include Industrial along Durham Rd. and Manufactured Home Parks and Multi-Family Dwellings scattered throughout the planning jurisdiction.

Land uses within Person County range from primarily rural-agrarian to lakeside residential and urban/suburban development in and around the City of Roxboro.



Figure 3.7 – Durham City-County Future Land Use Map



Source: Durham Comprehensive Plan, 2005

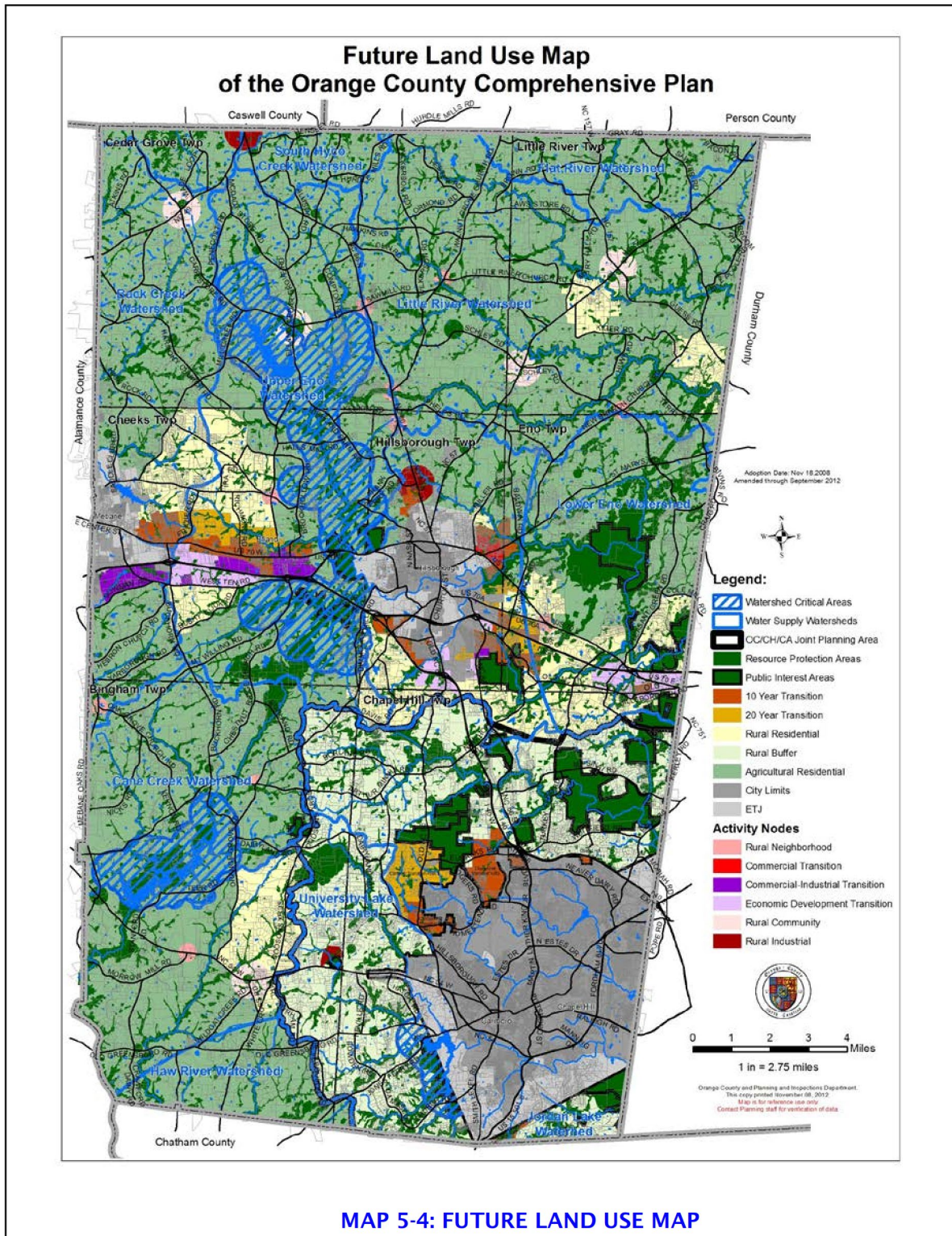
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Figure 3.8 – Orange County Future Land Use Map



Source: Orange County Comprehensive Plan 2030

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### 3.7 EMPLOYMENT AND INDUSTRY

Per the 2018 ACS 5-Year Estimates, the average median household income for the Eno-Haw region was \$55,237, which exceeds the state's median household income (\$52,413). However, by county median household income is lower than the state average in Alamance and Person Counties and higher in Durham and Orange Counties. Per capita income statistics mirror this pattern. Compared to the state, a greater proportion of the population is living below the poverty level in Alamance, Durham, and Person Counties and more of the population lacks health insurance coverage in Alamance and Durham Counties.

Table 3.8 shows economic statistics and Table 3.9 shows employment statistics for all counties in the region. Economic statistics by participating jurisdiction can be found in each jurisdiction's annex.

**Table 3.8 – Eno-Haw Region Economic Statistics, 2018**

Economic Characteristics	Alamance County	Durham County	Orange County	Person County	North Carolina
Median Household Income	\$45,735	\$58,190	\$68,211	\$48,811	\$52,413
Per Capita Income	\$26,215	\$34,063	\$40,650	\$25,922	\$29,456
Unemployment Rate	5.7%	5.2%	4.4%	8.6%	6.3%
% of Individuals Below Poverty Level	16.8	16.0	13.4	17.7	15.4
% Without Health Insurance	11.9	12.2	7.2	9.2	11.1

Source: U.S. Census Bureau, 2014-2018 American Community Survey 5-Year Estimates

**Table 3.9 – Eno-Haw Region Employment by Industry, 2018**

Industry	Alamance County	Durham County	Orange County	Person County
Agriculture, forestry, fishing and hunting, and mining	0.9%	0.4%	0.7%	1.3%
Construction	7.1%	5.9%	5.0%	8.8%
Manufacturing	16.1%	7.3%	6.0%	15.4%
Wholesale trade	2.7%	1.8%	1.5%	0.6%
Retail trade	12.6%	8.1%	8.7%	10.3%
Transportation and warehousing, and utilities	3.4%	2.8%	2.0%	6.1%
Information	1.1%	2.0%	1.6%	1.8%
Finance and insurance, and real estate and rental and leasing	4.7%	5.7%	5.4%	2.5%
Professional, scientific, and management, and administrative and waste management services	8.6%	14.2%	12.9%	8.0%
Educational services, and health care and social assistance	25.5%	33.6%	39.1%	28.8%
Arts, entertainment, and recreation, and accommodation and food services	9.6%	9.6%	9.6%	7.3%
Other services, except public administration	4.2%	4.9%	4.1%	4.4%
Public administration	3.5%	3.7%	3.3%	4.5%

Source: U.S. Census Bureau, 2014-2018 American Community Survey 5-Year Estimates

Across the region, the largest industry sector in 2018 was “educational services, and health care and social assistance,” comprising between 25.5 and 39.1 percent of employment across the participating counties. In Alamance and Person Counties, the next largest industry by employment was “manufacturing.” In Alamance County, this prominence is due in part to the continued presence of textile manufacturing; however, both counties have a variety of manufacturing. In Durham and Orange Counties, the next largest industry by employment was “professional, scientific, and management, and administrative and waste management services.” Durham County contains the majority of Research Triangle Park, a major

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employment hub for the region, which partially explains the presence of more large employers in Durham County.

Table 3.10 summarizes the major employers in each county in the Eno-Haw region from AccessNC as of the 2019 3<sup>rd</sup> quarter.

**Table 3.10 – Major Employers, Eno-Haw Region**

Company	Industry	Employment range
Alamance County		
Alamance-Burlington School System	Educational Services	1000+
Labcorp	Health Care and Social Assistance	1000+
Alamance Regional Medical Center	Health Care and Social Assistance	1000+
Elon University	Educational Services	1000+
Wal-Mart Associates Inc.	Retail Trade	1000+
Alamance County Government	Public Administration	1000+
City of Burlington	Public Administration	500-999
Gkn Driveline, Inc.	Manufacturing	500-999
Honda Power Equipment Mfg Inc	Manufacturing	500-999
Alamance Community College	Educational Services	500-999
Food Lion	Retail Trade	500-999
Industrial Connections & Solutions	Manufacturing	500-999
Glen Raven Inc	Manufacturing	250-499
People Inc	Administrative and Support and Waste Management and Remediation Services	250-499
Twin Lakes Community	Health Care and Social Assistance	250-499
Aramark Food and Support Services G	Accommodation and Food Services	250-499
Kernodle Clinic Inc	Health Care and Social Assistance	250-499
Triangle Paving Inc	Construction	250-499
McDonalds	Accommodation and Food Services	250-499
Jabil Circuit Inc	Manufacturing	250-499
Carolina Hosiery Mills Inc	Manufacturing	250-499
Lowes Home Centers Inc	Retail Trade	250-499
Carolina Biological Supply Company	Wholesale Trade	250-499
Kayser-Roth Corporation	Manufacturing	250-499
Alamance Foods Inc	Wholesale Trade	250-499
Durham County		
Duke University	Health Care and Social Assistance	1000+
511 Cleveland St	Educational Services	1000+
IBM Corporation	Manufacturing	1000+
Fidelity Workplace Investing LLC	Finance and Insurance	1000+
Veterans Administration VA Ro318	Health Care and Social Assistance	1000+
Blue Cross Blue Shield of NC	Finance and Insurance	1000+
City of Durham	Public Administration	1000+
Cree Inc	Manufacturing	1000+
RTI International	Professional, Scientific, and Technical Services	1000+
IQVIA Rds Inc	Professional, Scientific, and Technical Services	1000+
Durham County Government	Public Administration	1000+
Glaxosmithkline	Manufacturing	1000+
Nc Central University 18341	Educational Services	1000+
Amazon Fulfillment Services Inc	Transportation and Warehousing	1000+
A W North Carolina Inc	Manufacturing	1000+

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Company	Industry	Employment range
Biogen Idec Us Limited Partnership	Manufacturing	1000+
Network Appliance Inc	Wholesale Trade	1000+
Environmental Protection Agency	Public Administration	1000+
Credit Suisse USA Inc	Finance and Insurance	1000+
Harris Teeter	Retail Trade	1000+
Credit Suisse Services USA LLC	Finance and Insurance	1000+
Labcorp	Health Care and Social Assistance	500-999
Intervet Inc.	Manufacturing	500-999
BASF Corporation	Professional, Scientific, and Technical Services	500-999
Staff- 1 Services Group Inc	Administrative and Support and Waste Management and Remediation Services	500-999
Orange County		
UNC Chapel Hill	Educational Services	1000+
UNC Health Care System	Health Care and Social Assistance	1000+
Chapel Hill-Carrboro City Schools	Educational Services	1000+
UNC Physicians Network LLC	Health Care and Social Assistance	1000+
Orange County Schools	Educational Services	1000+
Local Government	Public Administration	1000+
Eurosport	Retail Trade	500-999
Town of Chapel Hill Inc	Public Administration	500-999
Wal-Mart Associates Inc.	Retail Trade	250-499
Aramark Food and Support Services G	Accommodation and Food Services	250-499
Harris Teeter	Retail Trade	250-499
A K G of America Inc	Manufacturing	250-499
Summit Design & Engineering Service	Professional, Scientific, and Technical Services	250-499
Hyatt Corporation	Accommodation and Food Services	250-499
Food Lion	Retail Trade	250-499
The Chapel Hill Residential	Health Care and Social Assistance	250-499
P H E Inc	Retail Trade	250-499
Performance BMW	Retail Trade	250-499
Weaver Street Market	Retail Trade	250-499
Residential Services Inc	Health Care and Social Assistance	100-249
Westrock Services Inc	Manufacturing	100-249
Wellspring Grocery	Retail Trade	100-249
U S Postal Service	Transportation and Warehousing	100-249
Town of Carrboro	Public Administration	100-249
Barnes & Noble College Booksellers	Retail Trade	100-249
Person County		
Person County Schools	Educational Services	500-999
Gkn Driveline, Inc.	Manufacturing	500-999
County of Person	Public Administration	250-499
Progress Energy Service Co	Utilities	250-499
Dlp Person Memorial Hospital	Health Care and Social Assistance	250-499
Wal-Mart Associates Inc.	Retail Trade	100-249
Eaton Corporation	Manufacturing	100-249
Piedmont Community College	Educational Services	100-249
Spuntech Industries Inc	Manufacturing	100-249
Food Lion	Retail Trade	100-249
Louisiana-Pacific Corporation	Manufacturing	100-249

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Company	Industry	Employment range
City of Roxboro	Public Administration	100-249
Ameristaff Inc	Administrative and Support and Waste Management and Remediation Services	100-249
Roxboro Nursing Center Inc	Health Care and Social Assistance	100-249
Accu Reference Medical Lab LLC	Health Care and Social Assistance	100-249
Lowes Home Centers Inc	Retail Trade	100-249
Us Flue Cured Tobacco Growers Inc	Manufacturing	50-99
Napa	Retail Trade	50-99
The Wood Company (A Corp)	Accommodation and Food Services	50-99
Person County Group Homes Inc	Health Care and Social Assistance	50-99
Piedmont Maintenance & Services Inc	Construction	50-99
Roxboro Community School Inc	Educational Services	50-99
United Home Care Inc	Health Care and Social Assistance	50-99
Centeredge Software	Professional, Scientific, and Technical Services	50-99
Dialight Corp	Manufacturing	50-99

Source: ACCESSNC Employer Profile

## 4 Risk Assessment

**Requirement §201.6(c)(2): [The plan shall include] A risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.**

**Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type...of all natural hazards that can affect the jurisdiction.**

**Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the...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.**

**44 CFR Subsection D §201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. Plans approved after October 1, 2008 must also address NFIP insured structures that have been repetitively damaged by floods. The plan should describe vulnerability in terms of:**

A) The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas;

(B): An estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate; and

(C): Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

### 4.1 OVERVIEW

This section describes the Hazard Identification and Risk Assessment process for the development of the Eno-Haw Regional Hazard Mitigation Plan. It describes how the County met the following requirements from the 10-step planning process:

- ▶ Planning Step 4: Assess the Hazard
- ▶ Planning Step 5: Assess the Problem

As defined by FEMA, risk is a combination of hazard, vulnerability, and exposure. “It is the impact that a hazard would have on people, services, facilities, and structures in a community and refers to the likelihood of a hazard event resulting in an adverse condition that causes injury or damage.”

This regional hazard risk assessment covers all of Alamance, Durham, Orange, and Person Counties including the unincorporated areas of these counties as well as incorporated jurisdictions participating in this plan.

The risk assessment process identifies and profiles relevant hazards and assesses the exposure of lives, property, and infrastructure to these hazards. The process allows for a better understanding of the potential risk to natural hazards in the county and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events. This risk assessment followed the methodology described in the FEMA publication *Understanding Your Risks—Identifying Hazards and Estimating Losses* (FEMA 386-2, 2002), which breaks the assessment down to a four-step process:



Data collected through this process has been incorporated into the following sections of this plan:

- ▶ **Section 4.2: Hazard Identification** identifies the natural and human-caused hazards that threaten the planning area.
- ▶ **Section 4.3: Risk Assessment Methodology and Assumptions**
- ▶ **Section 4.4: Asset Inventory** details the population, buildings, and critical facilities at risk within the planning area.
- ▶ **Section 4.5: Hazard Profiles, Analysis, and Vulnerability** discusses the threat to the planning area, describes previous occurrences of hazard events and the likelihood of future occurrences, and assesses the planning area's exposure to each hazard profiled; considering assets at risk, critical facilities, and future development trends.
- ▶ **Section 4.6: Conclusions on Hazard Risk** summarizes the results of the Priority Risk Index and defines each hazard as a Low, Medium, or High Risk hazard.

### 4.2 HAZARD IDENTIFICATION

To identify hazards relevant to the planning area, the HMPC began with a review of the list of hazards identified in the 2018 State Hazard Mitigation Plan, the 2015 Eno-Haw Regional Hazard Mitigation Plan, and the 2015 Person-Roxboro Hazard Mitigation Plan as summarized in Table 4.1. The HMPC used these lists to identify a full range of hazards for potential inclusion in this plan update and to ensure consistency across these planning efforts. All hazards on the below list were evaluated for inclusion in this plan update.

**Table 4.1 – Full Range of Hazards Evaluated**

Hazard	Included in 2018 State HMP?	Included in 2015 Eno-Haw HMP or 2015 Person-Roxboro HMP?
Flooding	Yes	Yes
Hurricanes and Coastal Hazards	Yes	Yes
Severe Winter Weather	Yes	Yes
Excessive Heat	Yes	Yes
Earthquakes	Yes	Yes
Wildfire	Yes	Yes
Dam Failures	Yes	Yes
Levee Failure	No	Yes
Drought	Yes	Yes
Tornadoes/Thunderstorms	Yes	Yes (evaluated as a separate hazards)
Geological (Landslides, Sinkholes, Coastal Erosion)	Yes	Yes (Landslide & Sinkhole)
Hazardous Substances	Yes	No
Radiological Emergency	Yes	No
Terrorism/Mass Casualty	Yes	No
Infectious Disease	Yes	No
Cyber Threat	Yes	No
Electromagnetic Pulse	Yes	No
Civil Unrest	No	No
Critical Infrastructure Failure	No	No

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The HMPC evaluated the above list of hazards using existing hazard data, past disaster declarations, local knowledge, and information from the 2018 State Plan, the 2015 Eno-Haw Regional Plan, and the 2015 Person-Roxboro Plan to determine the significance of these hazards to the planning area. Significance was measured in general terms and focused on key criteria such as frequency and resulting damage, which includes deaths and injuries, as well as property and economic damage.

One significant resource in this effort was the National Oceanic and Atmospheric Administration's National Center for Environmental Information (NCEI), which has been tracking various types of severe weather since 1950. Their Storm Events Database contains an archive by county of destructive storm or weather data and information which includes local, intense and damaging events. NCEI receives storm data from the National Weather Service (NWS). The NWS receives their information from a variety of sources, which include but are not limited to: county, state and federal emergency management officials, local law enforcement officials, SkyWarn spotters, NWS damage surveys, newspaper clipping services, the insurance industry and the general public, among others. The NCEI database contains 783 records of severe weather events that occurred in the Eno-Haw Region in the 20-year period from 1999 through 2018. Table 4.2 summarizes these events.

**Table 4.2 – NCEI Severe Weather Reports for Eno-Haw Region Counties, 1999 – 2018**

Type	# of Events	Property Damage	Crop Damage	Deaths	Injuries
Blizzard	0	\$0	\$0	0	0
Cold/Wind Chill	0	\$0	\$0	0	0
Drought	0	\$0	\$0	0	0
Extreme Cold/Wind Chill	0	\$0	\$0	0	0
Excessive Heat	0	\$0	\$0	0	0
Flash Flood	129	\$13,778,000	\$0	0	0
Flood	12	\$38,520,000	\$15,000,000	0	0
Frost/Freeze	0	\$0	\$0	0	0
Hail	229	\$2,017,500	\$60,500	0	0
Heat	1	\$0	\$0	1	0
Heavy Rain	2	\$0	\$0	0	0
Heavy Snow	4	\$0	\$0	0	0
High Wind	8	\$4,000	\$0	0	0
Hurricane	10	\$3,000,309,000	\$503,000,000	0	0
Ice Storm	5	\$3,634,000	\$0	0	0
Lightning	25	\$3,025,000	\$0	4	6
Strong Wind	59	\$1,289,150	\$24,000	1	3
Thunderstorm Wind	493	\$2,279,250	\$165,000	2	5
Tornado	15	\$2,155,000	\$10,000	0	2
Tropical Storm	5	\$1,700,000	\$25,000	0	0
Wildfire	0	\$0	\$0	0	0
Winter Storm	119	\$3,000,000	\$0	0	0
Winter Weather	106	\$95,000	\$0	0	0
<b>Total:</b>	<b>1,215</b>	<b>\$3,071,735,900</b>	<b>\$518,284,500</b>	<b>8</b>	<b>16</b>

Source: National Center for Environmental Information Events Database, June 2018

Note: Losses reflect totals for all impacted areas for each event.

The HMPC also researched past events that resulted in a federal and/or state emergency or disaster declaration for the Eno-Haw Region counties in order to identify significant hazards. Federal and/or state disaster declarations may be granted when the Governor certifies that the combined local, county and state resources are insufficient and that the situation is beyond their recovery capabilities. When the local



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government's capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. If the disaster is so severe that both the local and state government capacities are exceeded, a federal emergency or disaster declaration may be issued allowing for the provision of federal assistance.

Records of designated counties for FEMA major disaster declarations start in 1964. Since then, Alamance, Durham, Orange, and Person Counties have been designated in 15 different major disaster declarations. Table 4.3 summarizes the count of declarations per county, and Table 4.4 provides details for these declarations.

**Table 4.3 – Summary of Disaster Declarations by County**

County	Major Declarations Received
Alamance	11
Durham	9
Orange	10
Person	11

Source: FEMA Disaster Declarations Summary, updated March 15, 2019

**Table 4.4 – FEMA Major Disaster Declarations, Eno-Haw Region**

County*	Disaster #	Date	Incident Type	Event Title
A, O, P	4412	10/10/2018	Hurricane	Tropical Storm Michael
A, D, O, P	4393	9/14/2018	Hurricane	Hurricane Florence
A, O, P	4167	3/31/2014	Severe Ice Storm	Severe Winter Storm
A	1969	4/19/2011	Severe Storm(s)	Severe Storms, Tornadoes, and Flooding
P	1801	10/8/2008	Severe Storm(s)	Tropical Storm Hanna
A	1553	9/18/2004	Hurricane	Hurricane Ivan
D, O, P	1490	9/18/2003	Hurricane	Hurricane Isabel
A, O, P	1457	3/27/2003	Severe Ice Storm	Ice Storm
A, D, O, P	1448	12/12/2002	Severe Ice Storm	Severe Ice Storm
A, D, O, P	1312	1/31/2000	Severe Storm(s)	Severe Winter Storm
A, D, O, P	1292	9/16/1999	Hurricane	Hurricane Floyd Major Disaster Declarations
D	1211	3/22/1998	Severe Storm(s)	Severe Storms, Tornadoes, and Flooding
A, D, O, P	1134	9/6/1996	Hurricane	Hurricane Fran
A, D, O, P	1087	1/13/1996	Snow	Blizzard of 96
D	827	5/17/1989	Tornado	Tornadoes

Source: FEMA Disaster Declarations Summary, March 15, 2019

\*County code: A = Alamance, D = Durham, O = Orange, P = Person

Using the above information and additional discussion, the HMPC evaluated each hazard's significance to the planning area in order to decide which hazards to include in this plan update. Some hazard titles have been updated either to better encompass the full scope of a hazard or to assess closely related hazards together. Table 4.5 summarizes the determination made for each hazard.

**Table 4.5 – Hazard Evaluation Results**

Hazard	Included in this plan update?	Explanation for Decision
Flood	Yes	The 2015 Eno-Haw and Person-Roxboro plans and 2018 State plan addressed this hazard. Multiple disaster declarations for the region are related to flooding. NCEI reports 138 flood-related events.

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Hazard	Included in this plan update?	Explanation for Decision
Hurricane and Tropical Storm	Yes	The 2015 Eno-Haw and Person-Roxboro plans and 2018 State plan addressed this hazard. Past disaster declarations and NCEI storm reports indicate hurricanes are a significant hazard for the region.
Severe Winter Weather	Yes	The 2015 Eno-Haw and Person-Roxboro plans and 2018 State plan addressed this hazard. Past disaster declarations indicate this is a significant hazard for the region. NCEI reports 234 severe winter weather related events.
Extreme Heat	Yes	The 2015 Eno-Haw and Person-Roxboro plans and 2018 State plan addressed this hazard. NCEI reports 1 heat event for the region.
Earthquake*	Yes	The 2015 Eno-Haw and Person-Roxboro plans and 2018 State plan addressed this hazard. The region could face minor impacts from the Eastern Tennessee Seismic zone and the Charleston fault.
Wildfire	Yes	The 2015 Eno-Haw and Person-Roxboro plans and 2018 State plan addressed this hazard.
Dam Failure	Yes	The 2015 Eno-Haw and Person-Roxboro plans and 2018 State plan addressed this hazard. There are multiple dams in the region.
Levee Failure	No	The 2015 Eno-Haw and Person-Roxboro plans addressed this hazard in conjunction with dam failure. The USACE's National Levee Database does not identify any USACE or non-USACE levees in the region.
Drought	Yes	The 2015 Eno-Haw and Person-Roxboro plans and 2018 State plan addressed this hazard. There is significant agricultural exposure to drought in Alamance, Orange, and Person Counties.
Severe Weather (Thunderstorm, Lightning, and Hail)	Yes	The 2015 Eno-Haw and Person-Roxboro plans and 2018 State plan addressed these hazards. Multiple past disaster declarations indicate this is a significant hazard in the region. NCEI reports 827 related events in the past 20 years.
Tornado	Yes	The 2015 Eno-Haw and Person-Roxboro plans and 2018 State plan addressed this hazard. NCEI reports 15 tornado segments passing through the region in the past 20 years. Past disaster declarations have included tornados.
Landslide*	Yes	The 2015 Eno-Haw and Person-Roxboro plans and 2018 State plan addressed this hazard. USGS data indicates the region has moderate susceptibility to landslide.
Sinkholes	No	The 2015 Eno-Haw plan did not address this hazard. The 2015 Person-Roxboro plan included this hazard but found very low risk with no past incidents and unlikely probability. USGS data does not indicate a geological basis for sinkhole risk in the region.
Erosion	No	The 2018 State plan addressed this hazard for coastal areas. The 2015 Eno-Haw and Person-Roxboro plans did not address this hazard. Any riverine erosion risk will be discussed within the flood hazard profile.
Hazardous Materials Incident	Yes	The 2018 State plan addressed this hazard, but the 2015 Eno-Haw and Person-Roxboro plans did not. The HMPC decided this hazard should be included given the presence of fixed facilities and transportation route that carry hazardous substances.
Radiological Emergency	Yes	The 2018 State plan addressed this hazard, but the 2015 Eno-Haw and Person-Roxboro plans did not. Most of the region falls within the IPZ of Harris Nuclear Station, but none of the region is within the EPZ. The HMPC decided this hazard should be included.

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Hazard	Included in this plan update?	Explanation for Decision
Terrorism/Mass Casualty	Yes	The 2018 State plan addressed Terrorism, but the 2015 Eno-Haw and Person-Roxboro plans did not. The HMPC wants to address this hazard in terms of an active shooter event.
Infectious Disease	Yes	The 2018 State plan addressed this hazard, but the 2015 Eno-Haw and Person-Roxboro plans did not. The HMPC wants to address this hazard.
Cyber Threat	Yes	The 2018 State plan addressed this threat, but the 2015 Eno-Haw and Person-Roxboro plans did not. The HMPC wants to address this hazard.
Electromagnetic Pulse	No	The 2018 State plan addressed this threat, but the 2015 Eno-Haw and Person-Roxboro plans did not. The region considers this threat more appropriately addressed at the State level.
Critical Infrastructure Failure	Yes	The 2018 State plan did not address this hazard, but HMPC representatives feel it is a local issue that should be included.
Civil Unrest	Yes	The 2018 State plan did not address this hazard, but HMPC representatives feel it is a local issue that should be included.

\*These hazards were found to be low-risk hazards through the risk assessment process; therefore, they are not prioritized for mitigation actions.

The final list of hazards included in this plan are as follows:

- ▶ Dam Failure
- ▶ Drought
- ▶ Earthquake
- ▶ Extreme Heat
- ▶ Flood
- ▶ Hurricane & Tropical Storm
- ▶ Landslide
- ▶ Severe Weather (Thunderstorm Wind, Lightning, & Hail)
- ▶ Severe Winter Storm
- ▶ Tornado
- ▶ Wildfire
- ▶ Civil Unrest
- ▶ Critical Infrastructure Failure
- ▶ Cyber Threat
- ▶ Hazardous Materials Incident
- ▶ Infectious Disease
- ▶ Radiological Emergency
- ▶ Terrorism/Mass Casualty

### 4.3 RISK ASSESSMENT METHODOLOGY AND ASSUMPTIONS

The Disaster Mitigation Act of 2000 requires that the HMPC evaluate the risks associated with each of the hazards identified in the planning process. Each hazard was evaluated to determine its probability of future occurrence and potential impact. A vulnerability assessment was conducted for each hazard using either quantitative 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.

Each hazard is profiled in the following format:

#### Eno-Haw Region

Regional Hazard Mitigation Plan  
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### Hazard Description

This section provides a description of the hazard, including discussion of its speed of onset and duration, as well as any secondary effects followed by details specific to the Eno-Haw planning area.

### Location

This section includes information on the hazard's physical extent, with mapped boundaries where applicable.

### Extent

This section includes information on the hazard extent in terms of magnitude and describes how the severity of the hazard can be measured. Where available, the most severe event on record used as a frame of reference.

### Past Occurrences

This section contains information on historical events, including the location and consequences of all past events on record within or near the Eno-Haw planning area.

### Probability of Future Occurrence

This section gauges the likelihood of future occurrences based on past events and existing data. The frequency is determined by dividing the number of events observed by the number of years on record and multiplying by 100. This provides the percent chance of the event happening in any given year according to historical occurrence (e.g. 10 winter storm events over a 30-year period equates to a 33 percent chance of experiencing a severe winter storm in any given year). The likelihood of future occurrences is categorized into one of the classifications as follows:

- ▶ **Highly Likely** – Near or more than 100 percent chance of occurrence within the next year
- ▶ **Likely** – Between 10 and 100 percent chance of occurrence within the next year (recurrence interval of 10 years or less)
- ▶ **Possible** – Between 1 and 10 percent chance of occurrence within the next year (recurrence interval of 11 to 100 years)
- ▶ **Unlikely** – Less than 1 percent chance of occurrence within the next 100 years (recurrence interval of greater than every 100 years)

### 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.

### Vulnerability Assessment

This section quantifies, to the extent feasible using best available data, assets at risk to natural hazards and potential loss estimates. People, properties and critical facilities, and environmental assets that are vulnerable to the hazard are identified. Future development is also discussed in this section, including how exposure to the hazard may change in the future or how development may affect hazard risk.

The vulnerability assessments followed the methodology described in the FEMA publication *Understanding Your Risks—Identifying Hazards and Estimating Losses* (August 2001). The vulnerability assessment first describes the total vulnerability and values at risk and then discusses vulnerability by hazard. Data used to support this assessment included the following:

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- ▶ Geographic Information System (GIS) datasets, including building footprints, topography, aerial photography, and transportation layers;
- ▶ Hazard layer GIS datasets from state and federal agencies;
- ▶ Written descriptions of inventory and risks provided by the State Hazard Mitigation Plan; and
- ▶ Written descriptions of inventory and risks provided by the previous Eno-Haw Regional Hazard Mitigation Plan.
- ▶ Exposure and vulnerability estimates provided by the NCEM IRISK database.
- ▶ Crop insurance claims by cause from USDA's Risk Management Agency

NCEM's IRISK database incorporates county building footprint and parcel data. Footprints with an area less than 500 square feet were excluded from the analysis. To determine if a building is in a hazard area, the building footprints were intersected with each of the mapped hazard areas. If a building intersects two or more hazard areas (such as the 1-percent-annual-chance flood zone and the 0.2-percent-annual-chance flood zone), it is counted as being in the hazard area of highest risk. The parcel data provided building value and year built. Building value was used to determine the value of buildings at risk. Year built was used to determine if the building was constructed prior to or after the community had joined the NFIP and had an effective FIRM and building codes enforced.

Census blocks and Summary File 1 from the 2010 Census were used to determine population at risk. This included the total population, as well as the vulnerable elderly and children age groups. To determine population at risk, the census blocks were intersected with the hazard area. To better determine the actual number of people at risk, the intersecting area of the census block was calculated and divided by the total area of the census block to determine a ratio of area at risk. This ratio was applied to the population of the census block. For example, a census block has a population of 400 people. Five percent of the census block intersects the 1-percent-annual-chance flood hazard area. The ratio estimates that 20 people are then at risk within the 1-percent-annual-chance flood hazard area (5% of the total population for that census block).

Two distinct risk assessment methodologies were used in the formation of the vulnerability assessment. The first consists of a **quantitative** analysis that relies upon best available data and technology, while the second approach consists of a **qualitative** analysis that relies on local knowledge and rational decision making. The quantitative analysis involved the use of NCEM's IRISK database, which provides modeled damage estimates for flood, wind, and wildfire hazards.

Vulnerability can be quantified in those instances where there is a known, identified hazard area, such as a mapped floodplain. In these instances, the numbers and types of buildings subject to the identified hazard can be counted and their values tabulated. Where hazard risk cannot be distinctly quantified and modeled, other information can be collected in regard to the hazard area, such as the location of critical facilities, historic structures, and valued natural resources (e.g., an identified wetland or endangered species habitat). Together, this information conveys the vulnerability of that area to that hazard.

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

Key methodologies and assumptions for specific hazards analysis are described in their respective profiles.

### Priority Risk Index

The conclusions drawn from the hazard profiling and vulnerability assessment process can be used to prioritize all potential hazards to the Eno-Haw 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 of risk to five categories for each hazard (probability, impact, spatial extent, warning time, and duration). Each degree of risk was assigned a value (1 to 4) and a weighting factor as summarized in Table 4.6.

The results of the risk assessment and PRI scoring are provided in Section 4.6 Conclusions on Hazard Risk.

Table 4.6 – Priority Risk Index

RISK ASSESSMENT CATEGORY	LEVEL	DEGREE OF RISK CRITERIA	INDEX	WEIGHT
<b>PROBABILITY</b> What is the likelihood of a hazard event occurring in a given year?	UNLIKELY	LESS THAN 1% ANNUAL PROBABILITY	1	30%
	POSSIBLE	BETWEEN 1 & 10% ANNUAL PROBABILITY	2	
	LIKELY	BETWEEN 10 & 100% ANNUAL PROBABILITY	3	
	HIGHLY LIKELY	100% ANNUAL PROBABILITY	4	
<b>IMPACT</b> In terms of injuries, damage, or death, would you anticipate impacts to be minor, limited, critical, or catastrophic when a significant hazard event occurs?	MINOR	VERY FEW INJURIES, IF ANY. ONLY MINOR PROPERTY DAMAGE & 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 > 1 DAY	2	
	CRITICAL	MULTIPLE DEATHS/INJURIES POSSIBLE. MORE THAN 25% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR > 1 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 > 30 DAYS.	4	
<b>SPATIAL EXTENT</b> How large of an area could be impacted by a hazard event? Are impacts localized or regional?	NEGLECTIBLE	LESS THAN 1% OF AREA AFFECTED	1	20%
	SMALL	BETWEEN 1 & 10% OF AREA AFFECTED	2	
	MODERATE	BETWEEN 10 & 50% OF AREA AFFECTED	3	
	LARGE	BETWEEN 50 & 100% OF AREA AFFECTED	4	
<b>WARNING TIME</b> Is there usually some lead time associated with the hazard event? Have warning measures been implemented?	MORE THAN 24 HRS	SELF DEFINED	1	10%
	12 TO 24 HRS	SELF DEFINED	2	
	6 TO 12 HRS	SELF DEFINED	3	
	LESS THAN 6 HRS	SELF DEFINED	4	
<b>DURATION</b> How long does the hazard event usually last?	LESS THAN 6 HRS	SELF DEFINED	1	10%
	LESS THAN 24 HRS	SELF DEFINED	2	
	LESS THAN 1 WEEK	SELF DEFINED	3	
	MORE THAN 1 WEEK	SELF DEFINED	4	

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

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

The purpose of the PRI is to categorize and prioritize all potential hazards for the Eno-Haw 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.



## 4.4 ASSET INVENTORY

### 4.4.1 Population

NCEM's IRISK database provided the asset inventory used for this vulnerability assessment. Population data in IRISK is derived from the 2010 Census and includes a breakdown of population into two subpopulations considered to be at greater risk than the general population, the elderly and children. Table 4.7 details the population counts by jurisdiction used for the vulnerability assessment. Note that more current population estimates are provided in Section 3 Planning Area Profile but are not integrated into the risk assessment, which relies on IRISK.

**Table 4.7 – Population Counts by Jurisdiction, 2010**

Jurisdiction	2010 Census Population	Elderly (Age 65 and Over)	Children (Age 5 and Under)
<b>Alamance</b>			
City of Burlington	43,522	6,358	2,742
City of Graham	56,075	8,192	3,533
City of Mebane	16,584	2,423	1,045
Town of Elon	14,590	2,020	893
Town of Green Level	10,006	1,462	630
Town of Haw River	2,368	346	149
Town of Ossipee	3,773	551	238
Town of Swepsonville	544	79	34
Village of Alamance	1,151	168	73
Unincorporated Alamance County	1,462	214	92
<b>Subtotal Alamance</b>	<b>150,075</b>	<b>21,813</b>	<b>9,429</b>
<b>Durham</b>			
City of Durham	225,814	22,031	16,715
Unincorporated Durham County	38,181	3,725	2,826
<b>Subtotal Durham</b>	<b>263,995</b>	<b>25,756</b>	<b>19,541</b>
<b>Orange</b>			
Town of Carrboro	20,883	2,012	1,076
Town of Chapel Hill	59,351	5,722	3,117
Town of Hillsborough	8,467	816	436
Unincorporated Orange County	45,470	4,381	2,342
<b>Subtotal Orange</b>	<b>134,171</b>	<b>12,931</b>	<b>6,971</b>
<b>Person</b>			
City of Roxboro	13,079	1,986	785
Unincorporated Person County	26,396	4,007	1,584
<b>Subtotal Person</b>	<b>39,475</b>	<b>5,993</b>	<b>2,369</b>
<b>Region Total</b>	<b>587,716</b>	<b>66,493</b>	<b>38,310</b>

Source: NCEM IRISK Database; 2010 Decennial Census

Note: The population counts in IRISK are compiled from a census tract level and are estimated for incorporated jurisdictions based on a State dataset of extra-territorial jurisdiction boundaries. As a result, the population estimates for some jurisdictions skew large due to the inclusion of unincorporated areas. In the case of the City of Roxboro, which does not have an official extra-territorial jurisdiction, the state's estimate skews the City's population to 56% greater than the actual population by including parts of unincorporated Person County in the City of Roxboro estimates. The HMPC raised concerns about the errors in these estimates in order for corrections to be made in any future updates to IRISK.

#### 4.4.2 Property

Building counts were also provided by the IRISK database. These values were generated using building footprints and local parcel data. The methodology for generating the building asset inventory is described in greater detail in Section 4.3. Note that these building counts were provided in 2010, and the Eno-Haw Region has since experienced a substantial amount of growth and new development. Therefore, the exposure reflected in the following tables is an underestimate of actual present-day exposure. Section 3 Planning Area Profile describes the growth that has occurred since 2010 and provides a means of estimating the degree to which exposure and vulnerability may have increased.

**Table 4.8 – Building Counts and Values by Jurisdiction, 2010**

Jurisdiction	Building Count	Building Value
<b>Alamance</b>		
City of Burlington	24,403	\$5,515,560,224
City of Graham	7,269	\$1,316,164,837
City of Mebane	5,835	\$1,292,288,024
Town of Elon	2,760	\$719,062,825
Town of Green Level	1,177	\$113,426,782
Town of Haw River	2,352	\$409,669,987
Town of Ossipee	330	\$135,545,050
Town of Swepsonville	573	\$110,607,193
Village of Alamance	798	\$111,618,918
Unincorporated Alamance County	29,650	\$3,375,672,801
<b>Subtotal Alamance</b>	<b>75,147</b>	<b>\$13,099,616,641</b>
<b>Durham</b>		
City of Durham	75,589	\$18,139,339,725
Unincorporated Durham County	21,038	\$3,615,069,306
<b>Subtotal Durham</b>	<b>96,627</b>	<b>\$21,754,409,031</b>
<b>Orange</b>		
Town of Carrboro	5,782	\$1,446,024,246
Town of Chapel Hill	15,108	\$5,302,835,624
Town of Hillsborough	3,883	\$704,636,732
Unincorporated Orange County	24,533	\$3,203,843,233
<b>Subtotal Orange</b>	<b>49,306</b>	<b>\$10,657,339,835</b>
<b>Person</b>		
City of Roxboro	6,617	\$918,466,278
Unincorporated Person County	17,714	\$1,424,187,837
<b>Subtotal Person</b>	<b>24,331</b>	<b>\$2,342,654,115</b>
<b>Total</b>	<b>245,410</b>	<b>\$47,854,019,622</b>

Source: NCEM IRISK Database

To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Eno-Haw Region, current parcel data was evaluated to identify recent development that was not included in NCEM's IRISK database. The building footprint layer from IRISK was compared to current parcel data; any parcels with an improved value that did not already have a building in IRISK were summarized in the table below. This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which

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the IRISK exposure and vulnerability numbers differ from current conditions. This information is presented by individual jurisdiction in each jurisdiction's respective annex of this plan.

Table 4.9 provides a summary recent development not included in IRISK as an estimate of additional asset exposure in the Region.

**Table 4.9 – Parcel Development Not Included in IRISK, as of November 2019**

Jurisdiction	Improved Parcel Count	Total Improved Value
<b>Alamance County</b>		
Alamance	137	\$38,010,047
Burlington	1,926	\$538,509,617
Elon	375	\$104,400,254
Graham	699	\$181,053,856
Green Level	286	\$38,970,385
Haw River	92	\$10,716,505
Mebane	1,310	\$495,097,215
Ossipee	12	\$1,598,119
Sweepsonville	501	\$89,335,581
Unincorporated Alamance County	3,588	\$552,421,404
<b>Durham County</b>		
Durham	10,417	\$3,803,326,892
Unincorporated Durham County	1,073	\$354,853,208
<b>Orange County</b>		
Carrboro	545	\$172,753,800
Chapel Hill	419	\$224,217,019
Hillsborough	815	\$254,184,904
Unincorporated Orange County	3,291	\$771,519,650
<b>Person County</b>		
Roxboro	131	\$14,402,001
Unincorporated Person County	1,624	\$217,189,070
<b>Region Total</b>	<b>27,241</b>	<b>\$7,862,559,527</b>

Source: County parcel data, retrieved November 2019; IRISK database building footprints

### 4.4.3 Critical Facilities

The IRISK database also identifies Critical Infrastructure and Key Resources (CIKR) buildings as well as High Potential Loss Properties. These properties were also identified in 2010 and are likely an underestimate of the exposure of current CIKR and High Potential Loss Properties. These properties are detailed in Table 4.10 and Table 4.11, respectively.

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**Table 4.10 – Critical Infrastructure and Key Resources by Type and Jurisdiction**

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	Defense	Government Facilities	Healthcare	IT	National Monuments and Icons	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
<b>Alamance</b>																		
Unincorporated Alamance County	2,325	0	0	783	0	273	0	89	14	0	0	0	0	211	6	12	25	3,738
Burlington	45	43	0	1,453	2	448	1	119	112	0	0	2	0	486	23	5	40	2,779
Graham	27	13	0	331	0	92	1	99	18	0	0	2	0	102	2	1	7	695
Mebane	32	10	0	265	0	108	1	15	14	0	0	0	0	76	2	4	2	529
Elon	4	1	0	75	0	14	0	152	62	0	0	0	0	13	1	1	1	324
Green Level	15	0	0	76	0	16	0	5	0	0	0	0	0	7	1	0	0	120
Haw River	22	0	0	104	1	60	0	5	1	0	0	0	0	6	3	1	10	213
Ossipee	0	0	0	21	0	4	0	2	0	0	0	0	0	1	3	0	0	31
Swepsonville	2	0	0	13	0	5	0	2	0	0	0	0	0	6	0	1	1	30
Alamance	33	0	0	18	0	15	0	12	1	0	0	0	0	4	0	0	1	84
<b>Durham</b>																		
Unincorporated Durham County	1,230	4	0	766	0	544	0	98	41	0	0	0	0	351	1	0	17	3,052
Durham	88	62	0	3,552	0	1,215	0	1,013	364	0	0	0	4	1,404	77	0	37	7,816
<b>Orange</b>																		
Unincorporated Orange County	1,790	0	0	567	0	269	0	58	31	0	0	0	0	170	5	10	5	2,905
Carrboro	45	5	0	145	0	34	0	23	21	0	0	0	0	30	8	2	9	322
Chapel Hill	17	35	0	420	11	39	0	326	113	0	0	0	1	66	112	6	26	1,172
Hillsborough	9	53	0	234	1	59	0	56	15	0	0	0	0	25	10	4	6	472
<b>Person</b>																		
Unincorporated Person County	2,279	1	0	306	0	86	0	46	9	0	0	0	0	46	52	1	0	2,826
Roxboro	118	14	0	448	0	104	0	74	45	2	0	0	0	48	4	1	5	863
<b>Total</b>	<b>8,081</b>	<b>241</b>	<b>0</b>	<b>9,577</b>	<b>15</b>	<b>3,385</b>	<b>3</b>	<b>2,194</b>	<b>861</b>	<b>2</b>	<b>0</b>	<b>4</b>	<b>5</b>	<b>3,052</b>	<b>310</b>	<b>49</b>	<b>192</b>	<b>27,971</b>

Source: NCEM Risk Management Tool

## SECTION 4: RISK ASSESSMENT

**Table 4.11 – High Potential Loss Properties by Use and Jurisdiction**

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
<b>Alamance</b>								
Unincorporated Alamance	6	58	28	25	0	28	20	165
Burlington	72	288	144	42	0	54	42	642
Graham	14	55	39	28	0	12	8	156
Mebane	35	42	31	7	0	9	2	126
Elon	12	44	5	51	0	9	1	122
Green Level	0	1	4	1	0	0	1	7
Haw River	0	5	13	1	0	5	6	30
Ossipee	0	1	2	0	0	1	3	7
Swepsonville	0	5	3	2	0	0	0	10
Village of Alamance	0	1	4	2	0	3	0	10
<b>Durham</b>								
Unincorporated Durham County	24	78	83	21	0	6	18	230
Durham	451	704	133	239	0	60	51	1,638
<b>Orange</b>								
Unincorporated Orange County	37	6	4	0	0	8	4	59
Carrboro	47	15	1	1	0	0	9	73
Chapel Hill	377	124	3	10	0	16	32	562
Hillsborough	24	2	2	0	1	6	0	35
<b>Person</b>								
Unincorporated Person County	2	10	2	6	0	6	0	26
Roxboro	3	28	8	11	0	3	9	62
<b>Total</b>	<b>1,104</b>	<b>1,467</b>	<b>509</b>	<b>447</b>	<b>1</b>	<b>226</b>	<b>206</b>	<b>3,960</b>

Source: NCEM Risk Management Tool

In addition to examining CIKR overall, the following critical facilities and assets were examined against known hazard areas, where possible, in this risk assessment. These facilities are those that could severely disrupt emergency operations or response and recovery efforts should they be damaged by a hazard event. Note that these facilities are a subset of the CIKR inventory; critical facility exposure and risk is accounted for in the exposure and vulnerability of CIKR. Critical facilities are summarized in Table 4.12 and shown in Figure 4.1 through Figure 4.4.

Note that Orange County opted not to include a map of IRISK-identified facilities in this asset inventory due to concerns about the age of the data. Instead, Orange County has provided a separate map of critical infrastructure in the county which is included below and shown in full format in the County's annex.



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**Table 4.12 – Critical Facilities, Eno-Haw Region**

Sector	Asset	Count	Value
Emergency Management	EOC	3	\$3,448,049
	Fire	39	\$17,183,404
	Police	11	\$26,062,201
Healthcare and Public Health	Hospital	9	\$200,929,521
Government	School	123	\$213,884,625
	Community College	6	\$36,814,561
	University	178	\$134,561,560
Energy	Power Plant	14	\$195,805,135
	Substation	6	\$75,635,975
Water	Treatment Plant	155	\$821,805,410
Agriculture and Food Distribution	Hog Farm	20	\$2,934,299

Source: NCEM IRISK Database; GIS analysis

Due to the known underestimation of CIKR resources from the IRISK database, several participating counties and jurisdictions submitted lists of locally identified CIKR properties to be mapped. It is understood these locations are not recognized in the current IRISK database and therefore are not reflected in vulnerability assessment tables or impact analyses compiled from that data source. However, it is the intention of staff from these participating jurisdictions to document these locations for future updates to the Hazard Mitigation Plan and IRISK database, in order to ensure inclusion of such locations in future data analysis processes.

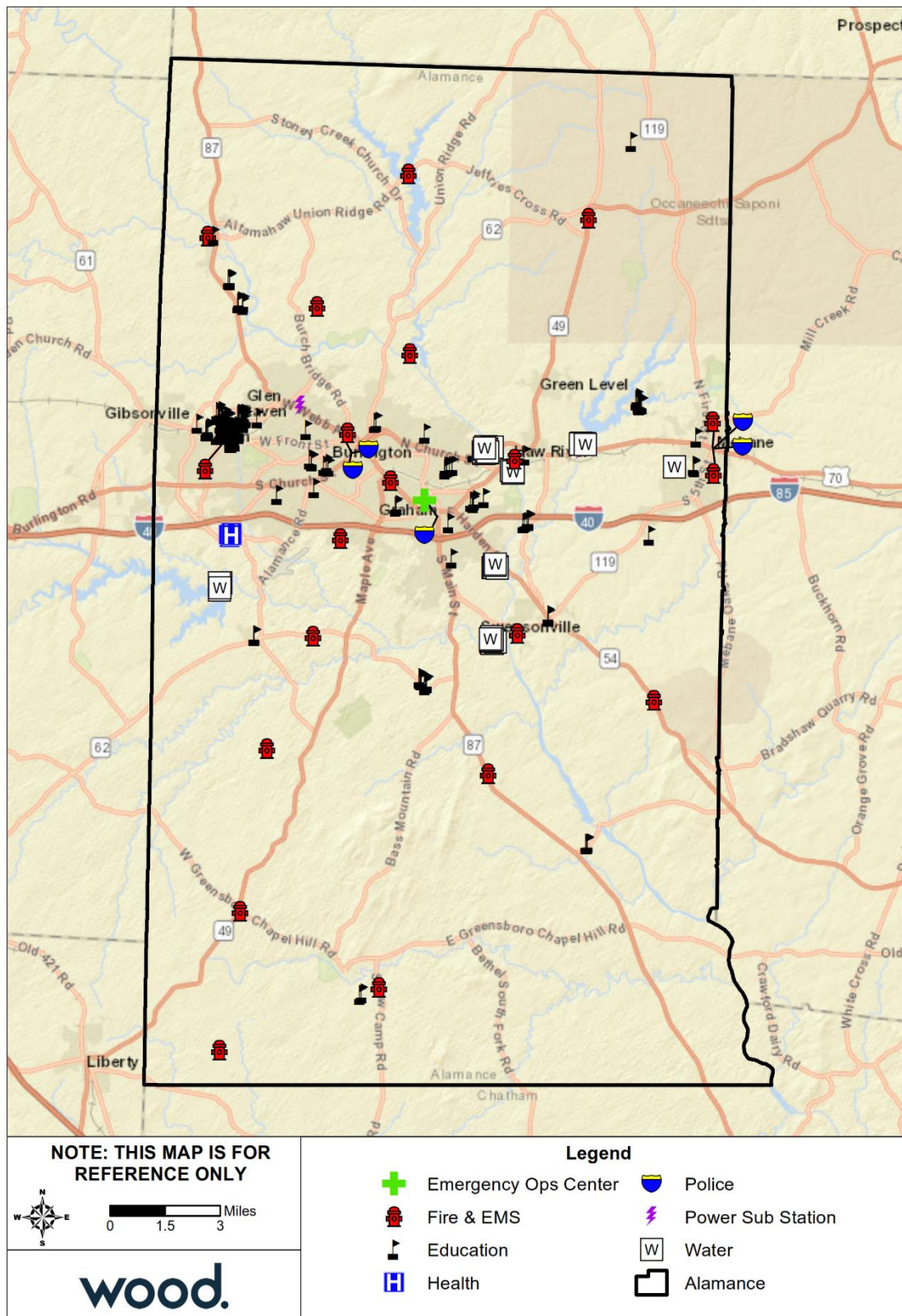
Table 4.13 summarizes the additional critical facilities identified by the HMPC that were not included in IRISK. These facilities are also included on the critical facility maps on the following pages, with the exception of the dams in Durham County, which are mapped under Section 4.5.1 Dam Failure.

**Table 4.13 – Critical Facilities Not Included in IRISK, Eno-Haw Region**

County	Asset	Count
Durham	EOC	1
	Dam	59
	EMS	12
	Fire	27
	Police	10
Person	Airport	1
	Fire/EMS	17
	Fuel Station	4
	Municipal	9
	Police Station	1
	Power Substation	3
	Utility	4
	Water	2

Source: Durham City, Durham County, Person County, City of Roxboro

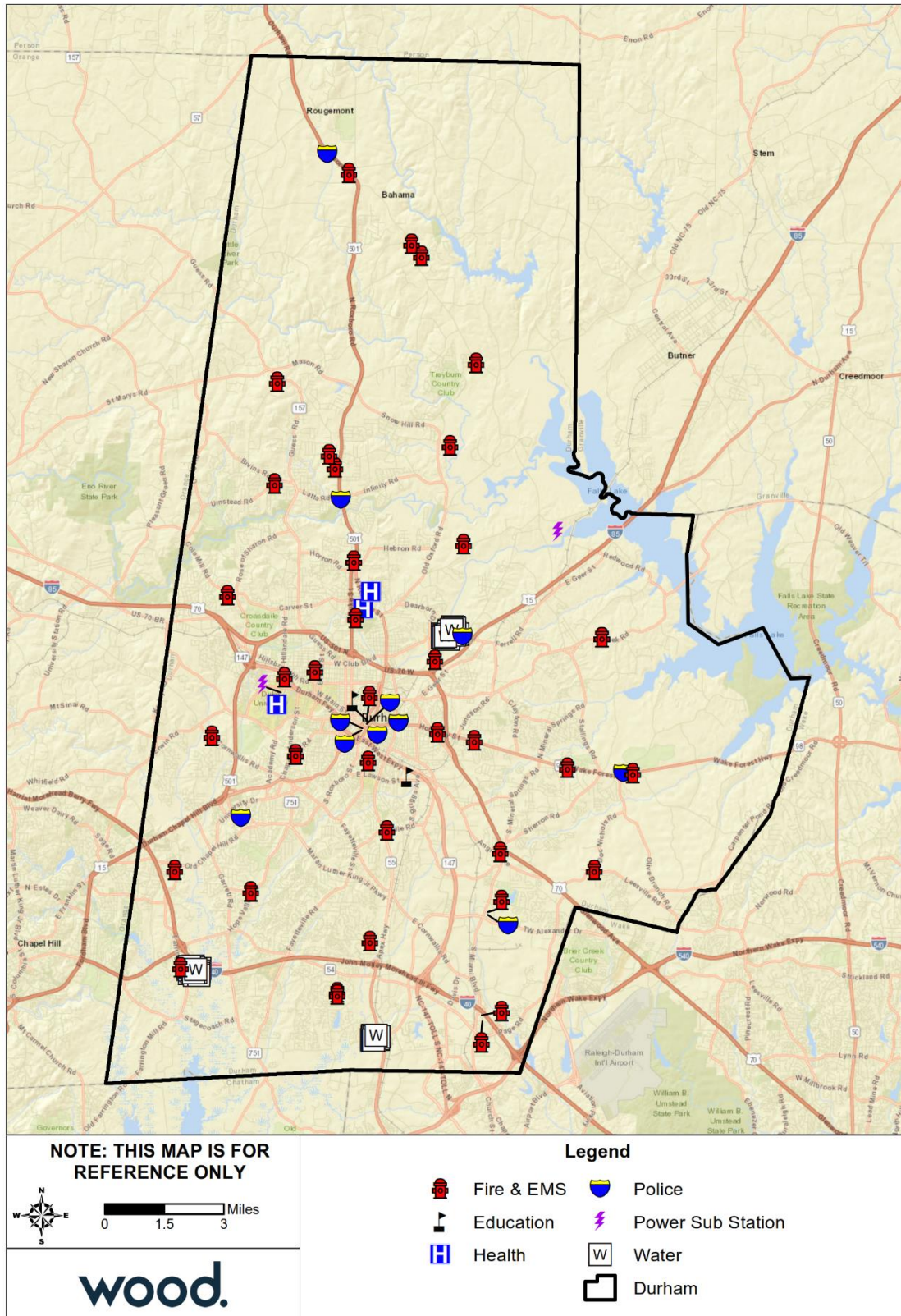
Figure 4.1 – Critical Facilities, Alamance County



Source: NCEM IRISK Database, GIS Analysis



Figure 4.2 – Critical Facilities, Durham County

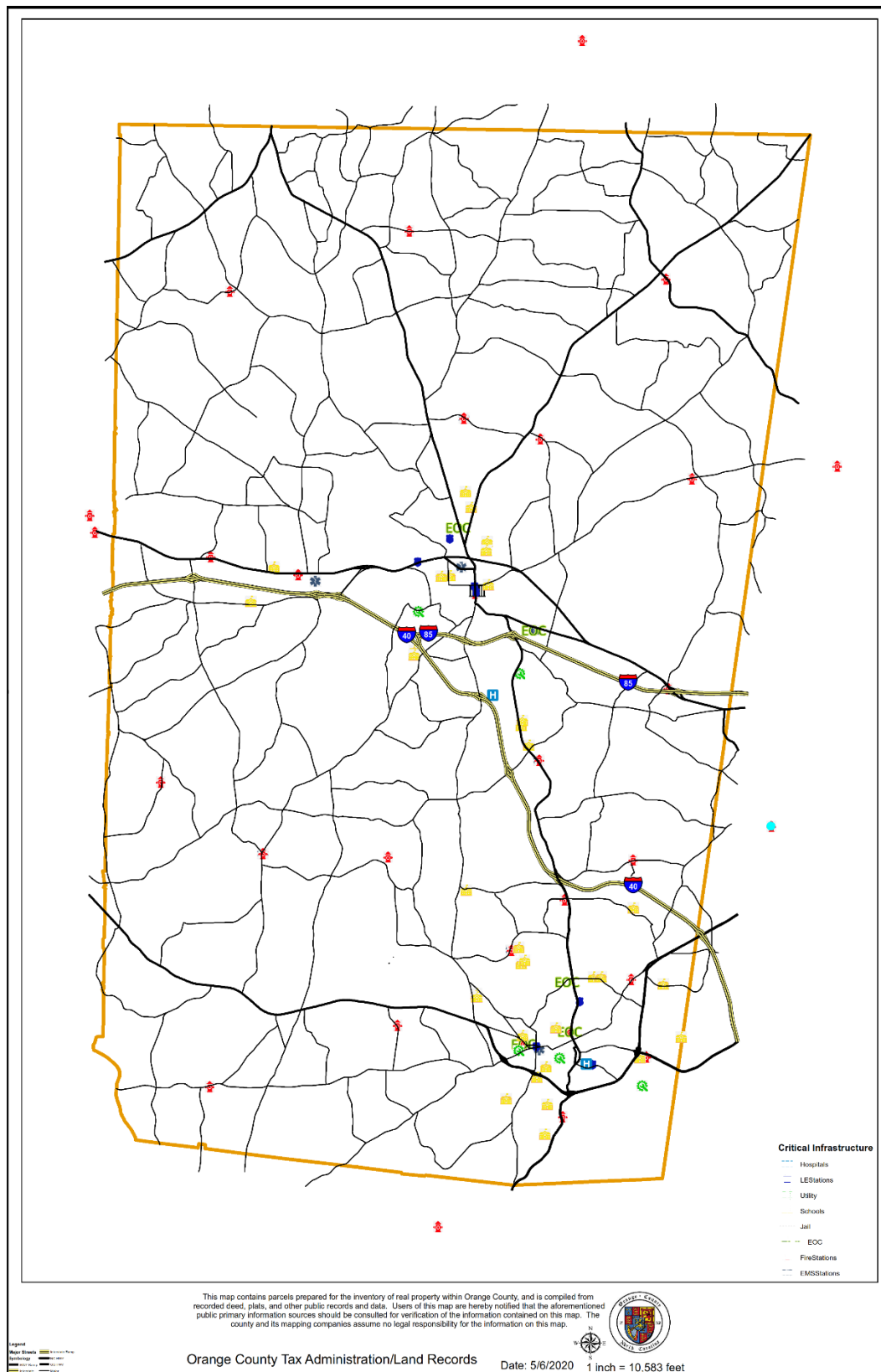


Source: NCEM IRISK Database, Durham County, GIS Analysis

Eno-Haw Region

Regional Hazard Mitigation Plan  
2020

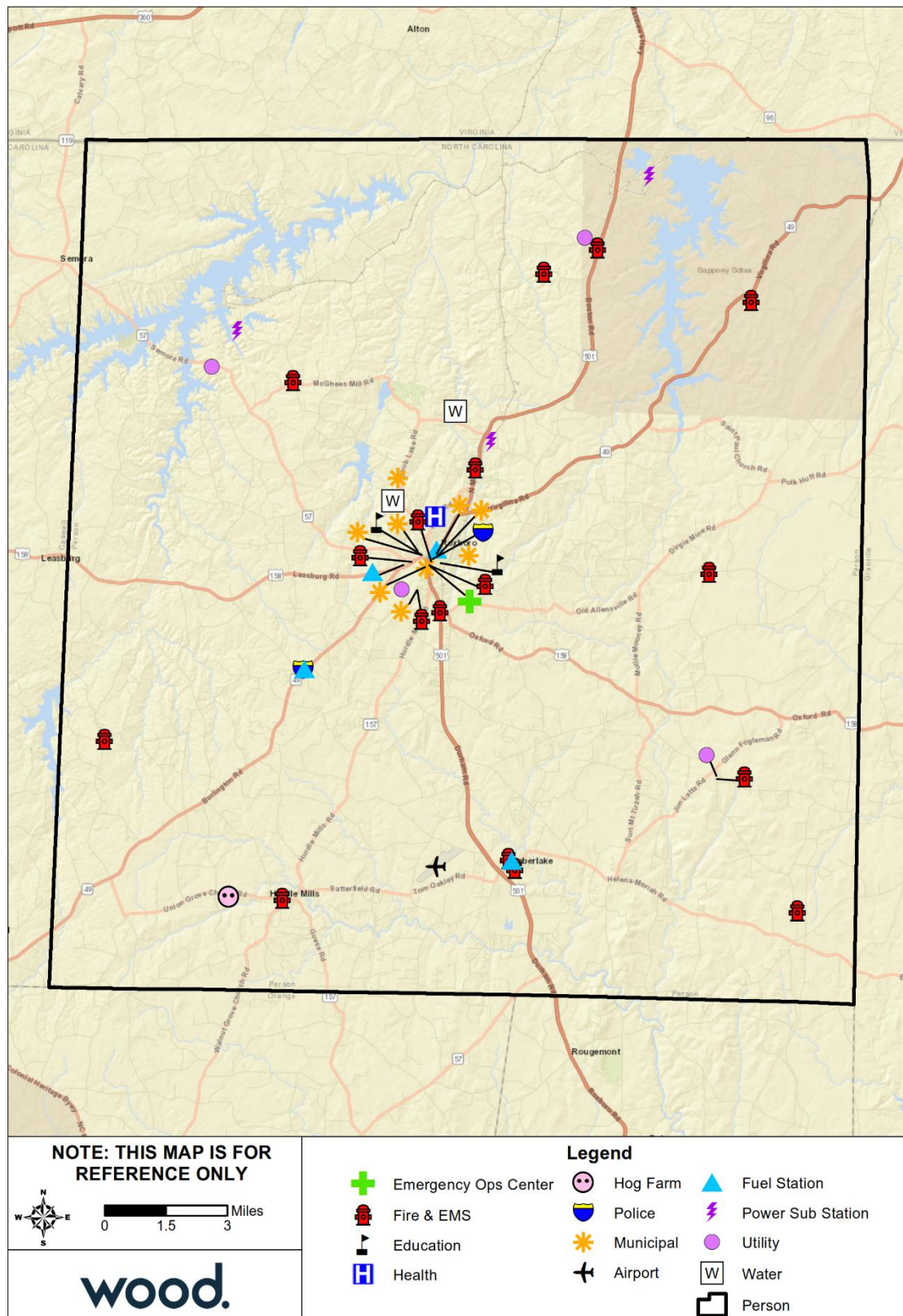
Figure 4.3 – Critical Facilities, Orange County



Source: Orange County Emergency Management



Figure 4.4 – Critical Facilities, Person County



Source: NCEM IRISK Database, Person County, GIS Analysis

Eno-Haw Region

Regional Hazard Mitigation Plan  
2020



### 4.4.4 Agriculture

The agricultural industry is also highly vulnerable to natural hazards, which can cause both crop and livestock losses. The exposure of agriculture in the region was measured using the USDA's 2017 Census of Agriculture. Table 4.14 below summarizes the agricultural exposure in the Region by county.

**Table 4.14 – Summary of Agriculture Exposure by County**

County	Number of Farms	Acreage in Farms	Proportion of Total Land Area in Farms	Acreage with Crop Insurance	Estimated Market Value of Land & Buildings
Alamance County	720	80,042	29.5%	10,146 (12.7%)	\$480,289,000
Durham County	241	18,603	10.1%	2,377 (12.8%)	\$198,234,000
Orange County	686	69,908	27.5%	14,797 (21.2%)	\$467,376,000
Person County	393	82,194	32.7%	29,592 (36.0%)	\$310,527,000

Source: USDA 2017 Census of Agriculture

## 4.5 HAZARD PROFILES, ANALYSIS, AND VULNERABILITY

### 4.5.1 Dam Failure

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Dam Failure	Possible	Critical	Negligible	Less than 6 hrs	Less than 1 week	2.4

#### Hazard Background

A dam is a barrier constructed across a watercourse that stores, controls, or diverts water. Dams are usually constructed of earth, rock, concrete, or mine tailings. The water impounded behind a dam is referred to as the reservoir and is measured in acre-feet. One acre-foot is the volume of water that covers one acre of land to a depth of one foot. Dams can benefit farm land, provide recreation areas, generate electrical power, and help control erosion and flooding issues. A dam failure is the collapse or breach of a dam that causes downstream flooding. Dam failures may be caused by natural events, manmade events, or a combination. Due to the lack of advance warning, failures resulting from natural events, such as earthquakes or landslides, may be particularly severe. Prolonged rainfall and subsequent flooding is the most common cause of dam failure.

Dam failures usually occur when the spillway capacity is inadequate and water overtops the dam or when internal erosion in dam foundation occurs (also known as piping). If internal erosion or overtopping causes a full structural breach, a high-velocity, debris-laden wall of water is released and rushes downstream, damaging or destroying anything in its path. Overtopping is the primary cause of earthen dam failure in the United States.

Dam failures can also result from any one or a combination of the following:

- ▶ Prolonged periods of rainfall and flooding;
- ▶ Inadequate spillway capacity, resulting in excess overtopping flows;
- ▶ Internal erosion caused by embankment or foundation leakage or piping;
- ▶ Improper maintenance, including failure to remove trees, repair internal seepage problems, replace lost material from the cross-section of the dam and abutments, or maintain gates, valves, and other operational components;
- ▶ Improper design, including the use of improper construction materials and construction practices;
- ▶ Negligent operation, including the failure to remove or open gates or valves during high flow periods;
- ▶ Failure of upstream dams on the same waterway; or
- ▶ High winds, which can cause significant wave action and result in substantial erosion.

Water released by a failed dam generates tremendous energy and can cause a flood that is catastrophic to life and property. Dam failures are generally catastrophic if the structure is breached or significantly damaged. A catastrophic dam failure could challenge local response capabilities and require evacuations to save lives. Impacts to life safety will depend on the warning time and the resources available to notify and evacuate the public. Major casualties and loss of life could result, as well as water quality and health issues. Potentially catastrophic effects to roads, bridges, and homes are also of major concern. Associated water quality and health concerns could also be issues. Factors that influence the potential severity of a full or partial dam failure are the amount of water impounded; the density, type, and value of development and infrastructure located downstream; and the speed of failure.

Dam failure can occur with little warning. Intense storms may produce a flood in a few hours or even minutes for upstream locations. Flash floods occur within six hours of the beginning of heavy rainfall, and

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dam failure may occur within hours of the first signs of breaching. Other failures and breaches can take much longer to occur, from days to weeks, as a result of debris jams or the accumulation of melting snow.

Dam failures are of particular concern because the failure of a large dam has the potential to cause more death and destruction than the failure of any other manmade structure. This is because of the destructive power of the flood wave that would be released by the sudden collapse of a large dam. Dams are innately hazardous structures. Failure or poor operation can result in the release of the reservoir contents—this can include water, mine wastes, or agricultural refuse—causing negative impacts upstream or downstream or at locations far from the dam. Negative impacts of primary concern are loss of human life, property damage, lifeline disruption, and environmental damage.

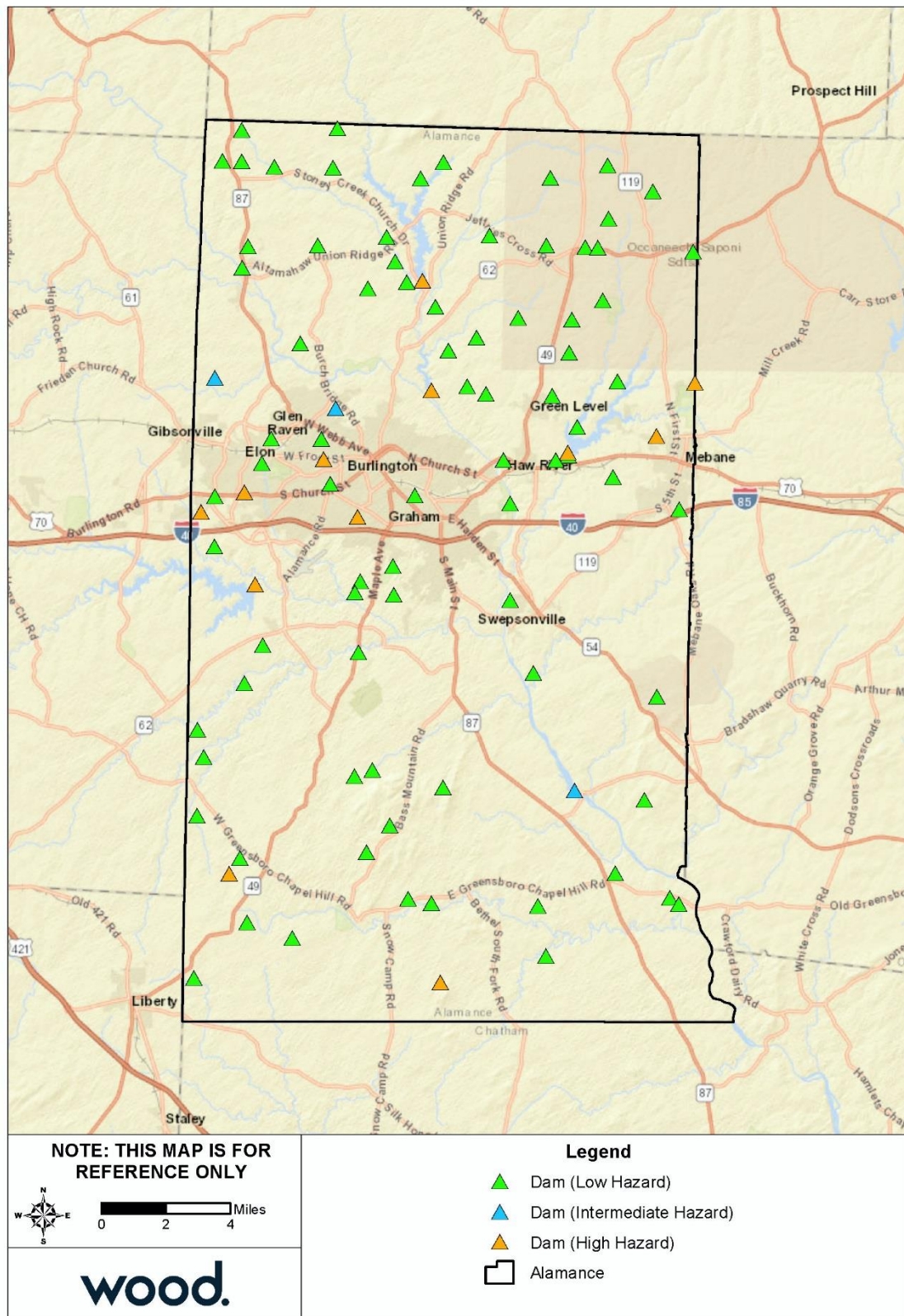
*Warning Time: 4 – Less than 6 hours*

*Duration: 3 – Less than 1 week*

### Location

The North Carolina Dam Inventory, maintained by North Carolina Department of Environmental Quality, provides a detailed inventory of all dams in the state. As of July 2018, there are 260 dams in the Eno-Haw region, 95 in Alamance County, 90 in Durham County, 48 in Orange County, and 27 in Person County. Of the 260, 164 are rated low hazard, 33 are rated intermediate hazard, and 63 are rated high hazard. Figure 4.5 through Figure 4.8 show the location of all dams in the Eno-Haw Region by county. Table 4.15 through Table 4.18 list all dams with high hazard potential in the region by county.

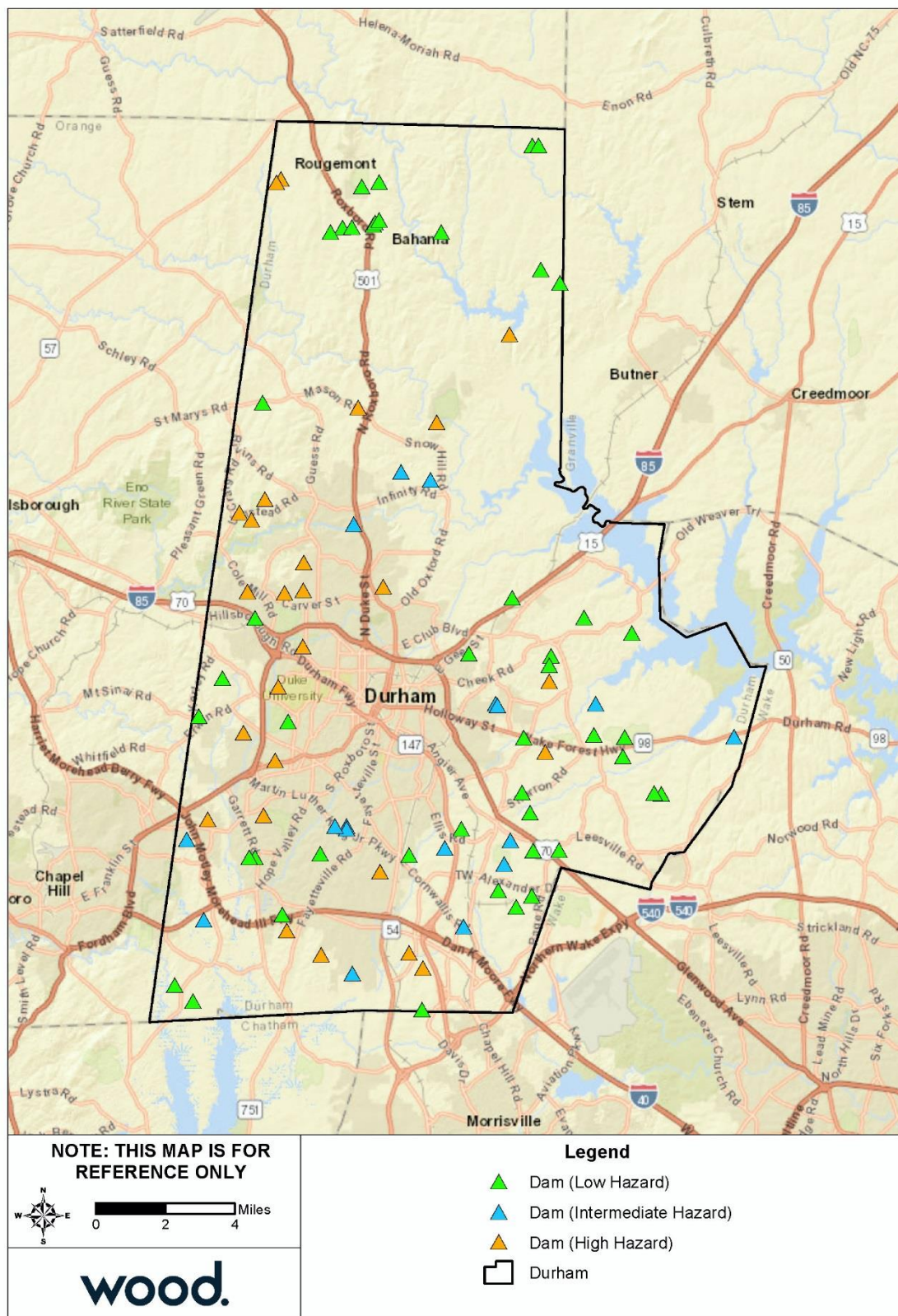
Figure 4.5 – Dam Locations in Alamance County



Source: North Carolina Dam Inventory, July 2018

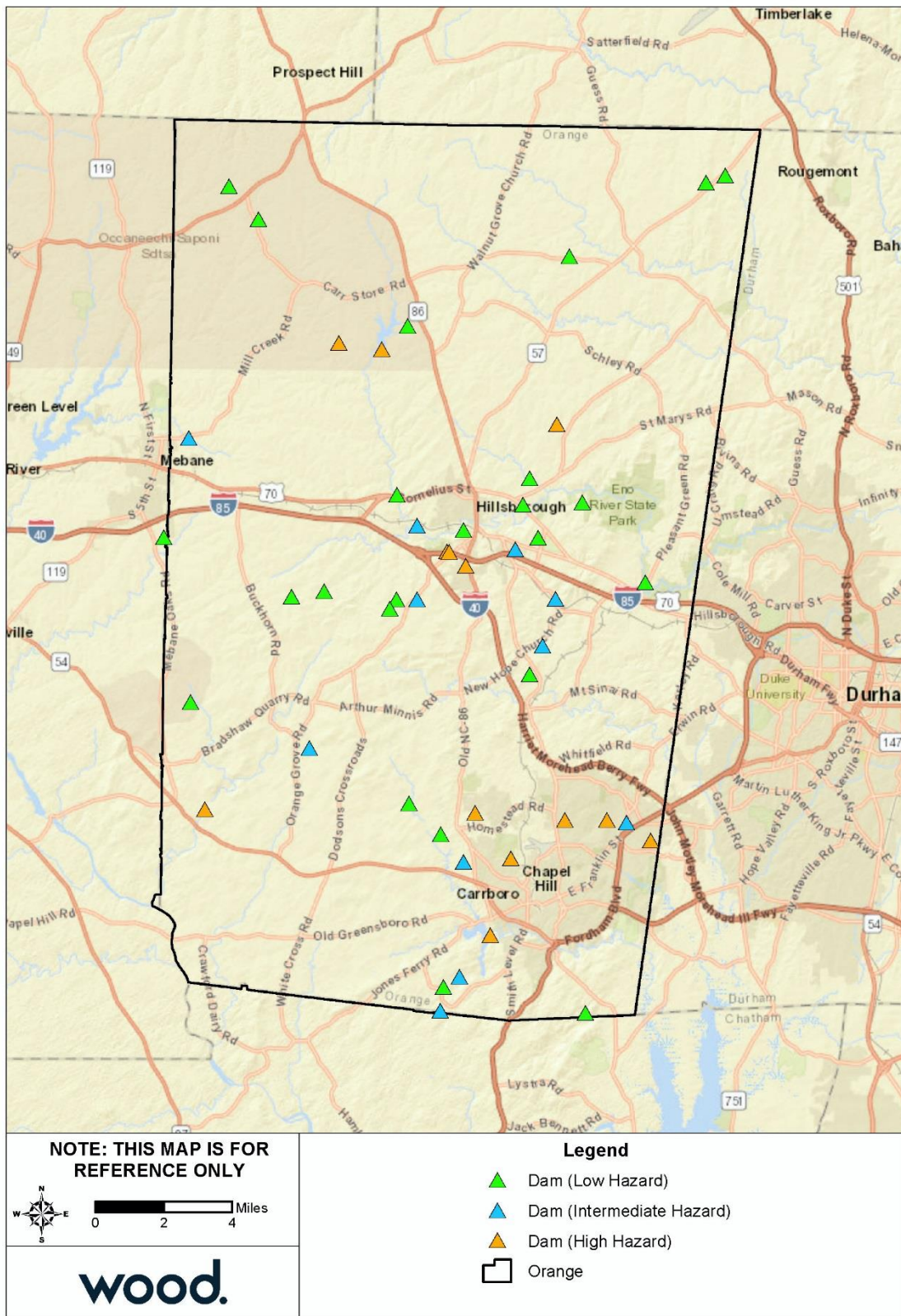


Figure 4.6 – Dam Locations in Durham County



Source: North Carolina Dam Inventory, July 2018

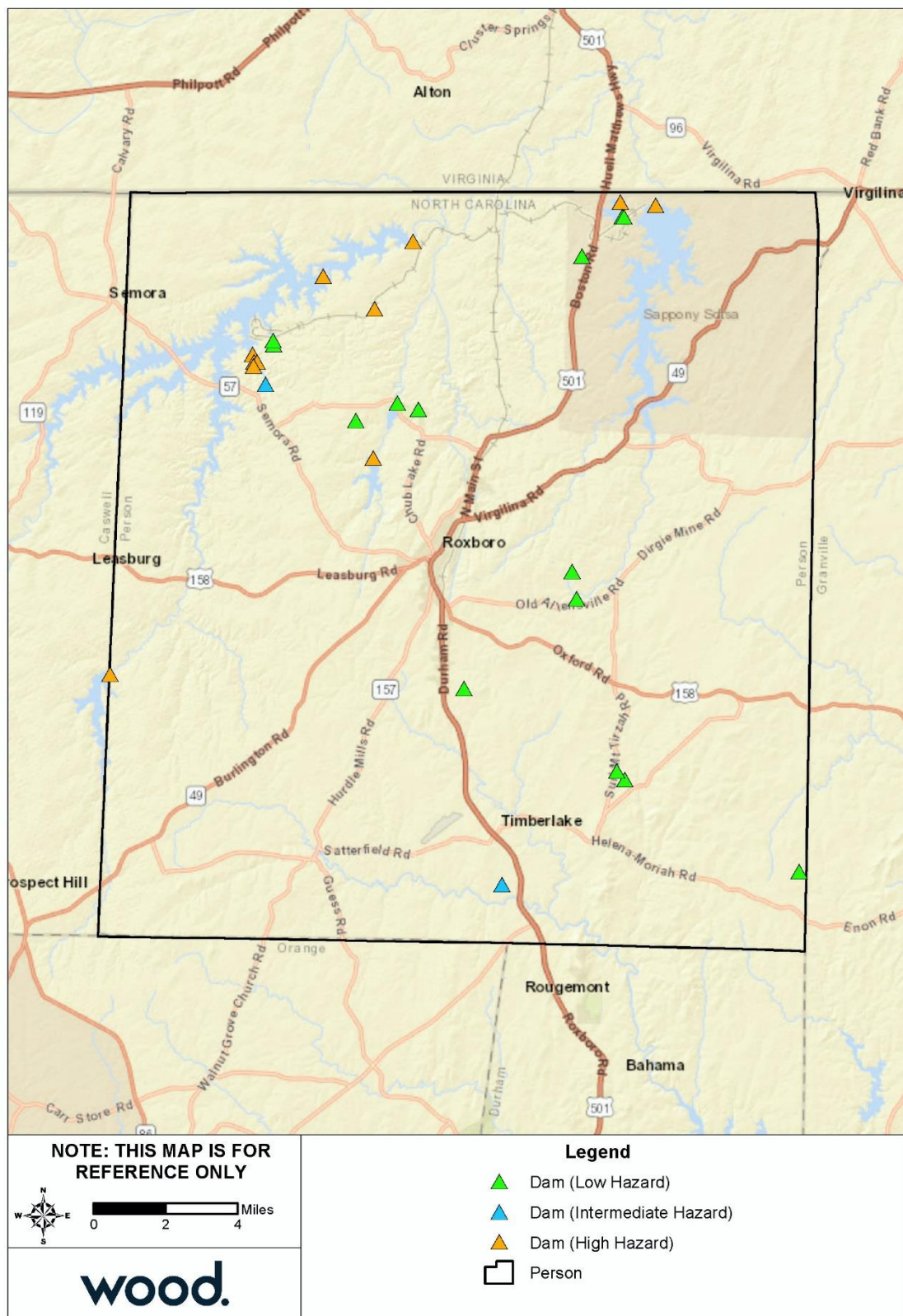
Figure 4.7 – Dam Locations in Orange County



Source: North Carolina Dam Inventory, July 2018



Figure 4.8 – Dam Locations in Person County



Source: North Carolina Dam Inventory, July 2018

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**Table 4.15 – High Hazard Dams in Alamance County**

Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
<b>Alamance County</b>				
Lake Cammack Dam	NC00739	Fair	36,000	Carolina
Forest Lake Dam	NC00748	Poor	235	Haw River
Timber Ridge Lake Dam	NC00742	Fair	288	Saxapahaw
Old Stony Creek Dam	NC00762	Poor	3,600	Hopedale
Tredmont Lake Dam	NC01732	Poor	331	
Back Creek Reservoir	NC04873	Fair	10,645	Haw River
<b>Burlington</b>				
McEwen Estate Dam	NC01734	Fair	142	Alamance
Tate Dam	NC01737	Fair	56	Burlington
Lake Mackintosh Dam	NC04954	Fair	30,825	Alamance
Hudgins Dam	NC05541	Unsatisfactory	10	
<b>Elon</b>				
Somerton Lake Dam	NC05203	Poor	46.89	Burlington
<b>Mebane</b>				
Mill Creek Subdivision Dam	NC05718	Fair	7	Mebane

Source: North Carolina Dam Inventory, July 2018

**Table 4.16 – High Hazard Dams in Durham County**

Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
<b>Durham County</b>				
Lake Michie Dam	NC01027	Satisfactory	18,660	Redwood
Eden Lake Dam	NC01043		140	Orange Factory
Willowhaven Lake Dam #2	NC01050	Satisfactory	58	Durham
Lake Vista Dam	NC01051	Fair	69	Durham
Discovery Lake Dam	NC01666	Satisfactory	336	Haywood
N. Durham Quarry East Dam	NC05165	Satisfactory	134	Bunny Rd at Lick Creek
N. Durham Quarry West Dam	NC05166	Satisfactory	83	Cothran Rd
<b>Durham (City)</b>				
Crystal Lake Dam	NC01021	Satisfactory	100	Durham (Hillandale Rd)
Newcomb Lake Dam	NC01023	Fair	94	Durham (Umstead Rd.)
Lake Elton Dam	NC01037	Satisfactory	155	Parkwood
Lakehurst S/D Dam	NC01039	Satisfactory	145	Farrington
Cole Lake Dam	NC01049	Fair	81	Huckleberry Springs (Fleming Dr)
Van Trine Lake Dam	NC01337			Durham
Dairy Pond Dam	NC02270	Satisfactory	31.2	Durham
Boles Lake Dam	NC05046	Satisfactory	60.2	Durham
Little River Dam	NC05143	Satisfactory	18,000	Falls
Georgiade Dam	NC02273	Not Rated	12	Durham
Stone Throw Apartments Pond Dam	NC02317	Fair	1	
Grove Park Dam	NC02323	Satisfactory	302	

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Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
Hock Dam	NC05112	Satisfactory	8	William Penn Plaza Rd
Oxford Commons Dam	NC02324	Satisfactory	24	William Penn Plaza Rd
Ridgefield Subdv. SWDP Dam 14	NC05629	Fair	6	Durham
The Streets at Southpoint Mall Dam	NC05653	Satisfactory	51	
Patterson Place Dam	NC05819	Satisfactory	82	
Forest at Duke Dam	NC06117	Satisfactory	-	
Williams Terminal Reservoir Dam	NC06139	Fair	-	Durham
Duke Water Harvesting Pond Dam	NC06146	Satisfactory	70	Durham

Source: North Carolina Dam Inventory, July 2018

**Table 4.17 – High Hazard Dams in Orange County**

Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
<b>Orange County</b>				
Lake Orange Dam	NC00773	Satisfactory	1,640	Hillsborough
Cane Creek Reservoir Dam	NC00779	Satisfactory	19,079	
University Lake Dam	NC00782	Satisfactory	4,836	Carrboro
Hillsborough Water Supply Dam	NC05793	Satisfactory	24,061	Hillsborough (N. Elland Cedar)
Randy Fox Dam	NC05715	Satisfactory	68	Hillsborough
Occoneechee Upper Dam	NC05776	Satisfactory	-	Virginia Cates Rd.
Occoneechee Lower Dam	NC05777	Satisfactory	5	Virginia Cates Rd.
<b>Carrboro</b>				
Hogan Farms Dam	NC00770	Satisfactory	160	Chapel Hill
Spring Valley Dam	NC04994	Satisfactory	22	
<b>Chapel Hill</b>				
Eastwood Lake Dam	NC00781	Satisfactory	330	Chapel Hill
Lake Ellen Dam	NC01537	Fair	120	Chapel Hill
Colony Lake	NC03671	Satisfactory	48	
<b>Hillsborough</b>				
Flint Ridge Dam	NC03663	Poor	22	Hillsborough

Source: North Carolina Dam Inventory, July 2018

**Table 4.18 – High Hazard Dams in Person County**

Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
<b>Person County</b>				
Lake Hyco Dam	NC00656	Poor	77,000	McGehees Mill
Roxboro Municipal Lake Dam	NC00658	Satisfactory	4,125	Chub Lake
Roxboro Afterbay Dam	NC00666	Fair	16,800	Denniston
South Hyco Lake Dam (Lake Roxboro)	NC03689	Satisfactory	9,400	
Mayo Lake Dam	NC06002	Fair	-	
Mayo Ash Pond Dam	NC06003	Fair	-	

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Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
Roxboro West Ash Pond Dam	NC06006	Fair	-	
Roxboro West FGD Settling Pond	NC06008	Fair	-	
Roxboro East FGD Settling Pond	NC06009	Fair	-	
Roxboro FGD Forward Flush Pond	NC06010	Fair	-	
Jimmie Bowes Transmission Line Embankment	NC06016	Satisfactory	-	

Source: North Carolina Dam Inventory, July 2018

### Extent

Each state has definitions and methods to determine the hazard potential of a dam. In North Carolina, dams are regulated by the state if they are 25 feet or more in height and impound 50 acre-feet or more. Dams and impoundments smaller than that may fall under state regulation if it is determined that failure of the dam could result in loss of human life or significant damage to property. The height of a dam is from the highest point on the crest of the dam to the lowest point on the downstream toe, and the storage capacity is the volume impounded at the elevation of the highest point on the crest of the dam.

Dam Safety Program engineers determine the "hazard potential" of a dam, meaning the probable damage that would occur if the structure failed, in terms of loss of human life and economic loss or environmental damage. Dams are assigned one of three classes based on the nature of their hazard potential:

- ▶ Class A (Low Hazard) includes dams located where failure may damage uninhabited low value non-residential buildings, agricultural land, or low volume roads.
- ▶ Class B (Intermediate Hazard) includes dams located where failure may damage highways or secondary railroads, cause interruption of use or service of public utilities, cause minor damage to isolated homes, or cause minor damage to commercial and industrial buildings. Damage to these structures will be considered minor only when they are located in backwater areas not subjected to the direct path of the breach flood wave; and they will experience no more than 1.5 feet of flood rise due to breaching above the lowest ground elevation adjacent to the outside foundation walls or no more than 1.5 feet of flood rise due to breaching above the lowest floor elevation of the structure.
- ▶ Class C (High Hazard) includes dams located where failure will likely cause loss of life or serious damage to homes, industrial and commercial buildings, important public utilities, primary highways, or major railroads.

**Table 4.19 – Dam Hazard Classifications**

Hazard Classification	Description	Quantitative Guidelines
<b>Low</b>	Interruption of road service, low volume roads	Less than 25 vehicles per day
	Economic damage	Less than \$30,000
<b>Intermediate</b>	Damage to highways, interruption of service	25 to less than 250 vehicles per day
	Economic damage	\$30,000 to less than \$200,000
	Loss of human life*	Probable loss of 1 or more human lives
<b>High</b>	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

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Source: NCDEQ

Based on classification criteria, a high hazard dam failure could cause death and/or injury as well as severe property damage and economic impacts within the affected area. Therefore, though the affected area would be negligible in size relative to the entire planning area, the potential impact of a high hazard dam failure is critical.

*Impact: 3 – Critical*

*Spatial Extent: 1 – Negligible*

### Historical Occurrences

According to the previous Eno-Haw and Person County plans and anecdotal evidence, there are no records of historical dam failures occurrences in or affecting the planning area.

### Probability of Future Occurrence

Given the significant presence of high hazard dams in the Eno-Haw Region, failure of a dam is possible. Dam failure has not occurred in the region, however historical events alone do not provide an adequate estimate of potential future occurrence. With heavy rain events becoming more frequent and intense, conditions conducive to dam failure may occur more frequently as well.

*Probability: 2 – Possible*

### Climate Change

Studies have been conducted to investigate the impact of climate change scenarios on dam safety. 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.

### Vulnerability Assessment

#### Methodologies and Assumptions

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Dam inundation areas were not available for the identified dams; therefore, a quantitative vulnerability assessment could not be completed. Vulnerability discussed below is based on anecdotal evidence and theoretical understanding of potential risks.

#### People

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A person's immediate vulnerability to a dam failure is directly associated with the person's distance downstream of the dam as well as proximity to the stream carrying the floodwater from the failure. For dams that have an Emergency Action Plan (EAP), the vulnerability of loss of life for persons in their homes or on their property may be mitigated by following the EAP evacuation procedures; however, the displaced persons may still incur sheltering costs. For persons located on the river (e.g. for recreation) the vulnerability of loss of life is significant.

People are also vulnerable to the loss of the uses of the lake upstream of a dam following failure. Several uses are minor, such as aesthetics or recreational use. However, some lakes serve as drinking water supplies and their loss could disrupt the drinking water supply and present a public health problem.



**Property**

Vulnerability of the built environment includes damage to the dam itself and any man-made feature located within the inundation area caused by the dam failure. Downstream of the dam, vulnerability includes potential damage to homes, personal property, commercial buildings and property, and government owned buildings and property; destruction of bridge or culvert crossings; weakening of bridge supports through scour; and damage or destruction of public or private infrastructure that cross the stream such as water and sewer lines, gas lines and power lines. Water dependent structures on the lake upstream of the dam, such as docks/piers, floating structures or water intake structures, may be damaged by the rapid reduction in water level during the failure.

**Environment**

Aquatic species within the lake will either be displaced or destroyed. The velocity of the flood wave will likely destroy riparian and instream vegetation and destroy wetland function. The flood wave will like cause erosion within and adjacent to the stream. Deposition of eroded deposits may choke instream habitat or disrupt riparian areas. Sediments within the lake bottom and any low oxygen water from within the lake will be dispersed, potentially causing fish kills or releasing heavy metals found in the lake sediment layers.

**Consequence Analysis**

Table 4.20 summarizes the potential negative consequences of dam failure.

**Table 4.20 – Consequence Analysis – Dam Failure**

Category	Consequences
Public	Localized impact expected to be severe for inundation area and moderate to light for other adversely affected areas.
Responders	Localized impact expected to limit damage to personnel in the inundation area at the time of the incident.
Continuity of Operations (including Continued Delivery of Services)	Damage to facilities/personnel in the area of the incident may require temporary relocation of some operations. Localized disruption of roads and/or utilities may postpone delivery of some services. Regulatory waivers may be needed locally. Fulfillment of some contracts may be difficult. Impact may reduce deliveries.
Property, Facilities and Infrastructure	Localized impact to facilities and infrastructure in the inundation area of the incident. Some severe damage possible.
Environment	Localized impact expected to be severe for inundation area and moderate to light for other adversely affected areas. Consequences include erosion, water quality degradation, wildlife displacement or destruction, and habitat destruction.
Economic Condition of the Jurisdiction	Local economy and finances adversely affected, possibly for an extended period of time, depending on damage and length of investigation.
Public Confidence in the Jurisdiction's Governance	Localized impact expected to primarily adversely affect only the dam owner and local entities.

**Hazard Summary by Jurisdiction**

The following table summarizes dam failure hazard risk by jurisdiction. Warning time and duration are inherent to the hazard and remain constant across jurisdictions. Spatial extent of any dam failure will be negligible relative to the planning area. Jurisdictions that have high hazard dams within their boundaries or are the nearest downstream location to a high hazard dam were assigned a probability rating of possible and an impact score of critical. Jurisdictions with no high hazard dams or upstream threats were assigned a probability rating of unlikely and an impact rating of limited.



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Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	Score	Priority
Alamance County	2	3	1	4	3	2.4	M
Burlington	2	3	1	4	3	2.4	M
Graham	1	2	1	4	3	1.8	L
Mebane	2	3	1	4	3	2.4	M
Elon	2	3	1	4	3	2.4	M
Green Level	1	2	1	4	3	1.8	L
Haw River	2	3	1	4	3	2.4	M
Ossipee	1	2	1	4	3	1.8	L
Sweepsonville	1	2	1	4	3	1.8	L
Alamance	2	3	1	4	3	2.4	M
Durham County	2	3	1	4	3	2.4	M
Durham	2	3	1	4	3	2.4	M
Orange County	2	3	1	4	3	2.4	M
Carrboro	2	3	1	4	3	2.4	M
Chapel Hill	2	3	1	4	3	2.4	M
Hillsborough	2	3	1	4	3	2.4	M
Person County	2	3	1	4	3	2.4	M
Roxboro	1	2	1	4	3	1.8	L

### 4.5.2 Drought

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Drought	Likely	Minor	Large	More than 24 hrs	More than 1 week	2.5

#### Hazard Background

Drought is a deficiency in precipitation over an extended period. It is a normal, recurrent feature of climate that occurs in virtually all climate zones. The duration of a drought varies widely. There are cases when drought develops relatively quickly and lasts a very short period of time, exacerbated by extreme heat and/or wind, and there are other cases when drought spans multiple years, or even decades. Studying the paleoclimate record is often helpful in identifying when long-lasting droughts have occurred. Common types of drought are detailed below in Table 4.21.

**Table 4.21 – Types of Drought**

Type	Details
<b>Meteorological Drought</b>	Meteorological Drought is based on the degree of dryness (rainfall deficit) and the length of the dry period.
<b>Agricultural Drought</b>	Agricultural Drought is based on the impacts to agriculture by factors such as rainfall deficits, soil water deficits, reduced ground water, or reservoir levels needed for irrigation.
<b>Hydrological Drought</b>	Hydrological Drought is based on the impact of rainfall deficits on the water supply such as stream flow, reservoir and lake levels, and ground water table decline.
<b>Socioeconomic Drought</b>	Socioeconomic drought is based on the impact of drought conditions (meteorological, agricultural, or hydrological drought) on supply and demand of some economic goods. Socioeconomic drought occurs when the demand for an economic good exceeds supply as a result of a weather-related deficit in water supply.

The wide variety of disciplines affected by drought, its diverse geographical and temporal distribution, and the many scales drought operates on make it difficult to develop both a definition to describe drought and an index to measure it. Many quantitative measures of drought have been developed in the United States, depending on the discipline affected, the region being considered, and the particular application. Several indices developed by Wayne Palmer, as well as the Standardized Precipitation Index, are useful for describing the many scales of drought.

The U.S. Drought Monitor provides a summary of drought conditions across the United States and Puerto Rico. Often described as a blend of art and science, the Drought Monitor map is updated weekly by combining a variety of data-based drought indices and indicators and local expert input into a single composite drought indicator.

The **Palmer Drought Severity Index** (PDSI) devised in 1965, was the first drought indicator to assess moisture status comprehensively. It uses temperature and precipitation data to calculate water supply and demand, incorporates soil moisture, and is considered most effective for unirrigated cropland. It primarily reflects long-term drought and has been used extensively to initiate drought relief. It is more complex than the Standardized Precipitation Index (SPI) and the Drought Monitor.

The **Standardized Precipitation Index** (SPI) is a way of measuring drought that is different from the Palmer Drought Severity Index (PDSI). Like the PDSI, this index is negative for drought, and positive for wet conditions. But the SPI is a probability index that considers only precipitation, while Palmer's indices are water balance indices that consider water supply (precipitation), demand (evapotranspiration) and loss (runoff).

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The State of North Carolina has a Drought Assessment and Response Plan as an Annex to its Emergency Operations Plan. This plan provides the framework to coordinate statewide response to a drought incident.

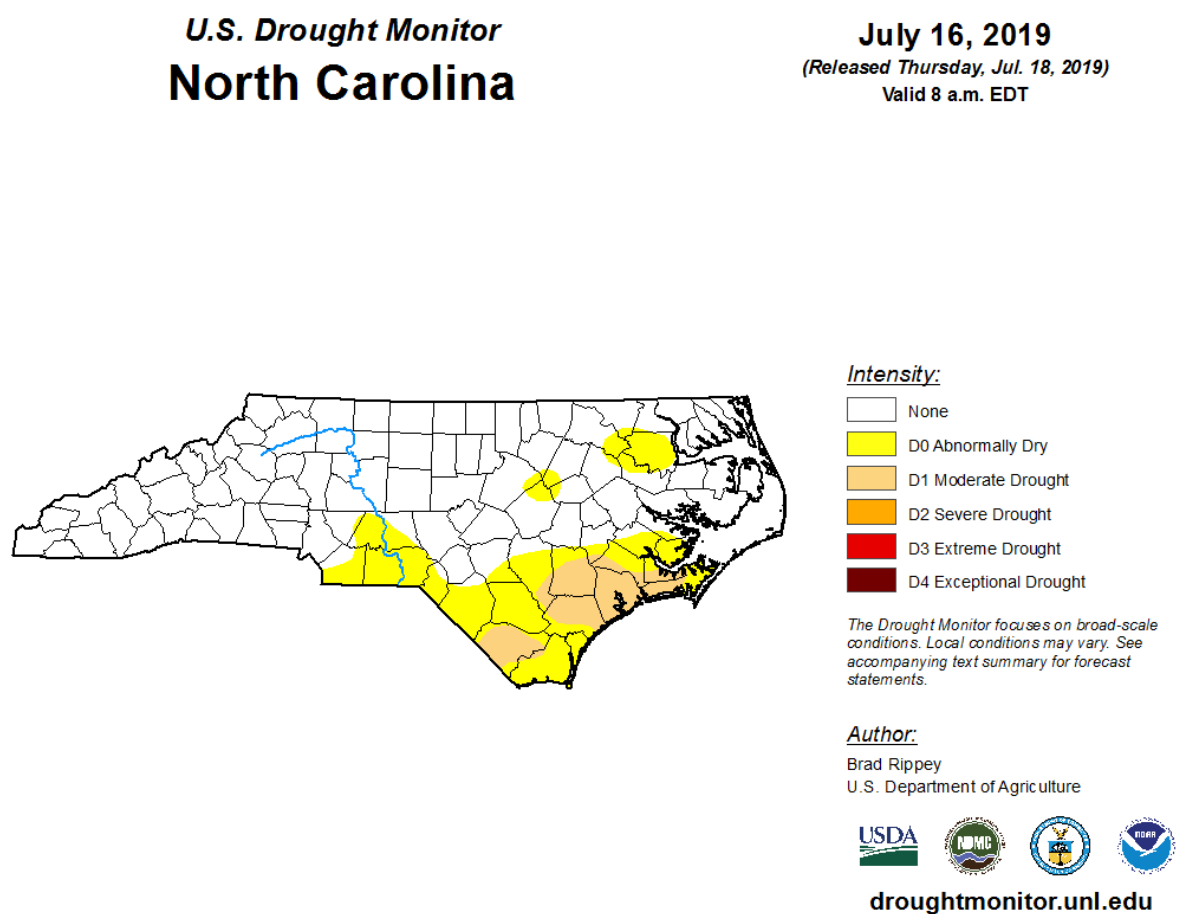
*Warning Time: 1 – More than 24 hours*

*Duration: 4 – More than one week*

### Location

Drought is a regional hazard that can cover the entire planning area, and in some cases the entire state. The figure below notes the U.S. Drought Monitor's drought ratings for North Carolina as of July 16, 2019; as of that date, the Eno-Haw region was experiencing no impacts of drought.

**Figure 4.9 – US Drought Monitor for Week of July 16, 2019**



Source: U.S. Drought Monitor

### Extent

Drought extent can be defined in terms of intensity, using the U.S. Drought Monitor scale. The Drought Monitor Scale measures drought episodes with input from the Palmer Drought Severity Index, the Standardized Precipitation Index, the Keetch-Byram Drought Index, soil moisture indicators, and other inputs as well as information on how drought is affecting people. Figure 4.10 details the classifications

## SECTION 4: RISK ASSESSMENT

used by the U.S. Drought Monitor. A category of D2 (severe) or higher on the U.S. Drought Monitor Scale can typically result in crop or pasture losses, water shortages, and the need to institute water restrictions.

**Figure 4.10 – US Drought Monitor Classifications**

Category	Description	Possible Impacts	Ranges				
			Palmer Drought Severity Index (PDSI)	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Drought Indicator Blends (Percentiles)
D0	Abnormally Dry	<ul style="list-style-type: none"> <li>Going into drought: <ul style="list-style-type: none"> <li>short-term dryness slowing planting, growth of crops or pastures</li> </ul> </li> <li>Coming out of drought: <ul style="list-style-type: none"> <li>some lingering water deficits</li> <li>pastures or crops not fully recovered</li> </ul> </li> </ul>	-1.0 to -1.9	21 to 30	21 to 30	-0.5 to -0.7	21 to 30
D1	Moderate Drought	<ul style="list-style-type: none"> <li>Some damage to crops, pastures</li> <li>Streams, reservoirs, or wells low, some water shortages developing or imminent</li> <li>Voluntary water-use restrictions requested</li> </ul>	-2.0 to -2.9	11 to 20	11 to 20	-0.8 to -1.2	11 to 20
D2	Severe Drought	<ul style="list-style-type: none"> <li>Crop or pasture losses likely</li> <li>Water shortages common</li> <li>Water restrictions imposed</li> </ul>	-3.0 to -3.9	6 to 10	6 to 10	-1.3 to -1.5	6 to 10
D3	Extreme Drought	<ul style="list-style-type: none"> <li>Major crop/pasture losses</li> <li>Widespread water shortages or restrictions</li> </ul>	-4.0 to -4.9	3 to 5	3 to 5	-1.6 to -1.9	3 to 5
D4	Exceptional Drought	<ul style="list-style-type: none"> <li>Exceptional and widespread crop/pasture losses</li> <li>Shortages of water in reservoirs, streams, and wells creating water emergencies</li> </ul>	-5.0 or less	0 to 2	0 to 2	-2.0 or less	0 to 2

Source: US Drought Monitor

From late 2007 through mid-2008, North Carolina experienced the worst drought in state history. During this time, portions of all four Eno-Haw Region counties experienced exceptional drought conditions.

*Impact: 1 – Minor*

*Spatial Extent: 4 – Large*

### Historical Occurrences

U.S. Drought Monitor records drought intensity weekly throughout the country. The North Carolina Department of Environmental Quality (NCDEQ) Division of Water Resources maintains records of Drought Monitor data for the state as far back as January 2000. Table 4.22 presents the number of weeks that each county in the N.E.W. Region spent in drought by intensity over the period from 2000 through 2018, for which the Drought Monitor has records for 973 weeks.

**Table 4.22 – Weeks in Drought, 2000-2018**

County	Weeks in Drought						% of time in Severe Drought or Worse
	Total	D0	D1	D2	D3	D4	
Alamance	496	247	124	65	22	32	12.2%
Durham	456	200	145	53	25	27	10.8%
Orange	484	230	137	65	22	30	12.0%
Person	436	219	121	47	38	11	9.9%

Source: NCDEQ Division of Water Resources, Drought Monitor History

Figure 4.11 through Figure 4.14 shows the historical periods where each county was considered in some level of drought condition. The color key shown in Figure 4.10 indicates the intensity of the drought.

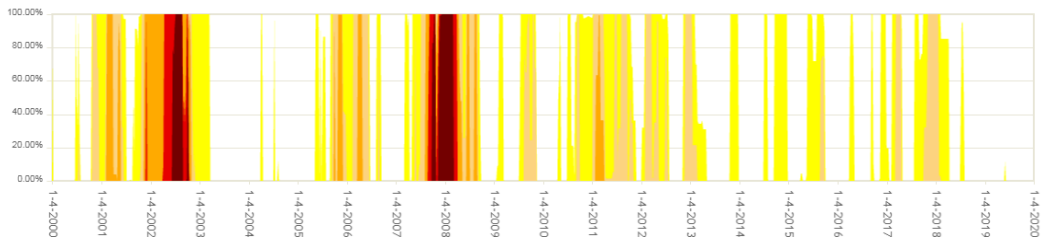
### Alamance County

Between 2000 and 2018, Alamance County was in some level of drought 51% of the time.

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**Figure 4.11 – US Drought Monitor Historical Trends – Alamance County 2000-2018**

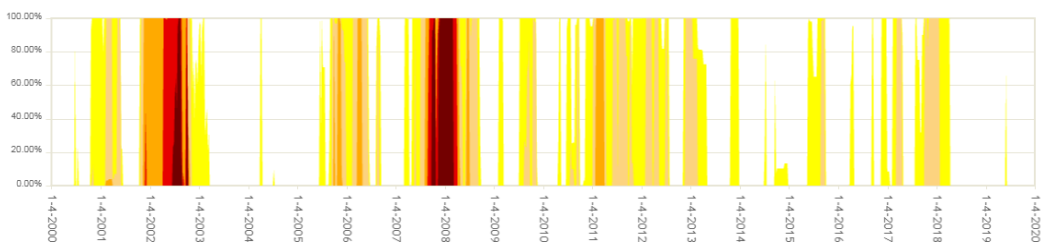


Source: U.S. Drought Monitor

### Durham County

Between 2000 and 2018, Durham County was in some level of drought 46.9% of the time.

**Figure 4.12 – US Drought Monitor Historical Trends – Durham County 2000-2018**

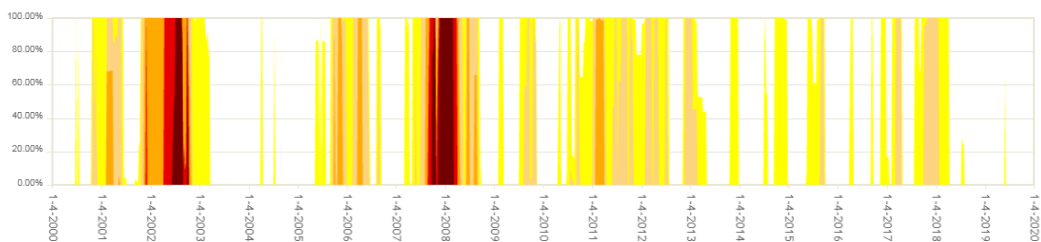


Source: U.S. Drought Monitor

### Orange County

Between 2000 and 2018, Orange County was in some level of drought 49.7% of the time.

**Figure 4.13 – US Drought Monitor Historical Trends – Orange County 2000-2018**

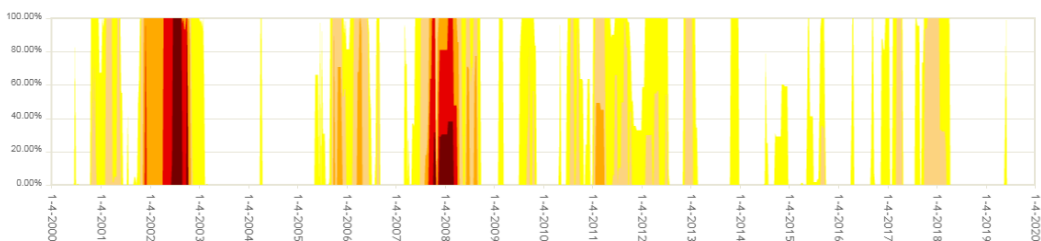


Source: U.S. Drought Monitor

### Person County

Between 2000 and 2018, Person County was in some level of drought 47.6% of the time.

**Figure 4.14 – US Drought Monitor Historical Trends – Person County 2000-2018**



Source: U.S. Drought Monitor

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The National Drought Mitigation Center (NDMC), located at the University of Nebraska in Lincoln, provides a clearinghouse for information on the effects of drought, based on reports from media, observers, impact records, and other sources.

According to the National Drought Mitigation Center's Drought Impact Reporter, during the 10-year period from January 2009 through December 2018, 289 drought impacts were noted for the State of North Carolina, of which 19 were reported to affect the Eno-Haw region. Table 4.23 summarizes the number of impacts reported by category and the years impacts were reported for each category. Note that the Drought Impact Reporter assigns multiple categories to each impact.

**Table 4.23 – Drought Impacts Reported for Eno-Haw Counties, January 2009 through December 2018**

Category	Impacts	Years Reported
Agriculture	2	2010, 2012
Fire	2	2011
Plants & Wildlife	9	2014, 2017
Relief, Response & Restrictions	7	2010, 2011, 2012, 2017
Water Supply & Quality	8	2011, 2012, 2014, 2015, 2017

Source: Drought Impact Reporter, <http://droughtreporter.unl.edu>

### Probability of Future Occurrence

#### *Probability: 3 – Likely*

Over the 19-year (973 week) period from 2000 through 2018, the Eno-Haw Region averaged 468 weeks of drought conditions ranging from abnormally dry to exceptional drought. This equates to a 48 percent chance of drought in any given week. Of this time, an average of approximately 109 weeks were categorized as a severe (D2) drought or greater; which equates to an 11 percent chance of severe drought in any given week.

### 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. The Triangle Regional Resilience Assessment notes that the number of days with extreme temperatures has been increasing in the Triangle, climbing from an average of 18 days over 92°F per year from 1948 to 2012 to a peak of 48 days over 92°F in 2010. The region overall is expected to see longer, more intense periods of drought.

### Vulnerability Assessment

#### **Methodologies and Assumptions**

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Vulnerability to drought in the Eno-Haw region is based on historical occurrences of drought in the planning area and generalized concerns regarding potential drought consequences. Agricultural vulnerability was estimated using data from the 2012 Census of Agriculture and a review of past claims related to drought.

#### **People**

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Drought can affect people's physical and mental health. For those economically dependent on a reliable water supply, drought may cause anxiety or depression about economic losses, reduced incomes, and

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other employment impacts. Conflicts may arise over water shortages. People may be forced to pay more for water, food, and utilities affected by increased water costs.

Drought may also cause health problems due to poorer water quality from lower water levels. If accompanied by extreme heat, drought can also result in higher incidents of heat stroke and even loss of human life.

### Property

Drought is unlikely to cause damages to the built environment. However, in areas with shrinking and expansive soils, drought may lead to structural damages. Drought may cause severe property loss for the agricultural industry in terms of crop and livestock losses. The USDA's Risk Management Agency (RMA) maintains a database of all paid crop insurance claims. Between 2007-2017, the sum of claims paid for crop damage as a result of drought in the Eno-Haw region was \$19,734,491, over 60 percent of these losses were paid out in Person County. The region averaged \$1,794,044 in losses every year. Losses were greatest in 2007 for all counties except for Alamance, where losses were greatest in 2011.

**Table 4.24 – Crop Losses Resulting from Drought, 2007-2017, Alamance County**

Year	Determined Acres	Indemnity Amount
2007	3,299.34	\$793,653.00
2008	1,131.12	\$273,753.00
2009	1,985.60	\$561,311.00
2010	1,909.19	\$636,395.00
2011	2,670.08	\$1,028,993.00
2012	1,007.26	\$179,029.00
2014	698.14	\$296,622.90
2015	1,879.76	\$507,006.90
2016	730.43	\$384,782.90
<b>Total</b>	<b>15,310.92</b>	<b>\$4,661,546.70</b>

Source: USDA Risk Management Agency

**Table 4.25 – Crop Losses Resulting from Drought, 2007-2017, Durham County**

Year	Determined Acres	Indemnity Amount
2007	980.07	\$160,081.00
2008	908.32	\$151,673.00
2009	190.67	\$25,294.00
2010	412.61	\$67,285.00
2011	687.75	\$155,180.00
2012	370.58	\$52,974.00
2014	150.56	\$17,874.16
2015	284.86	\$34,739.80
2016	133.05	\$24,683.00
<b>Total</b>	<b>4,118.47</b>	<b>\$689,783.96</b>

Source: USDA Risk Management Agency

**Table 4.26 – Crop Losses Resulting from Drought, 2007-2017, Orange County**

Year	Determined Acres	Indemnity Amount
2007	3,257.97	\$654,315.00
2008	1,382.18	\$189,012.00
2009	706.36	\$126,118.00
2010	2,312.01	\$340,313.00

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Year	Determined Acres	Indemnity Amount
2011	1,951.83	\$339,680.00
2012	1,272.73	\$266,205.00
2014	1,039.00	\$129,503.35
2015	785.50	\$89,972.40
2016	207.01	\$82,729.71
<b>Total</b>	<b>12,914.59</b>	<b>\$2,217,848.46</b>

Source: USDA Risk Management Agency

**Table 4.27 – Crop Losses Resulting from Drought, 2007-2017, Person County**

Year	Determined Acres	Indemnity Amount
2007	15,953.87	\$2,395,778.00
2008	12,595.77	\$1,837,537.00
2009	4,975.73	\$1,045,095.00
2010	9,048.97	\$1,621,155.00
2011	6,468.28	\$1,262,455.00
2012	3,258.53	\$669,129.00
2013	635.49	\$50,604.00
2014	1,810.55	\$389,822.68
2015	3,723.51	\$1,181,568.35
2016	3,699.43	\$1,712,168.50
<b>Total</b>	<b>62,170.13</b>	<b>\$12,165,312.53</b>

Source: USDA Risk Management Agency

### Environment

Drought can affect local wildlife by shrinking food supplies and damaging habitats. Sometimes this damage is only temporary, and other times it is irreversible. Wildlife may face increased disease rates due to limited access to food and water. Increased stress on endangered species could cause extinction.

Drought conditions can also provide a substantial increase in wildfire risk. As plants and trees die from a lack of precipitation, increased insect infestations, and diseases—all of which are associated with drought—they become fuel for wildfire. Long periods of drought can result in more intense wildfires, which bring additional consequences for the economy, the environment, and society. Drought may also increase likelihood of wind and water erosion of soils.

### Consequence Analysis

Table 4.28 summarizes the potential negative consequences of drought.

**Table 4.28 – Consequence Analysis - Drought**

Category	Consequences
Public	Can cause anxiety or depression about economic losses, conflicts over water shortages, reduced incomes, fewer recreational activities, higher incidents of heat stroke, and fatality.
Responders	Impacts to responders are unlikely. Exceptional drought conditions may impact the amount of water immediately available to respond to wildfires.
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.

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Category	Consequences
Property, Facilities and Infrastructure	Drought has the potential to affect water supply for residential, commercial, institutional, industrial, and government-owned areas. Drought can reduce water supply in wells and reservoirs. Utilities may be forced to increase rates.
Environment	Environmental impacts include strain on local plant and wildlife; increased probability of erosion and wildfire.
Economic Condition of the Jurisdiction	Farmers may face crop losses or increased livestock costs. Businesses that depend on farming may experience secondary impacts. Extreme drought has the potential to impact local businesses in landscaping, recreation and tourism, and public utilities.
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.

### Hazard Summary by Jurisdiction

The following table summarizes drought hazard risk by jurisdiction. Drought risk is uniform across the planning area. Warning time, duration, and spatial extent are inherent to the hazard and remain constant across jurisdictions. The majority of damages that result from drought are to crops and other agriculture-related activities as well as water-dependent recreation industries. The magnitude of the impacts is typically greater in unincorporated areas due to greater exposure of agriculture. Alamance, Orange, and Person Counties were assigned an impact rating of "limited" because each has over a quarter of their land area in agriculture, as detailed in Section 4.4.4. In developed areas, the magnitude of drought is less severe, with lawns and local gardens affected and potential impacts on local water supplies during severe, prolonged drought.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	Score	Priority
Alamance County	3	2	4	1	4	2.8	H
Burlington	3	1	4	1	4	2.5	H
Graham	3	1	4	1	4	2.5	H
Mebane	3	1	4	1	4	2.5	H
Elon	3	1	4	1	4	2.5	H
Green Level	3	1	4	1	4	2.5	H
Haw River	3	1	4	1	4	2.5	H
Ossipee	3	1	4	1	4	2.5	H
Swepsonville	3	1	4	1	4	2.5	H
Alamance	3	1	4	1	4	2.5	H
Durham County	3	1	4	1	4	2.5	H
Durham	3	1	4	1	4	2.5	H
Orange County	3	2	4	1	4	2.8	H
Carrboro	3	1	4	1	4	2.5	H
Chapel Hill	3	1	4	1	4	2.5	H
Hillsborough	3	1	4	1	4	2.5	H
Person County	3	2	4	1	4	2.8	H
Roxboro	3	1	4	1	4	2.5	H

### 4.5.3 Earthquake

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Earthquake	Unlikely	Minor	Large	Less than 6 hrs	Less than 6 hrs	1.9

#### Hazard Background

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

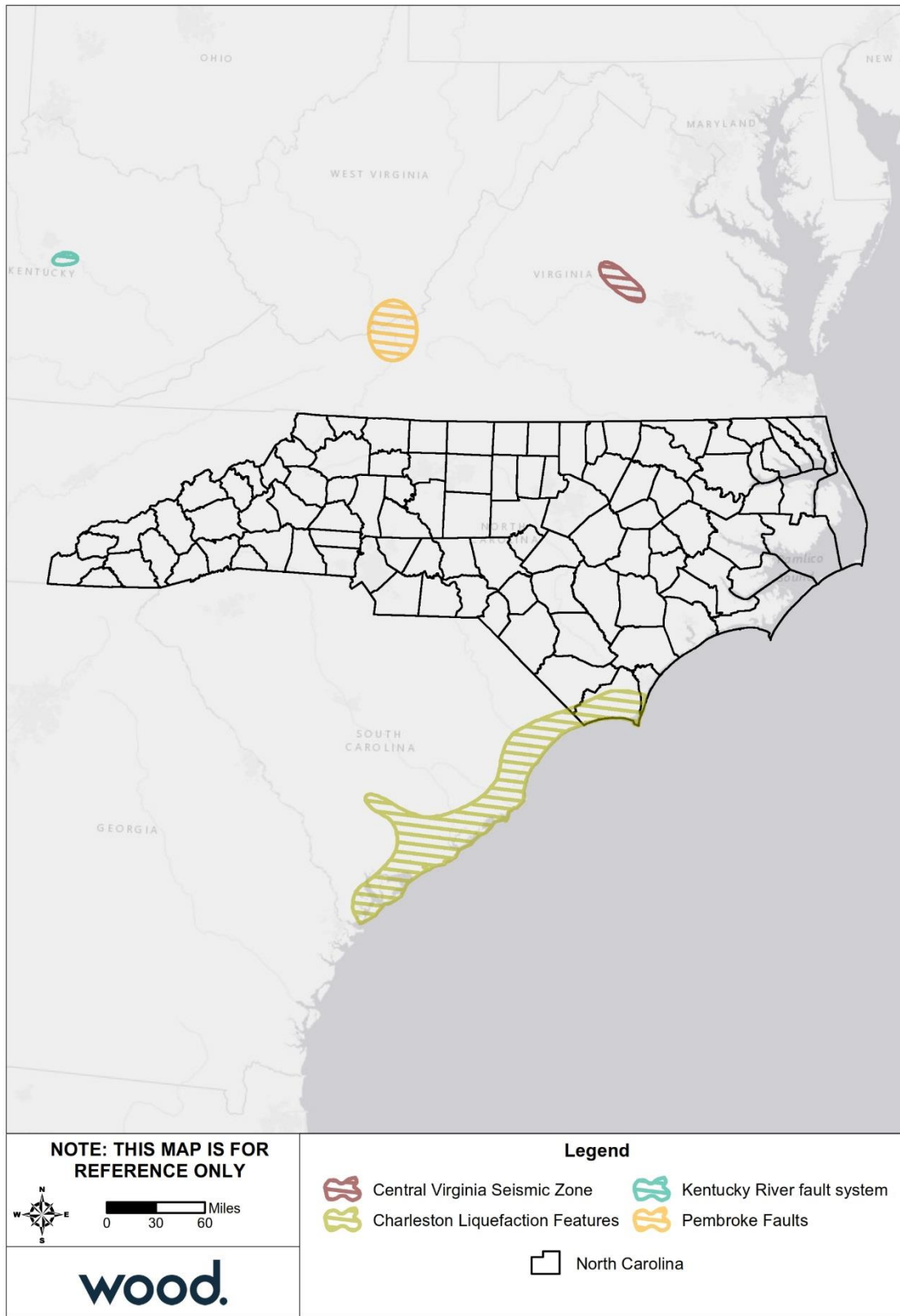
*Warning Time: 4 – Less than 6 hours*

*Duration: 1 – Less than 6 hours*

#### Location

Figure 4.15 reflects the Quaternary faults that present an earthquake hazard for the Eno-Haw region planning area based on data from the USGS Earthquake Hazards Program.

Figure 4.15 – US Quaternary Faults



Source: USGS Earthquake Hazards Program



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All of North Carolina is subject to earthquakes, with the western and southern region most vulnerable to a 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 8.0 on the Richter Scale during the last 200 years. In addition, there are several smaller fault lines in eastern Tennessee and throughout North Carolina that could produce less severe shaking.

### Extent

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. A detailed description of the Richter Scale is given in Table 4.29. Although the Richter scale is usually used by the news media when reporting the intensity of earthquakes and is the scale most familiar to the public, the scale currently used by the scientific community in the United States is called the Modified Mercalli Intensity (MMI) scale. The MMI scale is an arbitrary ranking based on observed effects. Table 4.30 shows descriptions for levels of earthquake intensity on the MMI scale compared to the Richter scale. Seismic shaking is typically the greatest cause of losses to structures during earthquakes.

**Table 4.29 – Richter Scale**

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

Source: FEMA

**Table 4.30 – Comparison of Richter Scale and Modified Mercalli Intensity (MMI) Scale**

MMI	Richter Scale	Felt Intensity
I	0 – 1.9	Not felt. Marginal and long period effects of large earthquakes.
II	2.0 – 2.9	Felt by persons at rest, on upper floors, or favorably placed.
III	3.0 – 3.9	Felt indoors. Hanging objects swing. Vibration like passing of light trucks. Duration estimated. May not be recognized as an earthquake.
IV	4.0 – 4.3	Hanging objects swing. Vibration like passing of heavy trucks. Standing motor cars rock. Windows, dishes, doors rattle. Glasses clink the upper range of IV, wooden walls and frame creak.
V	4.4 – 4.8	Felt outdoors; direction estimated. Sleepers awakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing, close, open. Pendulum clocks stop, start.
VI	4.9 – 5.4	Felt by all. Many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Books, etc., fall off shelves. Pictures fall off walls. Furniture moved. Weak plaster and masonry D cracked. Small bells ring. Trees, bushes shaken.
VII	5.5 – 6.1	Difficult to stand. Noticed by drivers of motor cars. Hanging objects quiver. Furniture broken. Damage to masonry D, including cracks. Weak chimneys broken at roof line. Fall of plaster, loose bricks, stones, tiles, cornices. Some cracks in masonry C. Waves on ponds. Small slides and caving in along sand or gravel banks. Large bells ring. Concrete irrigation ditches damaged.
VII	6.2 – 6.5	Steering of motor cars is affected. Damage to masonry C; partial collapse. Some damage to masonry B. Fall of stucco and some masonry walls. Twisting, fall of chimneys, factory

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MMI	Richter Scale	Felt Intensity
		stacks, monuments, towers, elevated tanks. Frame houses moved on foundations. Decayed piling broken off. Branches broken from trees. Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes.
IX	6.6 – 6.9	General panic. Masonry D destroyed; masonry C heavily damaged, sometimes with complete collapse; masonry B seriously damaged. (General damage to foundations.) Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in ground. In alluvial areas sand and mud ejected, earthquake fountains, sand craters.
X	7.0 – 7.3	Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud shifted horizontally on beaches and flat land. Rails bent slightly.
XI	7.4 – 8.1	Rails bent greatly. Underground pipelines completely out of service.
XII	> 8.1	Damage nearly total. Large rock masses displaced. Lines of sight and level distorted. Objects thrown in the air.

Masonry A: Good workmanship, mortar, and design; reinforced, especially laterally, and bound together by using steel, concrete, etc.; designed to resist lateral forces. Masonry B: Good workmanship and mortar; reinforced, but not designed in detail to resist lateral forces. Masonry C: Ordinary workmanship and mortar; no extreme weaknesses like failing to tie in at corners, but neither reinforced nor designed against horizontal forces. Masonry D: Weak materials, such as adobe; poor mortar; low standards of workmanship; weak horizontally.

Source: Oklahoma State Hazard Mitigation Plan.

As reported in the 2015 Eno-Haw Regional Hazard Mitigation Plan, the largest earthquake to occur within 30 miles of Durham was a 2.7 magnitude in 1978.

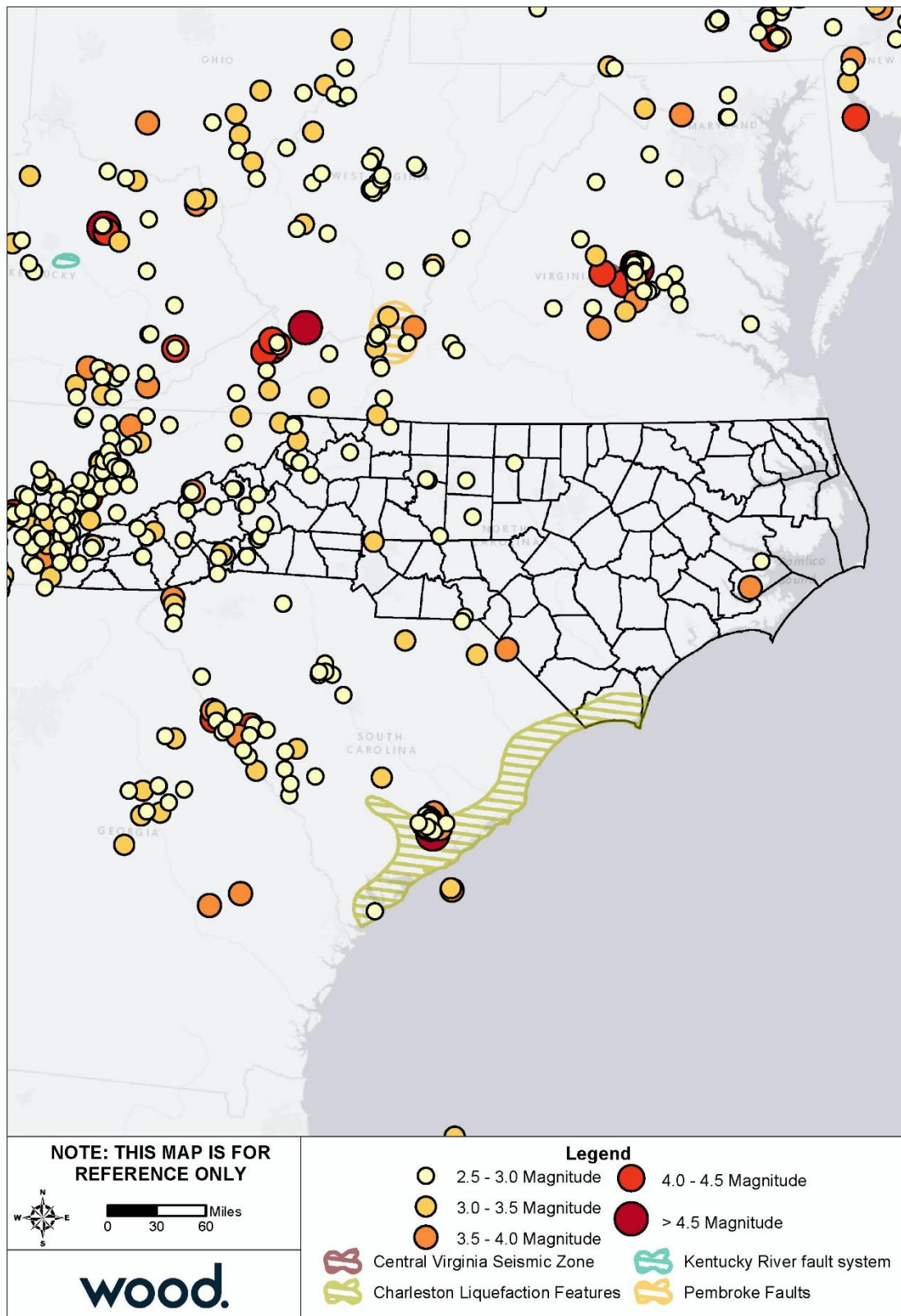
*Impact: 1 – Minor*

*Spatial Extent: 4 – Large*

### Historical Occurrences

The USGS Earthquake Hazards Program maintains a database of all historical earthquakes of a magnitude 2.5 and greater. These events are illustrated in the following pages. Figure 4.16 shows historical earthquakes by magnitude in relation to North Carolina and the Quaternary Faults identified by USGS. This includes events from 1973 to 2019.

Figure 4.16 – Historical Earthquakes by Magnitude, 1973-2019



Source: USGS Earthquakes Hazard Program

The above map documents all earthquakes that have occurred within North Carolina; however, given the long distances across which earthquake impacts can be felt, these events do not encompass all earthquakes that have affected North Carolina. The USGS Earthquake Hazards Program compiles data on a variety of earthquake metrics, including felt impact. According to USGS records, there have been two earthquakes with a felt impact of III or greater on the MMI scale in North Carolina since 1989; neither of these events caused felt impacts in the Eno-Haw Region.

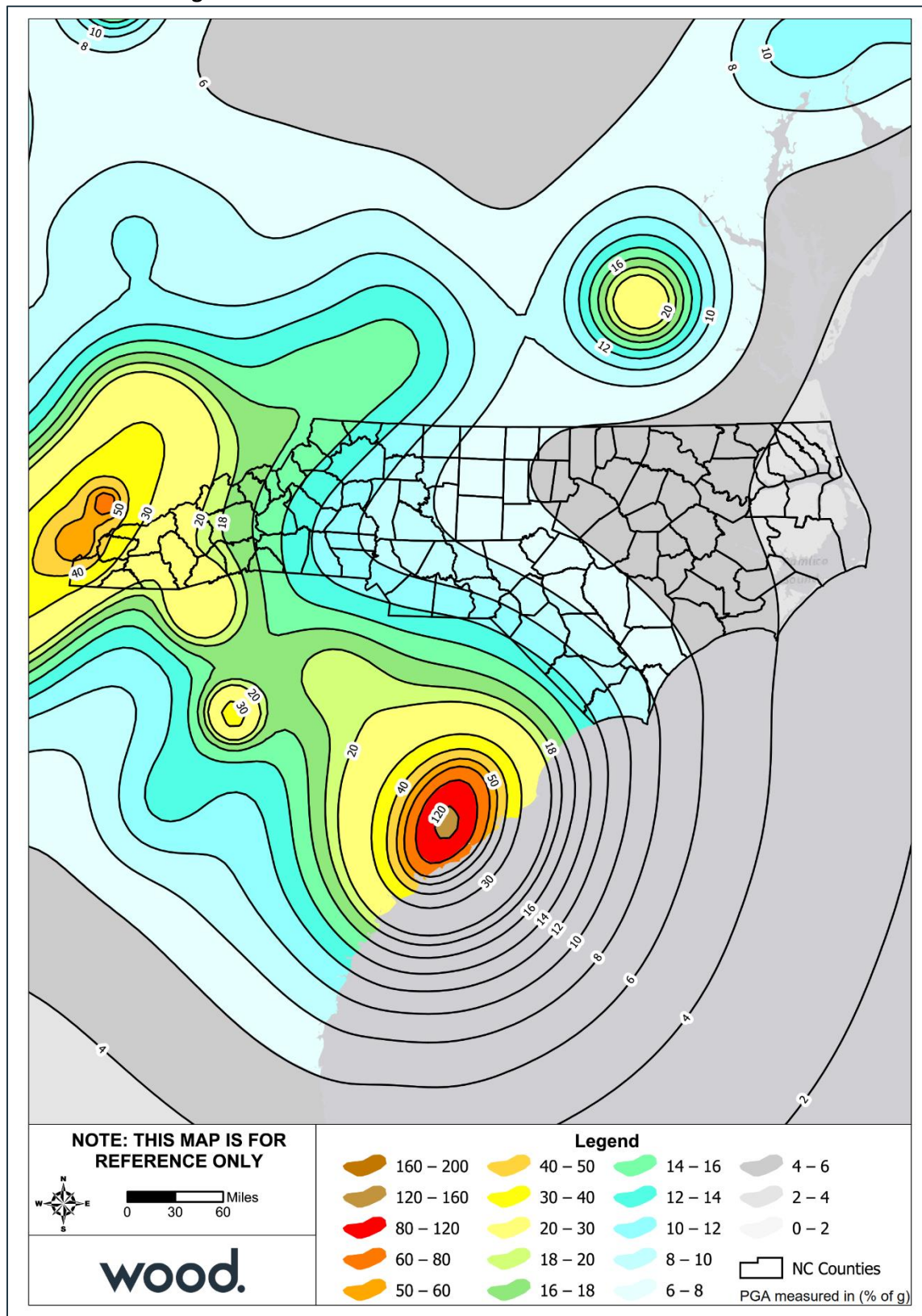
### Probability of Future Occurrence

Ground motion is the movement of the earth's surface due to earthquakes or explosions. It is produced by waves generated by a sudden slip on a fault or sudden pressure at the explosive source and travels through the earth and along its surface. Ground motion is amplified when surface waves of unconsolidated materials bounce off of or are refracted by adjacent solid bedrock. The probability of ground motion is depicted in USGS earthquake hazard maps by showing, by contour values, the earthquake ground motions (of a particular frequency) that have a common given probability of being exceeded in 50 years.

Figure 4.17 reflects the seismic hazard for the Eno-Haw Region based on the national USGS map of peak acceleration with two percent probability of exceedance in 50 years. To produce these estimates, the ground motions being considered at a given location are those from all future possible earthquake magnitudes at all possible distances from that location. The ground motion coming from a particular magnitude and distance is assigned an annual probability equal to the annual probability of occurrence of the causative magnitude and distance. The method assumes a reasonable future catalog of earthquakes, based upon historical earthquake locations and geological information on the recurrence rate of fault ruptures. When all the possible earthquakes and magnitudes have been considered, a ground motion value is determined such that the annual rate of its being exceeded has a certain value.

Therefore, for the given probability of exceedance, two percent, the locations shaken more frequently will have larger ground motions. The Eno-Haw Region is located within the light blue and dark gray zones representing a low peak acceleration of 0.04 to 0.08% g. Alamance County is located fully in 0.06 to 0.08% g zone and Durham County is located fully in the 0.04 to 0.06% zone.

Figure 4.17 – Seismic Hazard Information for North Carolina



Source: USGS Earthquake Hazards Program



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Based on this data, it can be reasonably assumed that an earthquake event affecting the Eno-Haw Region is unlikely.

*Probability: 1 – Unlikely*

### 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.

### Vulnerability Assessment

#### People

Earthquake events in the Eno-Haw Region are unlikely to produce more than mild ground shaking; therefore, injury or death is unlikely. Objects falling from shelves generally pose the greatest threat to safety.

Table 4.31 details the population estimated to be at risk from a 250-year earthquake, according to the NCEM IRISK database.

**Table 4.31 – Estimated Population Impacted by 250-Year Earthquake**

Jurisdiction	Total Population	Total Population at Risk		All Elderly Population	Elderly Population at Risk		All Children Population	Children at Risk	
		Number	Percent		Number	Percent		Number	Percent
Alamance County									
Unincorporated Alamance County	43,522	26,322	60.50%	6,358	3,845	60.50%	2,742	1,658	60.50%
City of Burlington	56,075	26,978	48.10%	8,192	3,935	48%	3,533	1,700	48.10%
City of Graham	16,584	7,709	46.50%	2,423	1,126	46.50%	1,045	486	46.50%
City of Mebane	14,590	5,488	37.6%	2,020	760	37.6%	893	336	37.6%
Town of Elon	10,006	5,431	54.30%	1,462	794	54.30%	630	342	54.30%
Town of Green Level	2,368	1,402	59.20%	346	205	59.20%	149	88	59.10%
Town of Haw River	3,773	2,034	53.90%	551	297	53.90%	238	128	53.80%
Town of Ossipee	544	175	32.20%	79	25	31.60%	34	11	32.40%
Town of Swepsonville	1,151	545	47.40%	168	80	47.60%	73	35	47.90%
Village of Alamance	1,462	829	56.70%	214	121	56.50%	92	52	56.50%
Subtotal Alamance	150,075	76,913	51.25%	21,813	11,188	51.29%	9,429	4,836	51.29%
Durham County									
Unincorporated Durham County	38,181	5,057	13.20%	3,725	493	13.20%	2,826	374	13.20%
City of Durham	225,814	21,755	9.63%	22,031	2,122	9.63%	16,715	1,610	9.63%
Subtotal Durham	263,995	26,812	10.16%	25,756	2,615	10.15%	19,541	1,984	10.15%
Orange County									

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Jurisdiction	Total Population	Total Population at Risk		All Elderly Population	Elderly Population at Risk		All Children Population	Children at Risk	
		Number	Percent		Number	Percent		Number	Percent
Unincorporated Orange County	45,470	12,600	27.70%	4,381	1,214	27.70%	2,342	649	27.70%
Town of Carrboro	20,883	2,991	14.30%	2,012	288	14.30%	1,076	154	14.30%
Town of Chapel Hill	59,351	7,887	13.29%	5,722	760	13.28%	3,117	414	13.28%
Town of Hillsborough	8,467	1,309	15.50%	816	126	15.40%	436	67	15.40%
<b>Subtotal Orange</b>	<b>134,171</b>	<b>24,787</b>	<b>18.47%</b>	<b>12,931</b>	<b>2,388</b>	<b>18.47%</b>	<b>6,971</b>	<b>1,284</b>	<b>18.42%</b>
<b>Person County</b>									
Unincorporated Person County	26,396	8,399	31.80%	4,007	1,275	31.80%	1,584	504	31.80%
City of Roxboro	13,079	3,125	23.90%	1,986	475	23.90%	785	188	23.90%
<b>Subtotal Person</b>	<b>39,475</b>	<b>11,524</b>	<b>29.20%</b>	<b>5,993</b>	<b>1,750</b>	<b>29.20%</b>	<b>2,369</b>	<b>692</b>	<b>29.20%</b>
<b>Total</b>	<b>587,716</b>	<b>140,036</b>	<b>23.83%</b>	<b>66,493</b>	<b>17,941</b>	<b>26.98%</b>	<b>38,310</b>	<b>8,796</b>	<b>22.96%</b>

Source: NCEM Risk Management Tool

### Property

In a severe earthquake event, buildings can be damaged by the shaking itself or by the ground beneath them settling to a different level than it was before the earthquake (subsidence). Buildings can even sink into the ground if soil liquefaction occurs. If a structure (a building, road, etc.) is built across a fault, the ground displacement during an earthquake could seriously damage that structure.

Earthquakes can also cause damages to infrastructure, resulting in secondary hazards. Damages to dams or levees could cause failures and subsequent flooding. Fires can be started by broken gas lines and power lines. Fires can be a serious problem, especially if the water lines that feed the fire hydrants have been damaged as well.

The Eno-Haw Region has not been impacted by an earthquake with more than a moderate intensity, so damage to the built environment is unlikely.

Table 4.32 and Table 4.33 detail the estimated buildings impacted from a 250-year earthquake event and a 500-year earthquake event, respectively.

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**Table 4.32 – Estimated Buildings Impacted by 250-Year Earthquake Event**

Jurisdiction	All Buildings	Residential Buildings at Risk			Commercial Buildings at Risk			Public Buildings at Risk			Total Buildings at Risk		
	Num	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages
<b>Alamance County</b>													
Unincorporated Alamance County	29,650	15,675	52.9%	\$81,369	3,408	11.5%	\$72,933	154	0.5%	\$14,963	19,237	64.9%	\$169,265
City of Burlington	24,403	10,281	42.1%	\$88,047	2,373	9.7%	\$401,369	208	0.9%	\$31,455	12,862	52.7%	\$520,871
City of Graham	7,269	3,056	42%	\$22,658	525	7.2%	\$63,096	131	1.8%	\$15,077	3,712	51.1%	\$100,830
City of Mebane	5,835	1,996	34.2%	\$14,336	458	7.8%	\$110,301	38	0.7%	\$7,626	2,492	42.7%	\$132,263
Town of Elon	2,760	1,321	47.9%	\$15,155	142	5.1%	\$19,588	160	5.8%	\$18,005	1,623	58.8%	\$52,748
Town of Green Level	1,177	626	53.2%	\$2,188	109	9.3%	\$3,923	9	0.8%	\$231	744	63.2%	\$6,342
Town of Haw River	2,352	1,153	49%	\$4,899	167	7.1%	\$18,756	18	0.8%	\$1,864	1,338	56.9%	\$25,519
Town of Ossipee	330	96	29.1%	\$446	21	6.4%	\$1,134	4	1.2%	\$357	121	36.7%	\$1,938
Town of Swepsonville	573	257	44.9%	\$1,912	24	4.2%	\$8,573	4	0.7%	\$482	285	49.7%	\$10,967
Village of Alamance	798	405	50.8%	\$3,650	66	8.3%	\$4,202	16	2%	\$1,600	487	61%	\$9,452
<b>Subtotal Alamance</b>	<b>75,147</b>	<b>34,866</b>	<b>46.4%</b>	<b>\$234,660</b>	<b>7,293</b>	<b>9.7%</b>	<b>\$703,875</b>	<b>742</b>	<b>1%</b>	<b>\$91,660</b>	<b>42,901</b>	<b>57.1%</b>	<b>\$1,030,195</b>
<b>Durham County</b>													
Unincorporated Durham County	21,038	2,348	11.2%	\$13,163	2,796	13.3%	\$311,748	214	1%	\$30,751	5,358	25.5%	\$355,662
City of Durham	75,588	6,329	8.4%	\$154,564	5,920	7.8%	\$786,180	1,537	2%	\$216,209	13,786	18.2%	\$1,156,953
<b>Subtotal Durham</b>	<b>96,626</b>	<b>8,677</b>	<b>8.98%</b>	<b>\$167,727</b>	<b>8,716</b>	<b>9.02%</b>	<b>\$1,097,928</b>	<b>1,751</b>	<b>1.81%</b>	<b>\$246,960</b>	<b>19,144</b>	<b>19.81%</b>	<b>\$1,512,615</b>
<b>Orange County</b>													
Unincorporated Orange County	24,533	5,981	24.4%	\$42,913	2,592	10.6%	\$92,811	211	0.9%	\$39,310	8,784	35.8%	\$175,034
Town of Carrboro	5,782	782	13.5%	\$25,423	257	4.4%	\$26,444	42	0.7%	\$8,758	1,081	18.7%	\$60,625
Town of Chapel Hill	15,108	1,816	12%	\$75,115	560	3.7%	\$135,773	499	3.3%	\$101,537	2,875	19%	\$312,424
Town of Hillsborough	3,883	518	13.3%	\$6,208	352	9.1%	\$46,427	105	2.7%	\$16,571	975	25.1%	\$69,206
<b>Subtotal Orange</b>	<b>49,306</b>	<b>9,097</b>	<b>18.45%</b>	<b>\$149,659</b>	<b>3,761</b>	<b>7.63%</b>	<b>\$301,455</b>	<b>857</b>	<b>1.74%</b>	<b>\$166,176</b>	<b>13,715</b>	<b>27.82%</b>	<b>\$617,289</b>
<b>Person County</b>													
Unincorporated Person County	17,714	4,736	26.7%	\$18,274	2,598	14.7%	\$40,544	124	0.7%	\$22,359	7,458	42.1%	\$81,177
City of Roxboro	6,617	1,371	20.7%	\$9,591	701	10.6%	\$114,968	125	1.9%	\$24,517	2,197	33.2%	\$149,076
<b>Subtotal Person</b>	<b>24,331</b>	<b>6,107</b>	<b>25.1%</b>	<b>\$27,865</b>	<b>3,299</b>	<b>13.6%</b>	<b>\$155,512</b>	<b>249</b>	<b>1%</b>	<b>\$46,876</b>	<b>9,655</b>	<b>39.7%</b>	<b>\$230,253</b>
<b>Total</b>	<b>245,410</b>	<b>58,747</b>	<b>23.9%</b>	<b>\$579,911</b>	<b>23,069</b>	<b>9.4%</b>	<b>\$2,258,770</b>	<b>3,599</b>	<b>1.5%</b>	<b>\$551,672</b>	<b>85,415</b>	<b>34.8%</b>	<b>\$3,390,352</b>

Source: NCEM Risk Management Tool

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**Table 4.33 – Estimated Buildings Impacted by 500-Year Earthquake Event**

Jurisdiction	All Buildings	Residential Buildings at Risk			Commercial Buildings at Risk			Public Buildings at Risk			Total Buildings at Risk		
	Num	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages
<b>Alamance County</b>													
Unincorporated Alamance County	29,650	25,911	87.4%	\$1,487,743	3,425	11.6%	\$699,048	283	1%	\$167,849	29,619	99.9%	\$2,354,640
City of Burlington	24,403	21,618	88.6%	\$1,535,403	2,401	9.8%	\$3,129,356	320	1.3%	\$318,481	24,339	99.7%	\$4,983,240
City of Graham	7,269	6,575	90.5%	\$430,981	530	7.3%	\$489,890	155	2.1%	\$141,266	7,260	99.9%	\$1,062,138
City of Mebane	5,835	5,303	90.9%	\$335,334	465	8%	\$898,971	64	1.1%	\$78,658	5,832	99.9%	\$1,312,963
Town of Elon	2,760	2,437	88.3%	\$224,678	147	5.3%	\$206,677	174	6.3%	\$147,561	2,758	99.9%	\$578,917
Town of Green Level	1,177	1,057	89.8%	\$44,879	109	9.3%	\$30,507	10	0.8%	\$2,943	1,176	99.9%	\$78,329
Town of Haw River	2,352	2,139	90.9%	\$98,913	168	7.1%	\$147,559	31	1.3%	\$18,450	2,338	99.4%	\$264,922
Town of Ossipee	330	299	90.6%	\$11,303	21	6.4%	\$9,436	7	2.1%	\$2,891	327	99.1%	\$23,629
Town of Swepsonville	573	543	94.8%	\$33,133	24	4.2%	\$56,274	5	0.9%	\$4,672	572	99.8%	\$94,079
Village of Alamance	798	714	89.5%	\$53,029	66	8.3%	\$32,592	17	2.1%	\$12,437	797	99.9%	\$98,058
<b>Subtotal Alamance</b>	<b>75,147</b>	<b>66,596</b>	<b>88.6%</b>	<b>\$4,255,396</b>	<b>7,356</b>	<b>9.8%</b>	<b>\$5,700,310</b>	<b>1,066</b>	<b>1.4%</b>	<b>\$895,208</b>	<b>75,018</b>	<b>99.8%</b>	<b>\$10,850,915</b>
<b>Durham County</b>													
Unincorporated Durham County	21,038	17,968	85.4%	\$598,227	2,818	13.4%	\$2,564,533	234	1.1%	\$288,620	21,020	99.9%	\$3,451,381
City of Durham	75,588	67,732	89.6%	\$3,926,650	6,071	8%	\$7,519,780	1,667	2.2%	\$2,039,430	75,470	99.8%	\$13,485,861
<b>Subtotal Durham</b>	<b>96,626</b>	<b>85,700</b>	<b>88.69%</b>	<b>\$4,524,877</b>	<b>8,889</b>	<b>9.20%</b>	<b>\$10,084,313</b>	<b>1,901</b>	<b>1.97%</b>	<b>\$2,328,050</b>	<b>96,490</b>	<b>99.86%</b>	<b>\$16,937,242</b>
<b>Orange County</b>													
Unincorporated Orange County	24,533	21,624	88.1%	\$1,262,476	2,657	10.8%	\$850,353	246	1%	\$389,570	24,527	100%	\$2,502,398
Town of Carrboro	5,782	5,464	94.5%	\$587,987	261	4.5%	\$254,468	46	0.8%	\$95,233	5,771	99.8%	\$937,689
Town of Chapel Hill	15,108	13,922	92.1%	\$1,738,894	617	4.1%	\$1,215,358	528	3.5%	\$1,018,502	15,067	99.7%	\$3,972,753
Town of Hillsborough	3,883	3,408	87.8%	\$166,724	358	9.2%	\$414,627	111	2.9%	\$186,994	3,877	99.8%	\$768,345
<b>Subtotal Orange</b>	<b>49,306</b>	<b>44,418</b>	<b>90.09%</b>	<b>\$3,756,081</b>	<b>3,893</b>	<b>7.90%</b>	<b>\$2,734,806</b>	<b>931</b>	<b>1.89%</b>	<b>\$1,690,299</b>	<b>49,242</b>	<b>99.87%</b>	<b>\$8,181,185</b>
<b>Person County</b>													
Unincorporated Person County	17,714	14,893	84.1%	\$509,166	2,613	14.8%	\$356,556	156	0.9%	\$211,555	17,662	99.7%	\$1,077,277
City of Roxboro	6,617	5,754	87%	\$208,672	710	10.7%	\$841,518	144	2.2%	\$210,153	6,608	99.9%	\$1,260,343
<b>Subtotal Person</b>	<b>24,331</b>	<b>20,647</b>	<b>84.9%</b>	<b>\$717,838</b>	<b>3,323</b>	<b>13.7%</b>	<b>\$1,198,074</b>	<b>300</b>	<b>1.2%</b>	<b>\$421,708</b>	<b>24,270</b>	<b>99.7%</b>	<b>\$2,337,620</b>
<b>Total</b>	<b>245,410</b>	<b>217,361</b>	<b>88.6%</b>	<b>\$13,254,192</b>	<b>23,461</b>	<b>9.6%</b>	<b>\$19,717,503</b>	<b>4,198</b>	<b>1.7%</b>	<b>\$5,335,265</b>	<b>245,020</b>	<b>99.8%</b>	<b>\$38,306,962</b>

Source: NCEM Risk Management Tool

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### Environment

An earthquake is unlikely to cause substantial impacts to the natural environment in the Eno-Haw Region. Impacts to the built environment (e.g. ruptured gas line) could damage the surrounding environment. However, this type damage is unlikely based on historical occurrences.

### Consequence Analysis

Table 4.34 summarizes the potential negative consequences of earthquake.

**Table 4.34 – Consequence Analysis - Earthquake**

Category	Consequences
Public	Impact expected to be severe for people who are unprotected or unable to take shelter; moderate to light impacts are expected for those who are protected.
Responders	Responders may be required to enter unstable structures or compromised infrastructure. Adverse impacts are expected to be severe for unprotected personnel and moderate to light for protected personnel.
Continuity of Operations (including Continued Delivery of Services)	Damage to facilities/personnel in the area of the incident may require relocation of operations and lines of succession execution. Disruption of lines of communication and destruction of facilities may extensively postpone delivery of services.
Property, Facilities and Infrastructure	Damage to facilities and infrastructure in the area of the incident may be extensive for facilities, people, infrastructure, and HazMat.
Environment	May cause extensive damage, creating denial or delays in the use of some areas. Remediation may be needed.
Economic Condition of the Jurisdiction	Local economy and finances expected to be adversely affected, possibly for an extended period of time.
Public Confidence in the Jurisdiction's Governance	Ability to respond and recover may be questioned and challenged if planning, response, and recovery are not timely and effective.

### Hazard Summary by Jurisdiction

The following table summarizes earthquake hazard risk by jurisdiction. Earthquake risk is uniform across the planning area.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	Score	Priority
Alamance County	1	1	4	4	1	1.9	L
Burlington	1	1	4	4	1	1.9	L
Graham	1	1	4	4	1	1.9	L
Mebane	1	1	4	4	1	1.9	L
Elon	1	1	4	4	1	1.9	L
Green Level	1	1	4	4	1	1.9	L
Haw River	1	1	4	4	1	1.9	L
Ossipee	1	1	4	4	1	1.9	L
Sweepsonville	1	1	4	4	1	1.9	L
Alamance	1	1	4	4	1	1.9	L
Durham County	1	1	4	4	1	1.9	L
Durham	1	1	4	4	1	1.9	L
Orange County	1	1	4	4	1	1.9	L
Carrboro	1	1	4	4	1	1.9	L
Chapel Hill	1	1	4	4	1	1.9	L
Hillsborough	1	1	4	4	1	1.9	L
Person County	1	1	4	4	1	1.9	L
Roxboro	1	1	4	4	1	1.9	L

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### 4.5.4 Extreme Heat

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Extreme Heat	Highly Likely	Critical	Large	More than 24 hrs	Less than 1 week	3.3

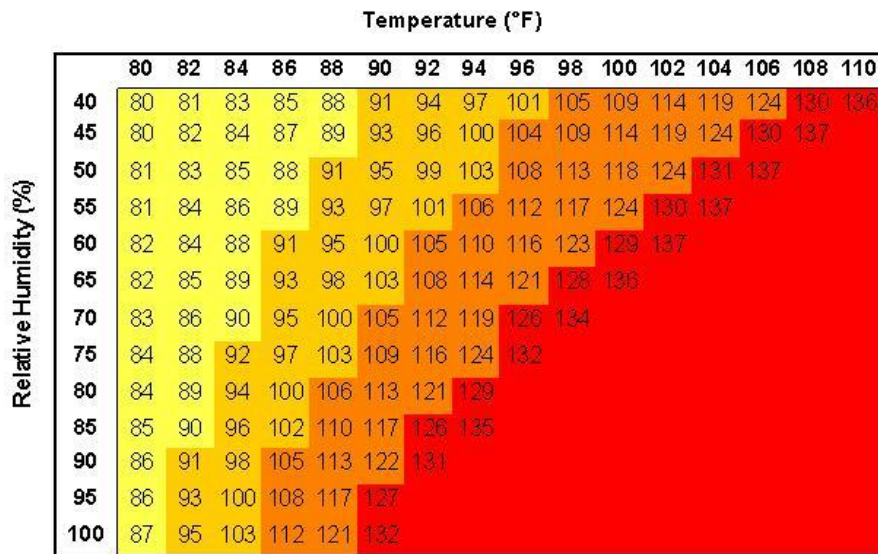
#### Hazard Background

Per information provided by FEMA, in most of the United States extreme heat is defined as a long period (2 to 3 days) of high heat and humidity with temperatures above 90 degrees. In extreme heat, evaporation is slowed and the body must work extra hard to maintain a normal temperature, which can lead to death by overwork of the body. Extreme heat often results in the highest annual number of deaths among all weather-related disasters. Per Ready.gov:

- Extreme heat can occur quickly and without warning
- Older adults, children, and sick or overweight individuals are at greater risk from extreme heat
- Humidity increases the feeling of heat as measured by heat index

Ambient air temperature is one component of heat conditions, with relative humidity being the other. The relationship of these factors creates what is known as the apparent temperature. The Heat Index Chart in Figure 4.18 uses both of these factors to produce a guide for the apparent temperature or relative intensity of heat conditions.

**Figure 4.18 – Heat Index Chart**



**Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity**

■ Caution ■ Extreme Caution ■ Danger ■ Extreme Danger

Source: National Weather Service (NWS) [http://www.nws.noaa.gov/os/heat/heat\\_index.shtml](http://www.nws.noaa.gov/os/heat/heat_index.shtml)

Note: Exposure to direct sun can increase Heat Index values by as much as 15°F. The shaded zone above 105°F corresponds to a heat index that may cause increasingly severe heat disorders with continued exposure and/or physical activity.

During these conditions, the human body has difficulties cooling through the normal method of the evaporation of perspiration. Health risks rise when a person is over exposed to heat.

The most dangerous place to be during an extreme heat incident is in a permanent home, with little or no air conditioning. Those at greatest risk for heat-related illness include people 65 years of age and older, young children, people with chronic health problems such as heart disease, people who are obese, people

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who are socially isolated, and people who are on certain medications, such as tranquilizers, antidepressants, sleeping pills, or drugs for Parkinson's disease. However, even young and healthy individuals are susceptible if they participate in strenuous physical activities during hot weather or are not acclimated to hot weather. Table 4.35 lists typical symptoms and health impacts of exposure to heat.

**Table 4.35 – Typical Health Impacts of Extreme Heat**

Heat Index (HI)	Disorder
80-90° F (HI)	Fatigue possible with prolonged exposure and/or physical activity
90-105° F (HI)	Sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure and/or physical activity
105-130° F (HI)	Heatstroke/sunstroke highly likely with continued exposure

Source: National Weather Service Heat Index Program, [www.weather.gov/os/heat/index.shtml](http://www.weather.gov/os/heat/index.shtml)

The National Weather Service has a system in place to initiate alert procedures (advisories or warnings) when the Heat Index is expected to have a significant impact on public safety. The expected severity of the heat determines whether advisories or warnings are issued. A common guideline for issuing excessive heat alerts is when the maximum daytime Heat Index is expected to equal or exceed 105 degrees Fahrenheit (°F) and the night time minimum Heat Index is 80°F or above for two or more consecutive days. A heat advisory is issued when temperatures reach 105 degrees and a warning is issued at 115 degrees.

Impacts of extreme heat are not only focused on human health, as prolonged heat exposure can have devastating impacts on infrastructure as well. Prolonged high heat exposure increases the risk of pavement deterioration, as well as railroad warping or buckling. High heat also puts a strain on energy systems and consumption, as air conditioners are run at a higher rate and for longer; extreme heat can also reduce transmission capacity over electric systems.

*Warning Time: 1 – More than 24 hours*

*Duration: 3 – Less than one week*

### Location

The entire planning area is susceptible to high temperatures and incidents of extreme heat.

### Extent

The extent of extreme heat can be defined by the maximum apparent temperature reached. Apparent temperature is a function of ambient air temperature and relative humidity and is reported as the heat index. The National Weather Service Forecast Office in Raleigh sets the following criteria for heat advisory and excessive heat warning:

- ▶ **Heat Advisory** – Heat Index of 105°F to 109°F for 3 hours or more. Can also be issued for lower values 100°F to 104°F for heat lasting several consecutive days
- ▶ **Excessive Heat Watch** – Potential for heat index values of 110°F or hotter within 24 to 48 hours. Also issued during prolonged heat waves when the heat index is near 110°F
- ▶ **Excessive Heat Warning** – Heat Index of 110°F or greater for any duration

Table 4.36 notes the highest temperature on record for each county in the Eno-Haw Region.

**Table 4.36 – Highest Temperature by County**

County	Temperature	Location	Date
Alamance	105°F	Burlington Fire Station #5	06/27/1954
Durham	107°F	Lake Michie	06/30/1959

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County	Temperature	Location	Date
Orange	107°F	Chapel Hill 2W	07/19/1902
Person	104°F	Roxboro 7 ESE	07/14/1966

Source: North Carolina Climate Office

*Impact: 3 – Critical*

*Spatial Extent: 4 – Large*

### Historical Occurrences

According to the National Oceanic and Atmospheric Administration (NOAA), 2017 was North Carolina's hottest year on record; that record stretches back 123 years to 1895.

NCEI records only one incident of heat or excessive heat for the Eno-Haw Region counties. This event occurred in Person County in July 2005 and resulted in the death of a farm worker who had left the farm at 11:30 AM. The heat index was 103°F by 11:00 AM.

The HMPC also noted an additional instance of extreme heat on July 20, 2019, when much of the region was under a heat advisory, with heat indexes reaching up to 110°F. In response to this advisory, many outdoor events were cancelled. Orange County extended the hours of cooling centers throughout the weekend and provided transportation to and from these centers.

Heat index records maintained by the North Carolina Climate Office indicate that the Region regularly experiences heat index temperatures above 100°F. Table 4.37 provides counts of heat index values by threshold recorded from 1999-2018 at the Raleigh-Durham International Airport weather station (KRDU), used as an indicator for the Eno-Haw Region overall. Counts are provided as the number of hours in a given year where the heat index reached or exceeded 100°F. According to this data, the Region averages approximately 87 hours per year with heat index values above 100°F.

**Table 4.37 – Historical Heat Index Counts, Raleigh-Durham Airport (KRDU), 1999-2018**

Year	Heat Index Value				Total
	100-104°F	105-109°F	110-114°F	≥115°F	
1999	106	45	13	0	164
2000	36	8	0	0	44
2001	36	17	4	1	58
2002	79	16	0	0	95
2003	37	7	0	0	44
2004	25	0	0	0	25
2005	95	17	8	0	120
2006	61	22	2	0	85
2007	76	25	13	0	114
2008	51	5	0	0	56
2009	34	1	0	0	35
2010	123	39	12	1	175
2011	87	33	1	0	121
2012	75	37	16	0	128
2013	11	1	0	0	12
2014	28	3	0	0	31
2015	75	9	0	0	84
2016	108	44	0	0	152

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Year	Heat Index Value				Total
	100-104°F	105-109°F	110-114°F	≥115°F	
2017	64	28	1	0	93
2018	95	8	0	0	103
<b>Sum</b>	<b>1,302</b>	<b>365</b>	<b>70</b>	<b>2</b>	<b>1,739</b>
<b>Average</b>	<b>65</b>	<b>18</b>	<b>4</b>	<b>0</b>	<b>87</b>

Source: North Carolina Climate Office, Heat Index Climatology Tool

### Probability of Future Occurrence

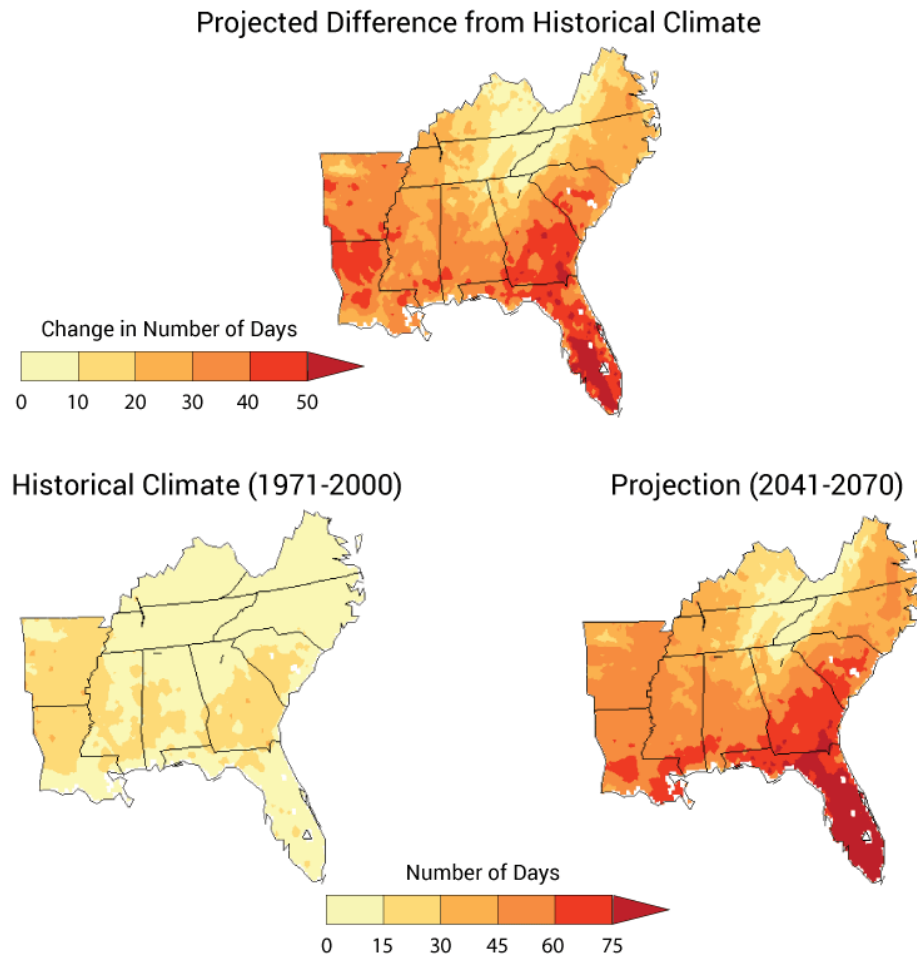
Data was gathered from the North Carolina State Climate Office's Heat Index Climatology Tool using the Raleigh-Durham International Airport weather station as an approximation for the Eno-Haw Region. Based on 20 years of available data, the Region averages 87 hours per year with heat index temperatures above 100°F. Heat index temperatures surpassed 100°F every year, occurring for at least 11 hours per year.

*Probability: 4 – Highly Likely*

### Climate Change

Research shows that average temperatures will continue to rise in the Southeast United States and globally, directly affecting the Eno-Haw Region in 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 4.19. The Triangle Regional Resilience Partnership Resilience Assessment notes that the number of days with extreme temperatures has been increasing in the Triangle; climbing from an average of 18 days over 92°F per year from 1948 to 2012 to a peak of 48 days over 92°F in 2010.

**Figure 4.19 – Projected Change in Number of Days Over 95°F**



Source: NOAA NCDC from 2014 National Climate Assessment

### Vulnerability Assessment

#### Methodologies and Assumptions

No data is available to assess the vulnerability of people or property in the planning area to extreme heat.

#### People

Extreme heat can cause heat stroke and even loss of human life. The elderly and the very young are most at risk to the effects of heat. People who are isolated are also more vulnerable to extreme heat. Socially vulnerable populations in areas with a high percentage of developed land and a small tree canopy are most vulnerable to negative health effects related to extreme heat, per the Triangle Regional Resilience Assessment.

#### Property

Extreme heat is unlikely to cause significant damages to the built environment. However, road surfaces can be damaged as asphalt softens, and concrete sections may buckle under expansion caused by heat. Train rails may also distort or buckle under the stress of heat induced expansion. Power transmission lines may sag from expansion and if contact is made with vegetation the line may short out causing power



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outages. Additional power demand for cooling also increases power line temperature adding to heat impacts.

Extreme heat can also cause significant agricultural losses. Between 2007-2017, the sum of claims paid for crop damage due to heat in the Eno-Haw Region was \$3,518,731 or an average of \$319,884 in losses every year. Table 4.38 through Table 4.41 summarize the crop losses due to drought reported in the RMA system by county. Person County accounted for the majority of these claims.

**Table 4.38 – Crop Losses Resulting from Heat, 2007-2017, Alamance County**

Year	Determined Acres	Indemnity Amount
2007	200.31	\$180,394.00
2008	43.07	\$46,654.00
2009	13.86	\$1,394.00
2010	426.79	\$146,589.00
2011	293.41	\$53,110.00
2012	575.90	\$77,791.00
2015	15.50	\$25,063.00
2016	54.93	\$33,828.40
2017	23.95	\$33,696.00
<b>Total</b>	<b>1,647.72</b>	<b>\$598,519.40</b>

Source: USDA Risk Management Agency

**Table 4.39 – Crop Losses Resulting from Heat, 2007-2017, Durham County**

Year	Determined Acres	Indemnity Amount
2007	16.87	\$17,846.00
2008	0.83	\$1,595.00
2010	266.25	\$75,483.00
2011	25.15	\$20,840.00
2012	134.48	\$23,462.00
<b>Total</b>	<b>443.58</b>	<b>\$139,226.00</b>

Source: USDA Risk Management Agency

**Table 4.40 – Crop Losses Resulting from Heat, 2007-2017, Orange County**

Year	Determined Acres	Indemnity Amount
2007	217.13	\$97,777.00
2010	116.44	\$8,778.00
2011	50.86	\$11,799.00
2012	746.96	\$175,374.00
<b>Total</b>	<b>1,131.39</b>	<b>\$293,728.00</b>

Source: USDA Risk Management Agency

**Table 4.41 – Crop Losses Resulting from Heat, 2007-2017, Person County**

Year	Determined Acres	Indemnity Amount
2007	817.90	\$626,860.00
2008	294.20	\$16,465.00
2010	1,738.90	\$587,866.00
2011	89.96	\$72,161.00
2012	1,675.60	\$444,871.00
2014	103.40	\$10,022.00
2015	63.54	\$1,646.70

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Year	Determined Acres	Indemnity Amount
2016	1,100.67	\$661,980.10
2017	517.85	\$65,386.00
<b>Total</b>	<b>6,402.02</b>	<b>\$2,487,257.80</b>

Source: USDA Risk Management Agency

### Environment

Wild animals are vulnerable to heat disorders similar to humans, including mortality. Vegetation growth will be stunted or plants may be killed if temperatures rise above their tolerance extremes.

### Consequence Analysis

Table 4.42 summarizes the potential negative consequences of extreme heat.

**Table 4.42 – Consequence Analysis – Extreme Heat**

Category	Consequences
Public	Extreme heat may cause illness and/or death.
Responders	Consequences may be greater for responders if their work requires exertion and/or wearing heavy protective gear.
Continuity of Operations (including Continued Delivery of Services)	Continuity of operations is not expected to be impacted by extreme heat because warning time for these events is long.
Property, Facilities and Infrastructure	Minor impacts may occur, including possible damages to road surfaces and power lines.
Environment	Environmental impacts include strain on local plant and wildlife, including potential for illness or death.
Economic Condition of the Jurisdiction	Farmers may face crop losses or increased livestock costs.
Public Confidence in the Jurisdiction's Governance	Extreme heat is unlikely to impact public confidence.

### Hazard Summary by Jurisdiction

The following table summarizes extreme heat hazard risk by jurisdiction. Extreme heat risk does not vary significantly by jurisdiction. More heavily urbanized areas may experience greater localized temperature extremes due to the urban heat island effect and therefore greater heat risk, but less developed areas may have a greater percentage of individuals working outside and therefore greater exposure to heat.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	Score	Priority
Alamance County	4	3	4	1	3	3.3	H
Burlington	4	3	4	1	3	3.3	H
Graham	4	3	4	1	3	3.3	H
Mebane	4	3	4	1	3	3.3	H
Elon	4	3	4	1	3	3.3	H
Green Level	4	3	4	1	3	3.3	H
Haw River	4	3	4	1	3	3.3	H
Ossipee	4	3	4	1	3	3.3	H
Sweepsonville	4	3	4	1	3	3.3	H
Alamance	4	3	4	1	3	3.3	H
Durham County	4	3	4	1	3	3.3	H
Durham	4	3	4	1	3	3.3	H
Orange County	4	3	4	1	3	3.3	H

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Carrboro	4	3	4	1	3	3.3	H
Chapel Hill	4	3	4	1	3	3.3	H
Hillsborough	4	3	4	1	3	3.3	H
Person County	4	3	4	1	3	3.3	H
Roxboro	4	3	4	1	3	3.3	H

### 4.5.5 Flood

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Flood	Likely	Limited	Small	6 to 12 hrs	Less than 1 week	2.5

#### Hazard Background

Flooding is defined by the rising and overflowing of water onto normally dry land. As defined by FEMA, a flood is a general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties. Flooding can result from an overflow of inland waters or an unusual accumulation or runoff of surface waters from any source.

Flooding is the most frequent and costly of all natural hazards in the United States, and has caused more than 10,000 death(s) since 1900. Approximately 90 percent of presidentially declared disasters result from flood-related natural hazard events. Taken as a whole, more frequent, localized flooding problems that do not meet federal disaster declaration thresholds ultimately cause the majority of damages across the United States.

#### Sources and Types of Flooding

Flooding within the Eno-Haw Region can be attributed to two main sources as noted below.

**Riverine Flooding:** During heavy rainfall events, the primary riverine flooding sources in the Eno-Haw Region are as follows, per each county's effective Flood Insurance Study:

- ▶ **Alamance County:** Cane Creek (South) Tributary, Eastside Creek, Michaels Branch, Steelhouse Branch, Willowbrook Creek
- ▶ **Durham County:** The County is more prone to flooding by small streams than flooding by a major river. The principle flood problems occur on the smaller tributaries, where, due to urban development pressures, there has been commercial and residential construction in the floodplains of these tributaries. However, local flooding from the Eno River has also occurred.
- ▶ **Orange County:** Eno River, North and South Forks Little River, New Hope Creek, Morgan Creek, Bolin Creek, and other streams.
- ▶ **Person County:** Flat River, the North Flat River, the South Flat River, Marlowes Creek and smaller creeks and tributaries.

These rivers and their tributaries are susceptible to overflowing their banks during and following excessive precipitation events. Though less common, riverine flood events (such as the "1%-annual-chance flood") will cause significantly more damage and economic disruption for the area than incidences of localized stormwater flooding.

**Flash Flooding:** A flash flood occurs when water levels rise at an extremely fast rate as a result of intense rainfall over a brief period, possibly from slow-moving intense thunderstorms and sometimes combined with rapid snowmelt, ice jam release, frozen ground, saturated soil, or impermeable surfaces. Ice jam flooding is a form of flash flooding that occurs when ice breaks up in moving waterways, and then stacks on itself where channels narrow. This creates a natural dam, often causing flooding within minutes of the dam formation. Flash flooding can happen in Special Flood Hazard Areas (SFHAs) as delineated by the National Flood Insurance Program (NFIP) and can also happen in areas not associated with floodplains. Flash flood hazards caused by surface water runoff are most common in urbanized areas, where greater population density generally equates to more impervious surface (e.g., pavement and buildings) which increases the amount of surface water generated.

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Flash flooding is a dangerous form of flooding which can reach full peak in only a few minutes. Rapid onset allows little or no time for protective measures. Flash flood waters move at very fast speeds and can move boulders, tear out trees, scour channels, destroy buildings, and obliterate bridges. Flash flooding can result in higher loss of life, both human and animal, than slower developing river and stream flooding.

In certain areas, aging storm sewer systems are not designed to carry the capacity currently needed to handle the increased storm runoff. Typically, the result is water backing into basements, which damages mechanical systems and can create serious public health and safety concerns.

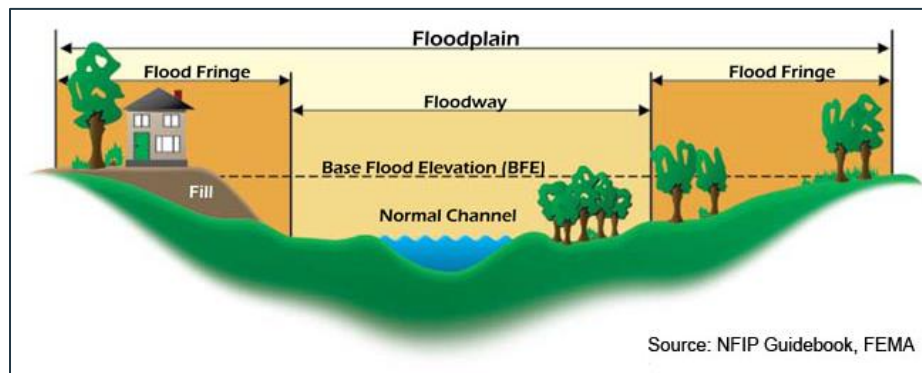
Localized flooding may be caused by the following issues:

- ▶ **Inadequate Capacity** – An undersized/under capacity pipe system can cause water to back-up behind a structure which can lead to areas of ponded water and/or overtopping of banks.
- ▶ **Clogged Inlets** – Debris covering the asphalt apron and the top of grate at catch basin inlets may contribute to an inadequate flow of stormwater into the system. Debris within the basin itself may also reduce the efficiency of the system by reducing the carrying capacity.
- ▶ **Blocked Drainage Outfalls** – Debris blockage or structural damage at drainage outfalls may prevent the system from discharging runoff, which may lead to a back-up of stormwater within the system.
- ▶ **Improper Grade** – Poorly graded asphalt around catch basin inlets may prevent stormwater from entering the catch basin as designed. Areas of settled asphalt may create low spots within the roadway that allow for areas of ponded water.

### Flooding and Floodplains

In the case of riverine flooding, the area adjacent to a channel is the floodplain, as shown in Figure 4.20. A floodplain is flat or nearly flat land adjacent to a stream or river that experiences occasional or periodic flooding. It includes the floodway, which consists of the stream channel and adjacent areas that carry flood flows, and the flood fringe, which are areas covered by the flood, but which do not experience a strong current. Floodplains are made when floodwaters exceed the capacity of the main channel or escape the channel by eroding its banks. When this occurs, sediments (including rocks and debris) are deposited that gradually build up over time to create the floor of the floodplain. Floodplains generally contain unconsolidated sediments, often extending below the bed of the stream.

Figure 4.20 – Characteristics of a Floodplain



In its common usage, the floodplain most often refers to that area that is inundated by the “100-year flood,” which is the flood that has a 1% chance in any given year of being equaled or exceeded. The 500-



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year flood is the flood that has a 0.2 percent chance of being equaled or exceeded in any given year. The potential for flooding can change and increase through various land use changes and changes to land surface, which result in a change to the floodplain. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity.

The 1%-annual-chance flood, which is the minimum standard used by most federal and state agencies, is used by the National Flood Insurance Program (NFIP) as the standard for floodplain management and to determine the need for flood insurance. Participation in the NFIP requires adoption and enforcement of a local floodplain management ordinance which is intended to prevent unsafe development in the floodplain, thereby reducing future flood damages. Participation in the NFIP allows for the federal government to make flood insurance available within the community as a financial protection against flood losses. Since floods have an annual probability of occurrence, have a known magnitude, depth and velocity for each event, and in most cases, have a map indicating where they will likely occur, they are in many ways often the most predictable and manageable hazard.

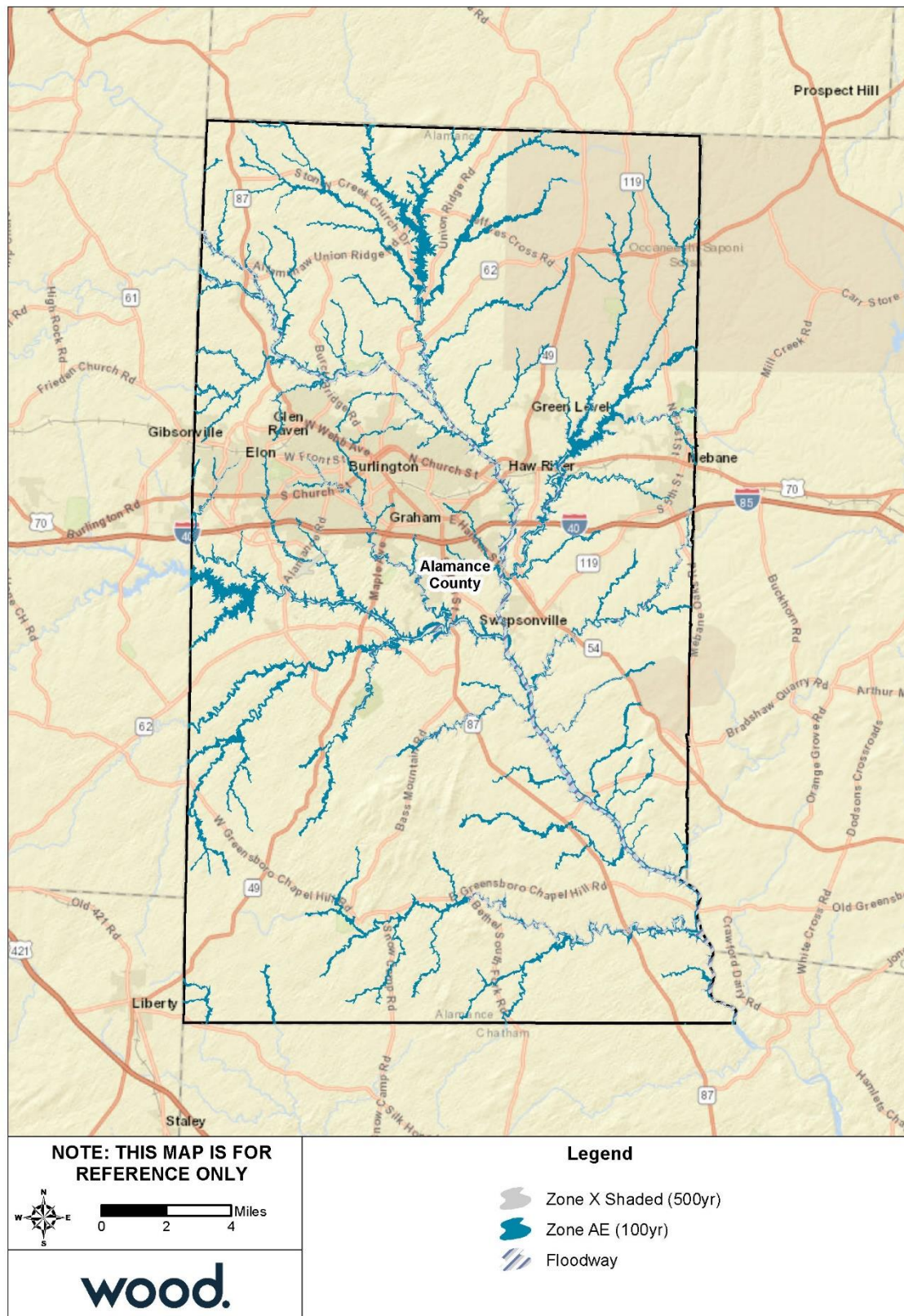
*Warning Time: 3 – 6 to 12 hours*

*Duration: 3 – Less than 1 week*

### Location

Figure 4.21 through Figure 4.24 reflect the effective mapped flood insurance zones for the Eno-Haw Region by county.

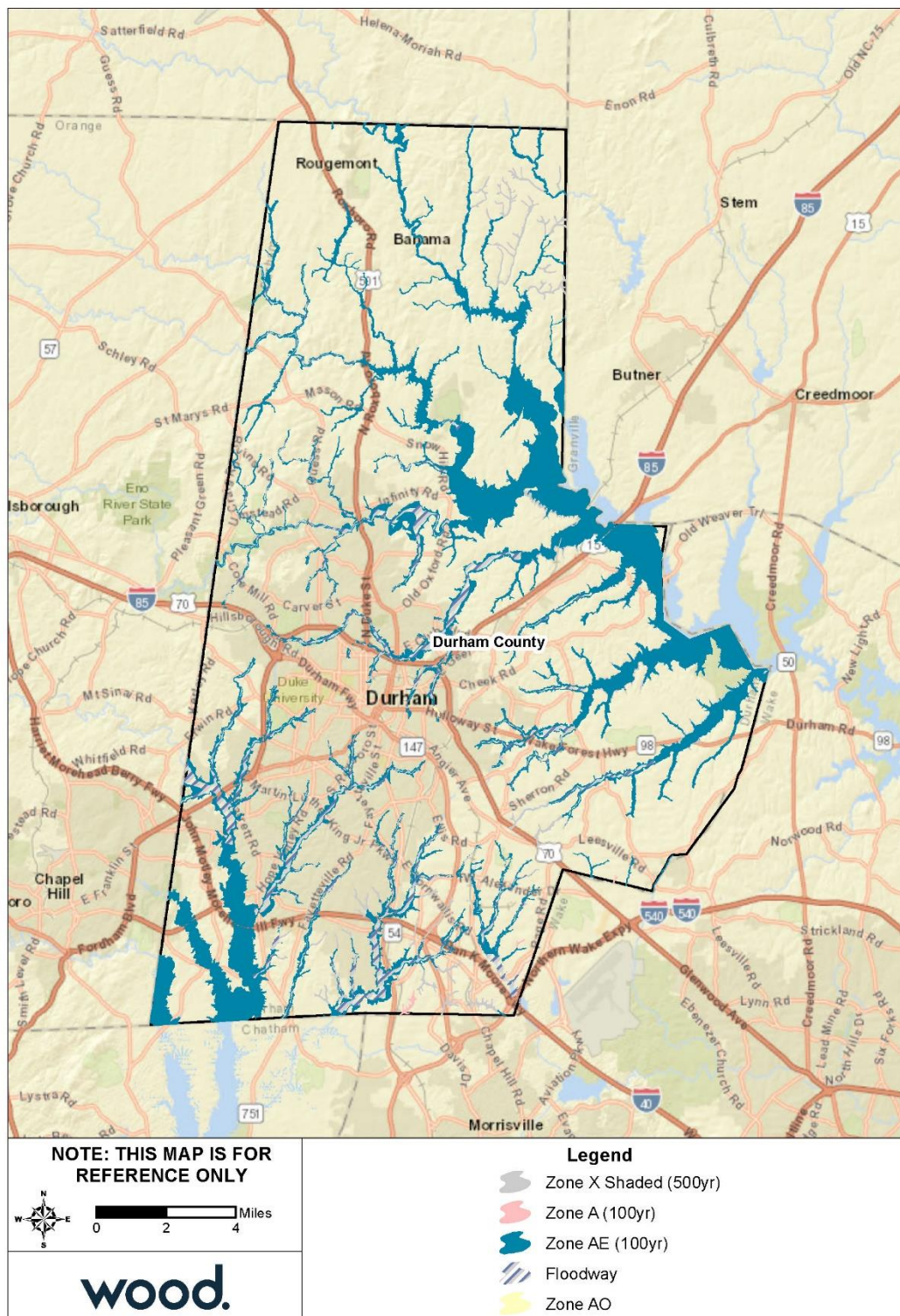
Figure 4.21 – FEMA Flood Hazard Areas in Alamance County



Source: FEMA Effective DFIRM retrieved from North Carolina Flood Risk Information System

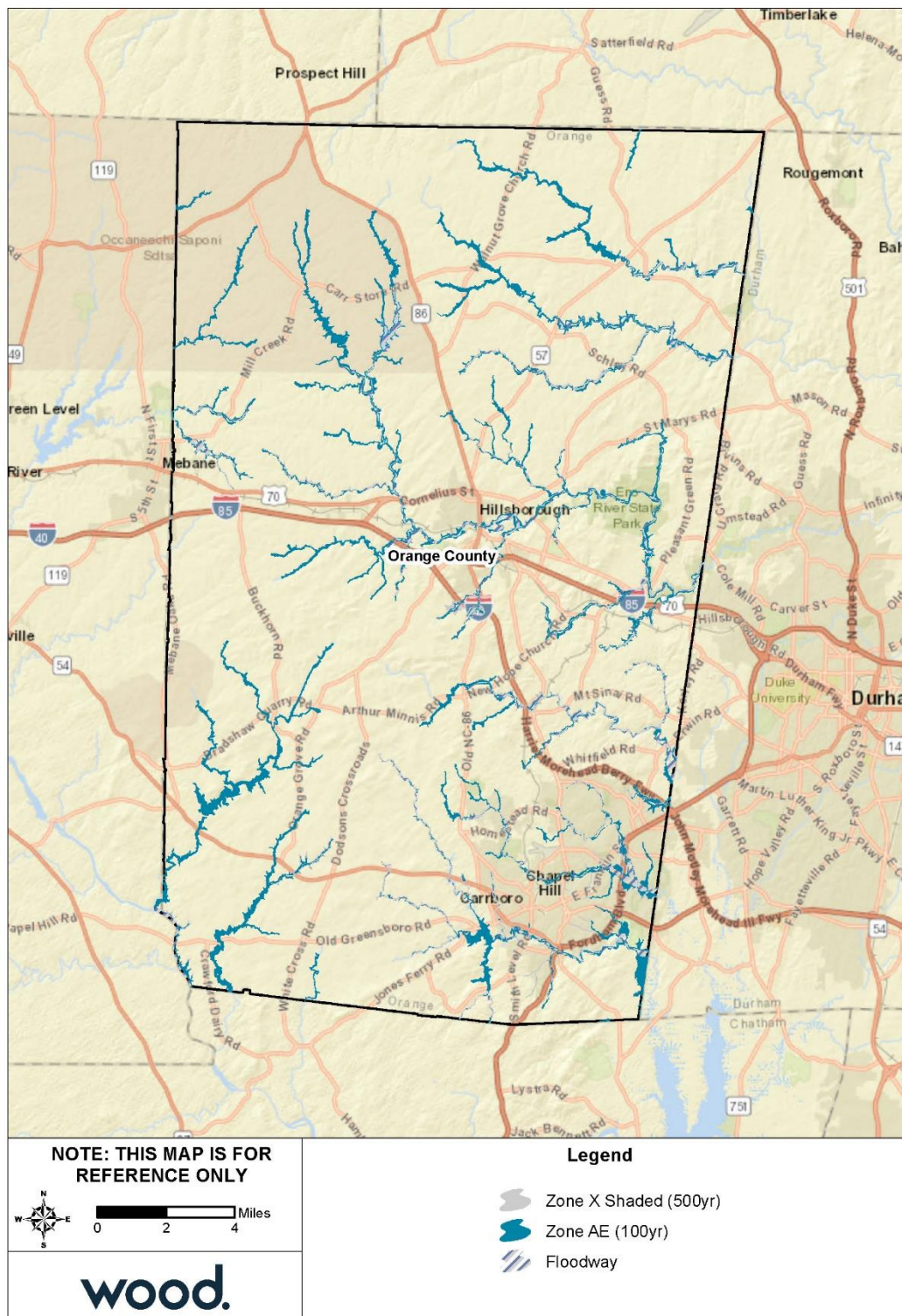


Figure 4.22 – FEMA Flood Hazard Areas in Durham County



Source: FEMA Effective DFIRM retrieved from North Carolina Flood Risk Information System

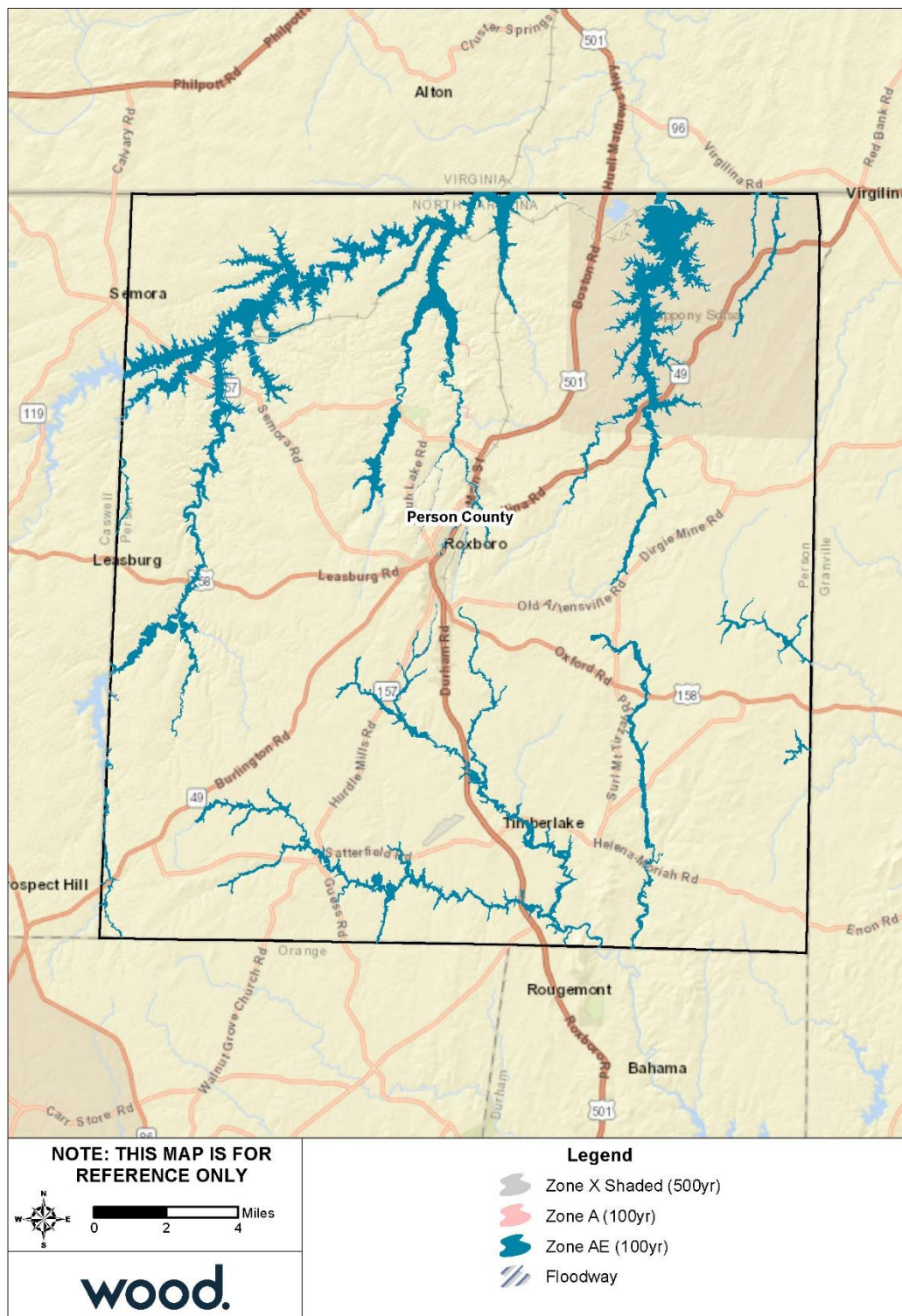
Figure 4.23 – FEMA Flood Hazard Areas in Orange County



Source: FEMA Effective DFIRM retrieved from North Carolina Flood Risk Information System



Figure 4.24 – FEMA Flood Hazard Areas in Person County



Source: FEMA Effective DFIRM retrieved from North Carolina Flood Risk Information System

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### Extent

Flood extent can be defined by the amount of land in the floodplain and the potential magnitude of flooding as measured by flood height and velocity.

Regulated floodplains are illustrated on inundation maps called Flood Insurance Rate Maps (FIRMs). It is the official map for a community on which FEMA has delineated both the Special Flood Hazard Areas (SFHAs) and the risk premium zones applicable to the community. SFHAs represent the areas subject to inundation by the 100-year flood event. Structures located within the SFHA have a 26-percent chance of flooding during the life of a standard 30-year mortgage. Flood prone areas were identified within Eno-Haw Region using the Effective FIRMs, with most recent updates and/or revisions dated November 17, 2017 for Alamance and Person counties and October 19, 2018 for Durham and Orange counties. Table 4.43 summarizes the flood insurance zones identified by the Digital FIRM (DFIRM).

**Table 4.43 – Mapped Flood Insurance Zones within the Eno-Haw Region**

Zone	Description
<b>A</b>	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas, no depths or base flood elevations are shown within these zones.
<b>AE</b>	AE Zones, also within the 100-year flood limits, are defined with BFEs that reflect the combined influence of stillwater flood elevations and wave effects less than 3 feet. The AE Zone generally extends from the landward VE zone limit to the limits of the 100-year flood from coastal sources, or until it reaches the confluence with riverine flood sources. The AE Zones also depict the SFHA due to riverine flood sources, but instead of being subdivided into separate zones of differing BFEs with possible wave effects added, they represent the flood profile determined by hydrologic and hydraulic investigations and have no wave effects. The Coastal AE Zone is differentiated from the AE Zone by the Limit of Moderate Wave Action (LiMWA) and includes areas susceptible to wave action between 1.5 to 3 feet.
<b>0.2% Annual Chance (shaded Zone X)</b>	Moderate risk areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by a levee. No BFEs or base flood depths are shown within these zones. (Zone X (shaded) is used on new and revised maps in place of Zone B.)
<b>Zone X (unshaded)</b>	Minimal risk areas outside the 1-percent and .2-percent-annual-chance floodplains. No BFEs or base flood depths are shown within these zones. Zone X (unshaded) is used on new and revised maps in place of Zone C.

Source: FEMA

Table 4.44 provides a summary by county of the Region's total area by flood zone on the effective DFIRM. Only about eight percent of the Region falls within the SFHA. Durham County has the greatest proportion of total area in the SFHA, at just over 13 percent, while Orange County has the smallest relative SFHA at just 4.6 percent of the county's total area.

**Table 4.44 – Flood Zone Acreage in the Eno-Haw Region**

Flood Zone	Acreage	Percent of Total (%)
<b>Alamance</b>		
Zone A	--	--
Zone AE	22,640	7.1%
Zone X (500-year)	1,457	0.5%
Zone X Unshaded	293,202	92.4%

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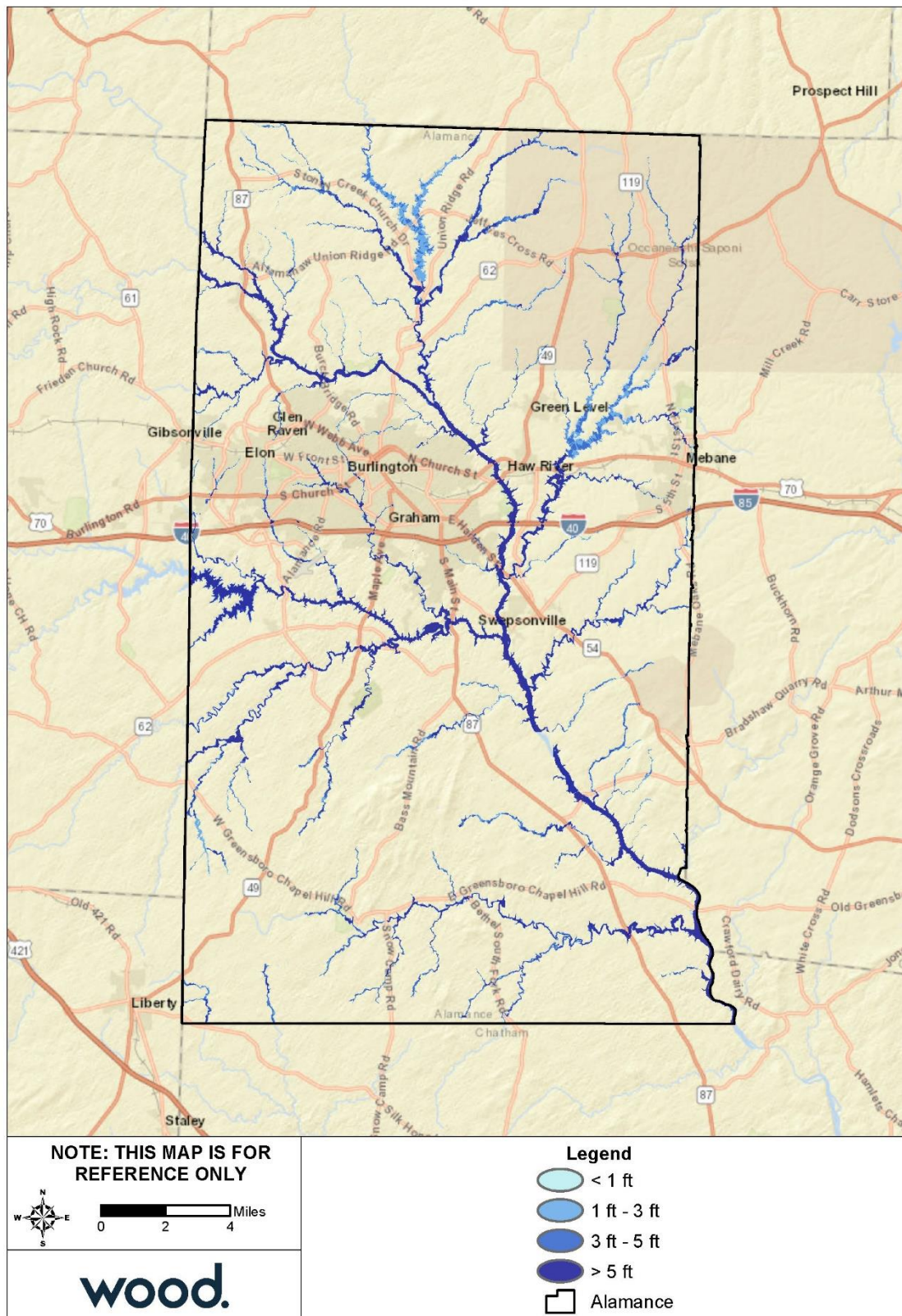
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Flood Zone	Acreage	Percent of Total (%)
<b>Subtotal</b>	317,300	--
<b>Durham</b>		
Zone A	81	0%
Zone AE	37,236	13.5%
Zone X (500-year)	1,560	0.6%
Zone X Unshaded	236,907	85.9%
<b>Subtotal</b>	275,702	--
<b>Orange</b>		
Zone A	0	--
Zone AE	12,148	4.6%
Zone X (500-year)	923	0.4%
Zone X Unshaded	249,953	95.0%
<b>Subtotal</b>	263,024	--
<b>Person</b>		
Zone A	26	0%
Zone AE	16,357	6.2%
Zone X (500-year)	102	0%
Zone X Unshaded	246,499	93.7%
<b>Subtotal</b>	262,958	--
<b>Total</b>	<b>1,118,985</b>	--

Source: FEMA Effective DFIRM

Figure 4.25 through Figure 4.28 show the depth of flooding estimated to occur from a 1% annual chance flood by county.

Figure 4.25 – Flood Depth, 100-Year Floodplain, Alamance County

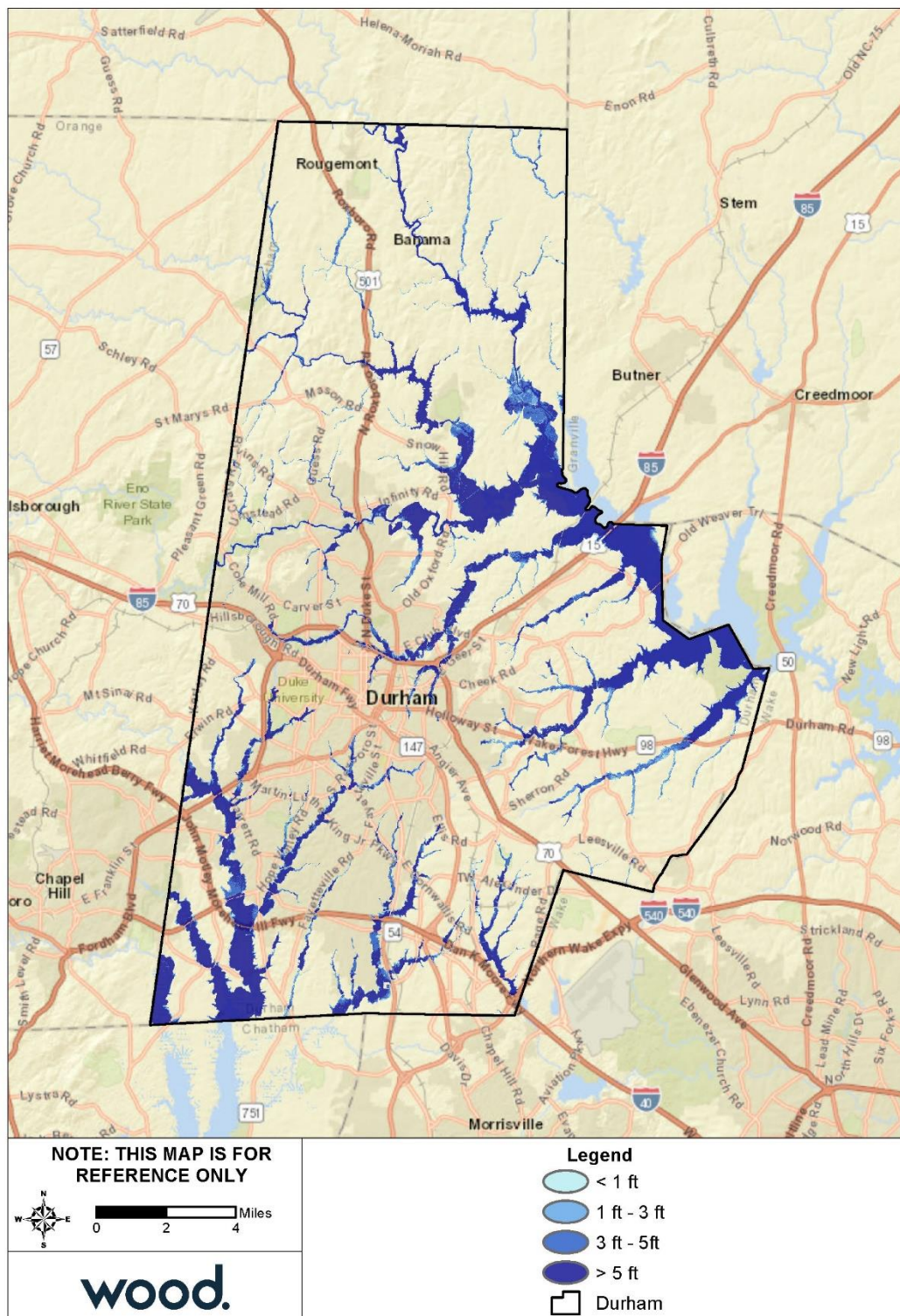


Source: FEMA Effective DFIRM



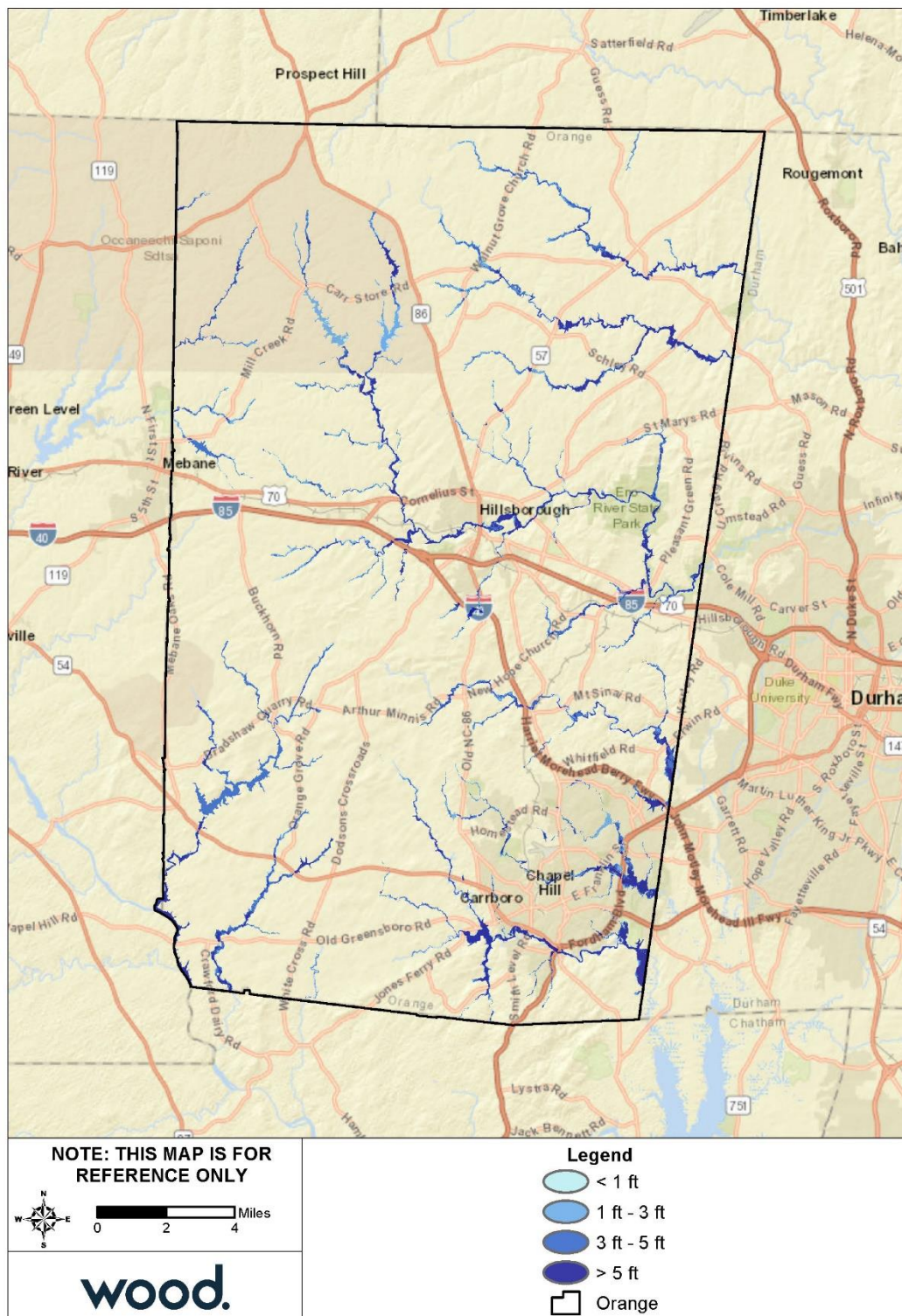
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Figure 4.26 – Flood Depth, 100-Year Floodplain, Durham County



Source: FEMA Effective DFIRM

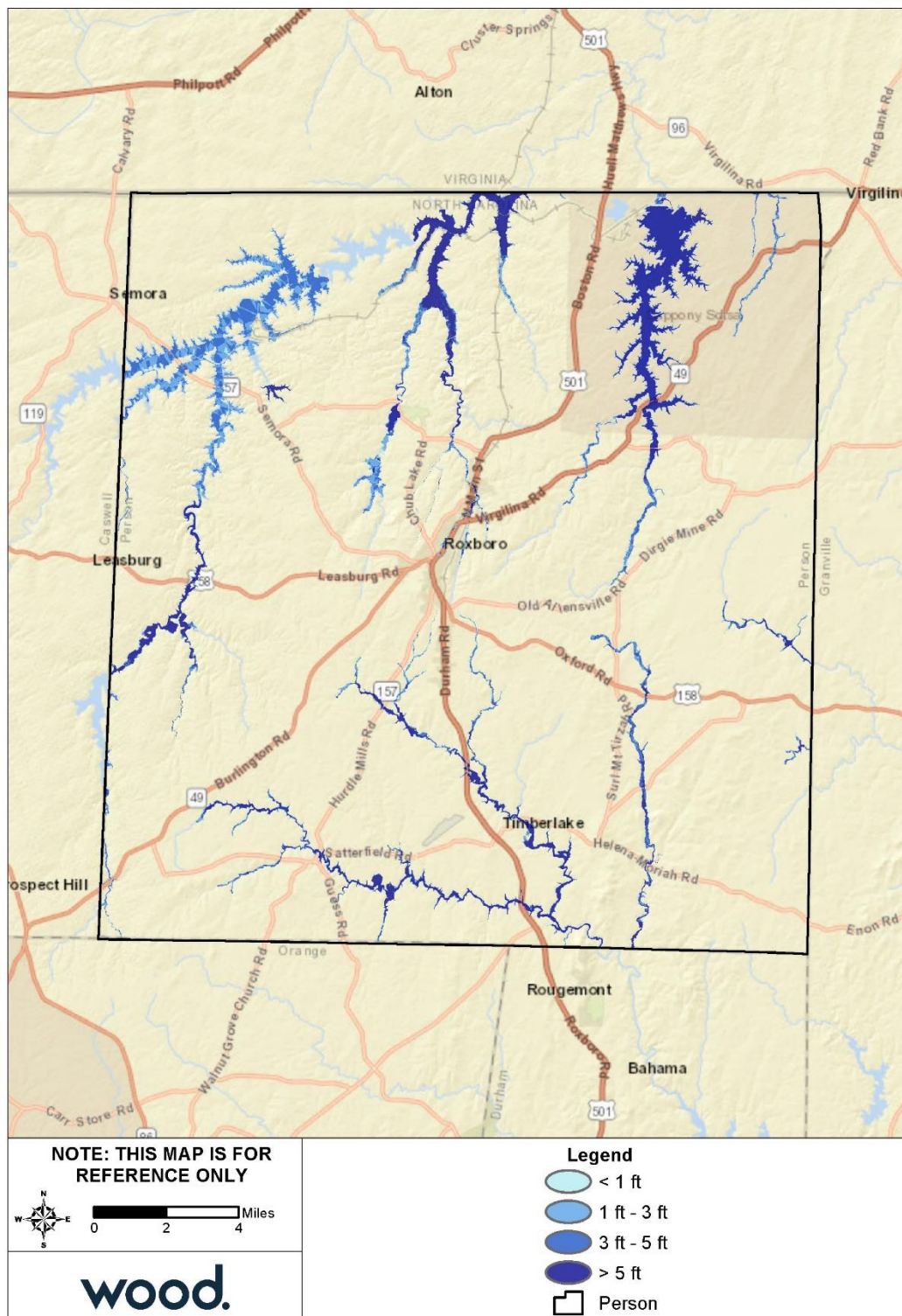
Figure 4.27 – Flood Depth, 100-Year Floodplain, Orange County



Source: FEMA Effective DFIRM



Figure 4.28 – Flood Depth, 100-Year Floodplain, Person County



Source: FEMA Effective DFIRM



## SECTION 4: RISK ASSESSMENT

The NFIP utilizes the 100-year flood as a basis for floodplain management. The Flood Insurance Study (FIS) defines the probability of flooding as flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 100-year period (recurrence intervals). Or considered another way, properties within a 100-year flood zone have a one percent probability of being equaled or exceeded during any given year. Mortgage lenders require that owners of properties with federally-backed mortgages located within SFHAs purchase and maintain flood insurance policies on their properties. Consequently, newer and recently purchased properties in the community are typically insured against flooding.

*Impact: 2 – Limited*

*Spatial Extent: 2 – Small*

### Historical Occurrences

According to NCEI Storm Events Database records, 141 flood-related events were reported during the 20-year period from 1999 through 2018, across 74 separate days. These events caused \$52,298,000 in property damages, and \$15,000,000 in crop damages.

Table 4.45 summarizes these historical occurrences of flooding by county and event type. It should be noted that only those historical occurrences listed in the NCEI database are shown here and that other, unrecorded or unreported events may have occurred within the planning area during this timeframe.

**Table 4.45 – NCEI Records of Flooding, 1999-2018**

Type	Event Count	Deaths/ Injuries	Reported Property Damage	Reported Crop Damage
<b>Alamance</b>				
Flash Flood	30	0/0	\$2,110,000	\$0
Flood	5	0/0	\$1,070,000	\$5,000,000
<b>Durham</b>				
Flash Flood	50	0/0	\$425,000	\$0
Flood	4	0/0	\$11,050,000	\$5,000,000
<b>Orange</b>				
Flash Flood	31	0/0	\$10,933,000	\$0
Flood	2	0/0	\$26,400,000	\$5,000,000
<b>Person</b>				
Flash Flood	18	0/0	\$310,000	\$0
Flood	1	0/0	\$0	\$0
<b>Region Total</b>				
Flash Flood	129	0/0	\$13,778,000	\$0
Flood	12	0/0	\$38,520,000	\$15,000,000
<b>Total</b>	<b>141</b>	<b>0/0</b>	<b>\$52,298,000</b>	<b>\$15,000,000</b>

Source: NCEI

Table 4.46 provides a summary of this historical information by location. Many of the events attributed to the county are countywide or cover large portions of the county. Similarly, though some events have associated starting locations identified, the event may have covered a larger area including multiple jurisdictions. Still, this list provides an indication of areas that may be particularly flood prone.

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Table 4.46 – Summary of Historical Flood Occurrences by Location, 1999-2018

Location	Event Count	Deaths/Injuries	Property Damage	Crop Damage
<b>Alamance</b>				
Altamaha	2	0/0	\$0	\$0
Burlington	7	0/0	\$0	\$0
Countywide	5	0/0	\$0	\$0
Elon College	3	0/0	\$0	\$0
Glen Raven	2	0/0	\$115,000	\$0
Graham	2	0/0	\$30,000	\$0
Just Xrds	1	0/0	\$500,000	\$0
Mebane	2	0/0	\$1,400,000	\$0
Pleasant Grove	1	0/0	\$50,000	\$0
Saxapahaw	2	0/0	\$0	\$0
Snow Camp	4	0/0	\$1,070,000	\$5,000,000
Swepsonville	1	0/0	\$0	\$0
Union Ridge	1	0/0	\$15,000	\$0
<b>Subtotal Alamance</b>	<b>35</b>	<b>0/0</b>	<b>\$3,180,000</b>	<b>\$5,000,000</b>
<b>Durham</b>				
Bahama	4	0/0	\$100,000	\$0
Braggtown	2	0/0	\$2,500	\$0
Countywide	8	0/0	\$0	\$0
Durham	12	0/0	\$40,000	\$0
East Durham	1	0/0	\$0	\$0
Few	2	0/0	\$0	\$0
Genlee	1	0/0	\$11,050,000	\$5,000,000
Gorman	2	0/0	\$20,000	\$0
Hayes	1	0/0	\$0	\$0
Hope Valley	8	0/0	\$112,500	\$0
Huckleberry Spring	2	0/0	\$100,000	\$0
Lowes Grove	1	0/0	\$0	\$0
Oak Grove	2	0/0	\$0	\$0
Orange Factory	1	0/0	\$0	\$0
Quail Roost	3	0/0	\$0	\$0
Rougemont	2	0/0	\$50,000	\$0
Weaver	1	0/0	\$0	\$0
West Durham	1	0/0	\$0	\$0
<b>Subtotal Durham</b>	<b>54</b>	<b>0/0</b>	<b>\$11,475,000</b>	<b>\$5,000,000</b>
<b>Orange</b>				
Blackwood	2	0/0	\$150,000	\$0
Buckhorn	1	0/0	\$0	\$0
Calvander	2	0/0	\$3,000	\$0
Carr	1	0/0	\$0	\$0
Carrboro	1	0/0	\$10,000	\$0
Chapel Hill	10	0/0	\$10,505,000	\$0
Countywide	2	0/0	\$0	\$0
Efland	2	0/0	\$250,000	\$0
Glenn	1	0/0	\$10,000	\$0

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Location	Event Count	Deaths/Injuries	Property Damage	Crop Damage
Hillsborough	3	0/0	\$0	\$0
Miles	2	0/0	\$0	\$0
North Portion	1	0/0	\$0	\$0
Teer	3	0/0	\$26,400,000	\$5,000,000
West Hillsborough	1	0/0	\$5,000	\$0
<b>Subtotal Orange</b>	<b>33</b>	<b>0/0</b>	<b>\$37,333,000</b>	<b>\$5,000,000</b>
<b>Person</b>				
Cavel	1	0/0	\$0	\$0
Countywide	2	0/0	\$0	\$0
Cunningham	2	0/0	\$0	\$0
Dennys Store	1	0/0	\$0	\$0
Gentrys Store	1	0/0	\$0	\$0
Gordonton	1	0/0	\$50,000	\$0
Helena	1	0/0	\$0	\$0
Hurdle Mills	2	0/0	\$0	\$0
Longs Store	1	0/0	\$250,000	\$0
Paynes Tavern	1	0/0	\$0	\$0
Roxboro	6	0/0	\$10,000	\$0
<b>Subtotal Person</b>	<b>19</b>	<b>0/0</b>	<b>\$310,000</b>	<b>\$0</b>
<b>Region Total</b>	<b>143</b>	<b>0/0</b>	<b>\$52,298,000</b>	<b>\$15,00,000</b>

Source: NCEI

The following event narratives are provided in the NCEI Storm Events Database and illustrate the impacts of flood events on the Region:

**July 23, 2000** – Flooding of streets and buildings was reported countywide, especially in Chapel Hill and Carrboro. The Eastgate Shopping center was damaged, as well as several apartments and homes. A bridge was washed out on Piney Mountain Rd.

**July 13, 2003** – Extensive flooding caused evacuations. 30 homes and 6 businesses sustained flood damage, and the wastewater treatment plant was damaged. About a dozen cars were underwater. Highways 70 and 119 were closed along with many other roads.

**June 30, 2013** – Heavy rain (4-5 inches) resulted in extensive flooding in the city of Chapel Hill. The first floor of the Town Hall flooded and may be closed for up to a year for repairs. Franklin Street saw widespread flooding, with water above the windows of cars in several locations and some businesses also being impacted. Several buildings on the University of North Carolina had water in them, including the bottom floor of Granville Tower. Another area of the city that experienced flooding was the East Gate Shopping Center, where water entered several businesses and stranded many cars in the parking lot. One hard hit residential area was along Estes Drive near Highway 15-501, where the Camelot Village Condominiums experienced extensive flooding. In fact, 76 out of 116 units flooded. Another residential area that experienced flooding was the Airport Gardens Public Housing Neighborhood, where 18 out of the 26 units flooded. Due to the flooding, the Orange County qualified for state and federal aid. Several areas of Carrboro experienced flooding, including the Rocky Brook Mobile Home Park on Greensboro Street, where residents had to be evacuated due to high water. In fact, 20 out of 31 homes were eventually condemned.

**September 17, 2018** – Torrential rainfall of 6 to 10 inches caused widespread flooding across the region, which caused flooding along the Eno and Haw Rivers and other creeks and streams throughout the region.

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Additionally, water held in Jordan Lake from rainfall in its headwaters resulted in flooding along the lake into far southeast portions of Orange and Durham counties. Flooding damaged approximately 276 structures throughout Orange County, destroying 1 structure and resulting in \$26.4 million in property damage. Flooding damaged approximately 638 structures throughout Durham County, destroying 4 structures and resulting in \$11.05 million in property damage. Flooding damaged approximately 202 structures throughout Alamance County, resulting in over \$1.07 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.

### Probability of Future Occurrence

By definition of the 100-year flood event, SFHAs are defined as those areas that will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year. Properties located in these areas have a 26 percent chance of flooding over the life of a 30-year mortgage.

The 500-year flood area is defined as those areas that will be inundated by the flood event having a 0.2-percent chance of being equaled or exceeded in any given year; it is not the flood that will occur once every 500 years.

While exposure to flood hazards vary across jurisdictions, all jurisdictions have at least some area of land in FEMA flood hazard areas. Additionally, flash floods and stormwater flooding can occur outside of mapped SFHAs and historical records indicate that these events are very common in the Region, with an average of 6.45 events reported annually over the last 20 years. Therefore, the probability of flooding is considered likely (between 10% and 100% annual probability) for all jurisdictions.

*Probability: 3 – Likely*

### 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. Therefore, with more rainfall falling in more intense incidents, the region 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.

### Vulnerability Assessment

#### **Methodologies and Assumptions**

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Population and property at risk to flooding was estimated using data from the North Carolina Emergency Management (NCEM) IRISK database, which was compiled in NCEM's Risk Management Tool.

As a subset of the building vulnerability analysis, exposure of pre-FIRM structures was also estimated. Table 4.47 below provides the NFIP entry date for each participating jurisdiction, which was used to determine which buildings were constructed pre-FIRM. Pre-FIRM structures are those built prior to the community's first FIRM and thus before the adoption of flood protection building standards. These structures are therefore assumed to be at greater risk to the flood hazard.

To estimate the number of pre-FIRM structures in each community using year built data, if the NFIP entry date for a given community was between January and June, buildings constructed the same year as the entry date were considered to be post-FIRM (e.g., if the NFIP entry date is 02/01/1991, buildings constructed in 1990 and before were considered pre-FIRM. Buildings constructed from 1991 to the present were counted as post-FIRM.). If the NFIP entry date was between July and December, then the

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following year was applied for the year built cut-off (e.g., if the NFIP entry date was 12/18/2007, buildings constructed in the year 2007 and before were counted as pre-FIRM, 2008 and newer were post-FIRM).

**Table 4.47 – NFIP Entry Dates**

Jurisdiction	NFIP Entry Date
<b>Alamance County</b>	
Alamance County (Unincorporated)	12/1/1981
Alamance	12/17/1987
Burlington	4/1/1981
Elon	6/5/1989
Graham	11/19/1980
Green Level	12/22/1998
Haw River	11/5/1980
Mebane	11/5/1980
Ossipee	Non-participating
Swepsonville	12/1/1981
<b>Durham County</b>	
Durham County (Unincorporated)	2/15/1979
Durham	1/3/1979
<b>Orange County</b>	
Orange County (Unincorporated)	3/6/1981
Carrboro	6/25/1976
Chapel Hill	4/17/1978
Hillsborough	5/15/1980
Person County (Unincorporated)	9/14/1990
Roxboro	3/25/1991

Source: Federal Emergency Management Agency

Effective FEMA DFIRM data was used for the flood hazard areas. Flood zones used in the analysis consist of Zone AE (1-percent-annual-chance flood), Zone AE Floodway, and the 0.2-percent-annual-chance flood hazard area.

### People

Certain health hazards are common to flood events. While such problems are often not reported, three general types of health hazards accompany floods. The first comes from the water itself. Floodwaters carry anything that was on the ground that the upstream runoff picked up, including dirt, oil, animal waste, and lawn, farm and industrial chemicals. Pastures and areas where farm animals are kept or where their wastes are stored can contribute polluted waters to the receiving streams.

Debris also poses a risk both during and after a flood. During a flood, debris carried by floodwaters can cause physical injury from impact. During the recovery process, people may often need to clear debris out of their properties but may encounter dangers such as sharp materials or rusty nails that pose a risk of tetanus. People must be aware of these dangers prior to a flood so that they understand the risks and take necessary precautions before, during, and after a flood.

Floodwaters also saturate the ground, which leads to infiltration into sanitary sewer lines. When wastewater treatment plants are flooded, there is nowhere for the sewage to flow. Infiltration and lack of treatment can lead to overloaded sewer lines that can back up into low-lying areas and homes. Even



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when it is diluted by flood waters, raw sewage can be a breeding ground for bacteria such as E.coli and other disease causing agents.

The second type of health problem arises after most of the water has gone. Stagnant pools can become breeding grounds for mosquitoes, and wet areas of a building that have not been properly cleaned breed mold and mildew. A building that is not thoroughly cleaned becomes a health hazard, especially for small children and the elderly.

Another health hazard occurs when heating ducts in a forced air system are not properly cleaned after inundation. When the furnace or air conditioner is turned on, the sediments left in the ducts are circulated throughout the building and breathed in by the occupants. If a local water system loses pressure, a boil order may be issued to protect people and animals from contaminated water.

The third problem is the long-term psychological impact of having been through a flood and seeing one's home damaged and personal belongings destroyed. The cost and labor needed to repair a flood-damaged home puts a severe strain on people, especially the unprepared and uninsured. There is also a long-term problem for those who know that their homes can be flooded again. The resulting stress on floodplain residents takes its toll in the form of aggravated physical and mental health problems.

Floods can also result in fatalities. Though there are no deaths or injuries as a result of flood reported for the Region in NCEI records, these impacts can occur. Individuals face particularly high risk when driving through flooded streets.

Table 4.48 details the population at risk from the 1% annual chance flood event, according to data from the NCEM IRISK database. Note that development and population growth have occurred since the original analysis for the IRISK dataset was performed, therefore actual population at risk is likely higher.

**Table 4.48 – Population Impacted by the 100-Year Flood Event**

Jurisdiction	Total Population	Total Population at Risk		All Elderly Population	Elderly Population at Risk		All Children Population	Children at Risk	
		Number	%		Number	%		Number	%
Alamance									
Alamance County (Unincorporated Area)	43,522	92	0.20%	6,358	13	0.20%	2,742	6	0.20%
City of Burlington	56,075	525	0.90%	8,192	77	0.90%	3,533	33	0.90%
City of Graham	16,584	222	1.30%	2,423	32	1.30%	1,045	14	1.30%
City of Mebane	14,590	44	0.30%	2,020	6	0.30%	893	3	0.34%
Town of Elon	10,006	86	0.90%	1,462	13	0.90%	630	5	0.80%
Town of Gibsonville	2,368	0	0%	346	0	0%	149	0	0%
Town of Green Level	3,773	34	0.90%	551	5	0.90%	238	2	0.80%
Town of Haw River	544	0	0%	79	0	0%	34	0	0%
Town of Ossipee	1,151	0	0%	168	0	0%	73	0	0%
Town of Swepsonville	1,462	2	0.10%	214	0	0%	92	0	0%
Village of Alamance	150,075	1,005	0.67%	21,813	146	0.67%	9,429	63	0.67%
Durham									
Durham County (Unincorporated Area)	38,181	322	0.84%	3,725	31	0.83%	2,826	24	0.85%
City of Durham	225,814	2,186	1%	22,031	213	1%	16,715	162	1%
Orange									
Orange County (Unincorporated Area)	45,470	80	0.20%	4,381	8	0.20%	2,342	4	0.20%

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Jurisdiction	Total Population	Total Population at Risk		All Elderly Population	Elderly Population at Risk		All Children Population	Children at Risk	
		Number	%		Number	%		Number	%
Town of Carrboro	20,883	199	1%	2,012	19	0.90%	1,076	10	0.90%
Town of Chapel Hill	59,351	914	1.54%	5,722	88	1.54%	3,117	48	1.54%
Town of Hillsborough	8,467	10	0.10%	816	1	0.10%	436	1	0.20%
<b>Person</b>									
Person County (Unincorporated Area)	26,396	9	0%	4,007	1	0%	1,584	1	0.10%
City of Roxboro	13,079	41	0.30%	1,986	6	0.30%	785	2	0.30%
<b>Region Total</b>	<b>587,716</b>	<b>4,766</b>	<b>0.81%</b>	<b>66,493</b>	<b>513</b>	<b>0.77%</b>	<b>38,310</b>	<b>291</b>	<b>0.76%</b>

Source: NCEM Risk Management Tool

### Property

Residential, commercial, and public buildings, as well as critical infrastructure such as transportation, water, energy, and communication systems may be damaged or destroyed by flood waters.

Table 4.49 details the property at risk from the 1% annual chance flood event, according to data from the NCEM IRISK database. As with population vulnerability data, actual property at risk is likely higher due to the amount of development that has occurred since the original analysis for the IRISK dataset was performed.

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**Table 4.49 – Buildings Impacted by the 100-Year Flood Event**

Jurisdiction	All Buildings	Number of Pre-FIRM Buildings at Risk		Residential Buildings at Risk			Commercial Buildings at Risk			Public Buildings at Risk			Total Buildings at Risk		
	Num	Num	% of Total	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages
Alamance															
Alamance County (Unincorporated Area)	29,650	38	0.10%	55	0.20%	\$363,953	6	0%	\$230,681	0	0%	\$0	61	0.20%	\$594,634
City of Burlington	24,403	192	0.80%	201	0.80%	\$646,943	15	0.10%	\$167,698	2	0%	\$18,193	218	0.90%	\$832,834
City of Graham	7,269	29	0.40%	88	1.20%	\$199,197	1	0%	\$1,246	0	0%	\$0	89	1.20%	\$200,443
City of Mebane	5,835	0	0%	16	0.30%	\$53,658	1	0%	\$1,960	0	0%	\$0	17	0.30%	\$55,618
Town of Elon	2,760	20	0.70%	21	0.80%	\$40,705	0	0%	\$0	0	0%	\$0	21	0.80%	\$40,705
Town of Green Level	1,177	0	0%	0	0%	\$0	0	0%	\$0	0	0%	\$0	0	0%	\$0
Town of Haw River	2,352	17	0.70%	19	0.80%	\$110,767	3	0.10%	\$29,139	0	0%	\$0	22	0.90%	\$139,907
Town of Ossipee	330	0	0%	0	0%	\$0	0	0%	\$0	0	0%	\$0	0	0%	\$0
Town of Swepsonville	573	0	0%	0	0%	\$0	0	0%	\$0	0	0%	\$0	0	0%	\$0
Village of Alamance	798	1	0.10%	1	0.10%	\$339	0	0%	\$0	0	0%	\$0	1	0.10%	\$339
Durham															
City of Durham	75,588	480	0.60%	651	0.90%	\$7,217,149	64	0.10%	\$5,812,077	6	0%	\$228,083	721	1%	\$13,257,310
Durham County (Unincorporated Area)	21,038	63	0.30%	152	0.70%	\$853,878	13	0.10%	\$2,191,130	2	0%	\$14,030	167	0.80%	\$3,059,038
Orange															
Orange County (Unincorporated Area)	24,533	8	0%	38	0.20%	\$171,926	2	0%	\$29,200	0	0%	\$0	40	0.20%	\$201,126
Town of Carrboro	5,782	14	0.20%	52	0.90%	\$1,360,258	0	0%	\$0	0	0%	\$0	52	0.90%	\$1,360,258

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Jurisdiction	All Buildings	Number of Pre-FIRM Buildings at Risk		Residential Buildings at Risk			Commercial Buildings at Risk			Public Buildings at Risk			Total Buildings at Risk		
	Num	Num	% of Total	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages
Town of Chapel Hill	15,108	228	1.50%	216	1.40%	\$11,132,018	34	0.20%	\$6,204,100	1	0%	\$247,944	251	1.70%	\$17,584,062
Town of Hillsborough	3,883	5	0.10%	4	0.10%	\$5,872	1	0%	\$9,528	0	0%	\$0	5	0.10%	\$15,399
Person															
City of Roxboro	6,617	35	0.50%	18	0.30%	\$50,719	15	0.20%	\$701,674	2	0%	\$18,403	35	0.50%	\$770,796
Person County (Unincorporated Area)	17,714	0	0%	5	0%	\$12,780	0	0%	\$0	0	0%	\$0	5	0%	\$12,780
<b>Total</b>	<b>245,410</b>	<b>1,130</b>	<b>0.50%</b>	<b>1,537</b>	<b>0.60%</b>	<b>\$22,220,162</b>	<b>155</b>	<b>0.10%</b>	<b>\$15,378,433</b>	<b>13</b>	<b>0%</b>	<b>\$526,653</b>	<b>1,705</b>	<b>0.70%</b>	<b>\$38,125,249</b>

Source: NCEM Risk Management Tool

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The damage estimates for the 1% annual chance flood event total \$46,279,356, which equates to a loss ratio of less than 1 percent. The loss ratio is the damage estimate divided by the total potential exposure (i.e., total value of all buildings in the planning area), displayed as a percentage of value at risk. FEMA considers loss ratios greater than 10% to be significant and an indicator a community may have more difficulties recovering from an event.

Table 4.50 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings across all jurisdictions, by sector for the 100-year flood event. Vulnerability of CIKR as well as High Potential Loss Properties, where applicable, can be found by jurisdiction in each community's annex to this plan.

**Table 4.50 – Critical Infrastructure and Key Resources Buildings at Risk to 100-Year Flood by Sector**

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	3	\$272,662
Commercial Facilities	108	\$7,413,171
Communications	1	\$283,671
Critical Manufacturing	28	\$7,891,080
Energy	8	\$342,366
Food and Agriculture	8	\$32,092
Government Facilities	7	\$469,408
Healthcare and Public Health	7	\$724,292
Transportation Systems	15	\$2,265,319
Water	16	\$6,373,107
<b>Total</b>	<b>201</b>	<b>\$26,067,168</b>

Source: NCEM Risk Management Tool

### Repetitive Loss Analysis

A repetitive loss property is a property for which two or more flood insurance claims of more than \$1,000 have been paid by the NFIP within any 10-year period since 1978. An analysis of repetitive loss was completed to examine repetitive losses within the region.

According to 2020 NFIP records from the FEMA Community Information System, there are a total of 196 repetitive loss properties within the Eno-Haw region, which have produced over \$13.1 million in claims payments. There are 26 properties on the list classified as severe repetitive loss properties. A severe repetitive loss property is classified as such if it has four or more separate claim payments of more than \$5,000 each (including building and contents payments) or two or more separate claim payments (building only) where the total of the payments exceeds the current value of the property.

Table 4.51 summarizes repetitive loss properties by jurisdiction as identified by FEMA through the NFIP.

**Table 4.51 – Repetitive Loss Properties by Jurisdiction**

Jurisdiction	Total Number of Properties	Total Number of Losses	Total Number of Severe Repetitive Loss Properties	Total Amount of Claims Payments
Alamance County	9	16	2	\$283,480.40
City of Burlington	8	18	2	\$322,040.69
City of Graham	1	2	0	\$8,880.76
City of Mebane	0	0	0	\$0
Town of Elon	1	3	0	\$27,590.23
Town of Green Level	0	0	0	\$0
Town of Haw River	0	0	0	\$0

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Jurisdiction	Total Number of Properties	Total Number of Losses	Total Number of Severe Repetitive Loss Properties	Total Amount of Claims Payments
Town of Ossipee	0	0	0	\$0
Town of Swepsonville	0	0	0	\$0
Village of Alamance	0	0	0	\$0
City of Durham	63	92	6	\$1,700,609.94
Durham County	9	14	1	\$216,197.28
Orange County	4	5	0	\$107,362.93
Town of Carrboro	9	10	0	\$134,476.19
Town of Chapel Hill	92	154	15	\$10,342,665.66
Town of Hillsborough	0	0	0	\$0
City of Roxboro	0	0	0	\$0
Person County	0	0	0	\$0
<b>Total</b>	<b>196</b>	<b>314</b>	<b>26</b>	<b>\$13,143,304.08</b>

Source: FEMA Community Information System

These repetitive loss properties include primarily residential as well as some commercial property types. These property types are representative of all communities in the plan with repetitive losses.

### Environment

During a flood event, chemicals and other hazardous substances may end up contaminating local water bodies. Flooding kills animals and in general disrupts the ecosystem. Snakes and insects may also make their way to the flooded areas.

Floods can also cause significant erosion, which can alter streambanks and deposit sediment, changing the flow of streams and rivers and potentially reducing the drainage capacity of those waterbodies.

### Consequence Analysis

Table 4.52 summarizes the potential detrimental consequences of flood.

**Table 4.52 – Consequence Analysis - Flood**

Category	Consequences
Public	Localized impact expected to be severe for incident areas and moderate to light for other adversely affected areas.
Responders	First responders are at risk when attempting to rescue people from their homes. They are subject to the same health hazards as the public. Flood waters may prevent access to areas in need of response or the flood may prevent access to the critical facilities themselves which may prolong response time. Damage to personnel will generally be localized to those in the flood areas at the time of the incident and is expected to be limited.
Continuity of Operations (including Continued Delivery of Services)	Floods can severely disrupt normal operations, especially when there is a loss of power. Damage to facilities in the affected area may require temporary relocation of some operations. Localized disruption of roads, facilities, and/or utilities caused by incident may postpone delivery of some services.
Property, Facilities and Infrastructure	Buildings and infrastructure, including transportation and utility infrastructure, may be damaged or destroyed. Impacts are expected to be localized to the area of the incident. Severe damage is possible.

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Category	Consequences
Environment	Chemicals and other hazardous substances may contaminate local water bodies. Wildlife and livestock deaths possible. The localized impact is expected to be severe for incident areas and moderate to light for other areas affected by the flood or HazMat spills.
Economic Condition of the Jurisdiction	Local economy and finances will be adversely affected, possibly for an extended period of time. During floods (especially flash floods), roads, bridges, farms, houses and automobiles are destroyed. Additionally, the local government must deploy firemen, police and other emergency response personnel and equipment to help the affected area. It may take years for the affected communities to be re-built and business to return to normal.
Public Confidence in the Jurisdiction's Governance	Ability to respond and recover may be questioned and challenged if planning, response, and recovery are not timely and effective.

### Hazard Summary by Jurisdiction

The following table summarizes flood hazard risk by jurisdiction. To account for increased risk of flood due to stormwater and flash flooding, communities with between 2 and 12 flash flood events in the period from 2007-2018 were assigned a probability rating of 3, and communities with over 12 flash flood events during this period were assigned a probability rating of 4. Note that countywide events were not considered in these counts. Communities with 10% or more of their land area in the SFHA were assigned a spatial extent of 3. All other factors do not vary by jurisdiction.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	Score	Priority
Alamance County	3	2	2	3	3	2.5	H
Burlington	3	2	2	3	3	2.5	H
Graham	3	2	2	3	3	2.5	H
Mebane	3	2	2	3	3	2.5	H
Elon	3	2	2	3	3	2.5	H
Green Level	3	2	2	3	3	2.5	H
Haw River	3	2	2	3	3	2.5	H
Ossipee	3	2	2	3	3	2.5	H
Sweepsonville	3	2	2	3	3	2.5	H
Alamance	3	2	2	3	3	2.5	H
Durham County	3	2	2	3	3	2.5	H
Durham	3	2	2	3	3	2.5	H
Orange County	3	2	2	3	3	2.5	H
Carrboro	3	2	2	3	3	2.5	H
Chapel Hill	3	2	2	3	3	2.5	H
Hillsborough	3	2	2	3	3	2.5	H
Person County	3	2	2	3	3	2.5	H
Roxboro	3	2	2	3	3	2.5	H

### 4.5.6 Hurricane and Tropical Storm

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Hurricane & Tropical Storm	Likely	Critical	Large	More than 24 hrs	Less than 24 hrs	2.9

#### Hazard Background

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

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

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

*Warning Time: 1 – More than 24 hours*

*Duration: 2 – Less than 24 hours*

#### Location

Hurricanes and tropical storms can occur anywhere within the Eno-Haw Region. While coastal areas are most vulnerable to hurricanes, the wind and rain impacts of these storms can be felt hundreds of miles inland.

#### Extent

Hurricane intensity is classified by the Saffir-Simpson Scale (Table 4.53), which rates hurricane intensity on a scale of 1 to 5, with 5 being the most intense.






**Table 4.53 – Saffir-Simpson Scale**

Category	Maximum Sustained Wind Speed (MPH)	Types of Damage
1	74–95	Very dangerous winds will produce some damage; Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96–110	Extremely dangerous winds will cause extensive damage; Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3	111–129	Devastating damage will occur; Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4	130–156	Catastrophic damage will occur; Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5	157 +	Catastrophic damage will occur; A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Source: National Hurricane Center

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 4.54 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 4.54 – Hurricane Damage Classifications**

Storm Category	Damage Level	Description of Damages	Photo Example
<b>1</b>	MINIMAL	No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Also, some coastal flooding and minor pier damage.	
<b>2</b>	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.	
<b>3</b>	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.	
<b>4</b>	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.	
<b>5</b>	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

Tropical cyclones weaken relatively quickly after making landfall; therefore, the Eno-Haw Region will not typically experience major hurricane force winds, though these occurrences are possible. The strongest storm on record to pass through the region was Hurricane Fran in 1999, which moved through the Region as a Category 1 storm. However, within 50 miles of the Region Fran was a Category 3 storm. Hurricane Hazel in 1954 passed within 50 miles of the Region as a Category 4 storm.

*Impact: 3 – Critical*

*Spatial Extent: 4 – Large*

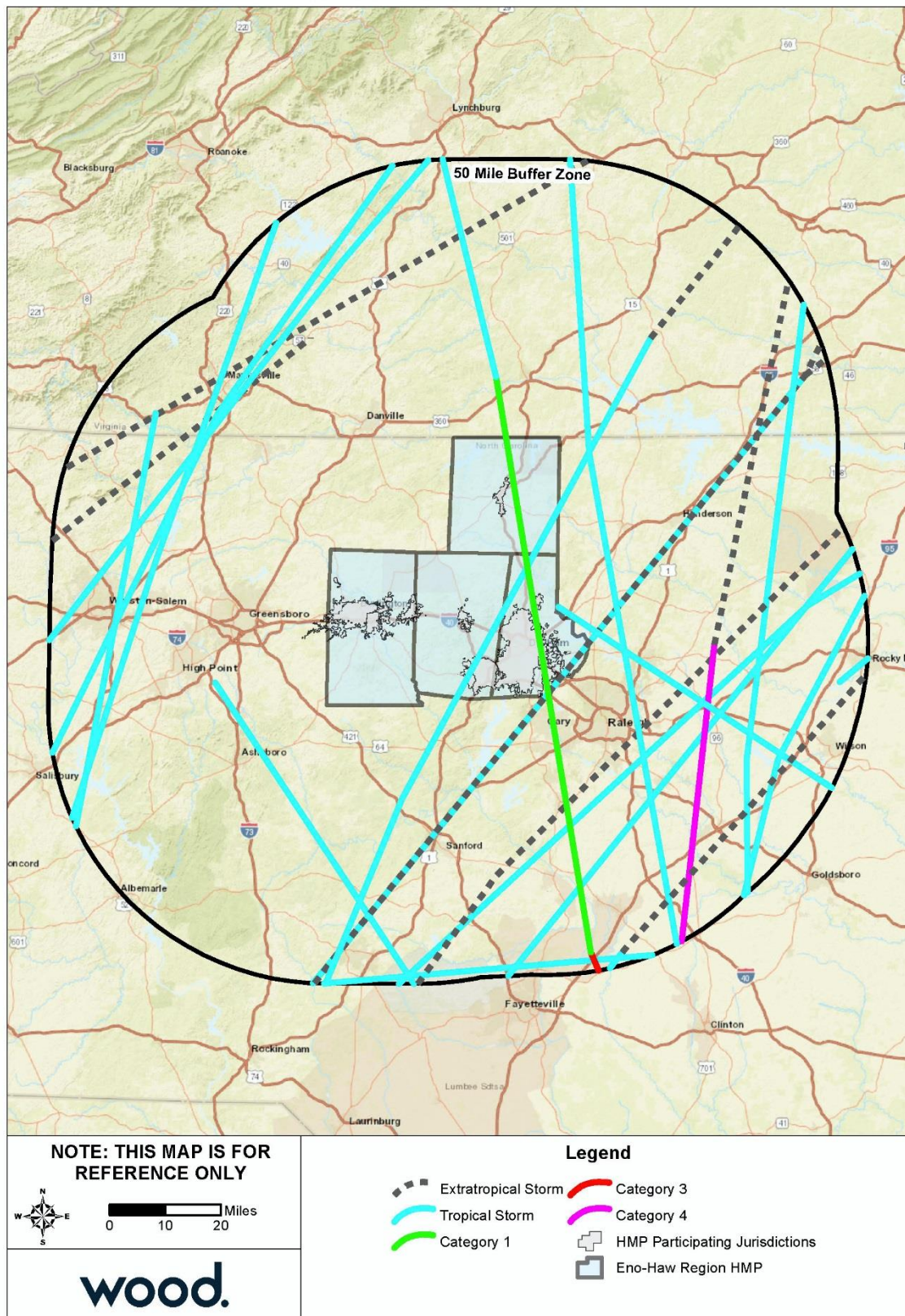
### Historical Occurrences

According to the Office of Coastal Management's Tropical Cyclone Storm Segments data, which is a subset of the International Best Track Archive for Climate Stewardship (IBTrACS) dataset, 22 hurricanes and tropical storms passed within 50 miles of the Eno-Haw Region between 1900 and 2016. These storms tracks are shown in Figure 4.29. The date, storm name, storm category, and maximum wind speed of each event are detailed in Table 4.55.



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Figure 4.29 – Hurricane and Tropical Storm Tracks within 50 Miles of Eno-Haw Region, 1900-2016



Source: NOAA Office of Coastal Management

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**Table 4.55 – Hurricane and Tropical Storm Tracks within 50 Miles of Eno-Haw Region, 1900-2016**

Date	Storm Name	Max Storm Category*	Max Wind Speed (mph)
6/16/1902	Unnamed	Extratropical Storm	46
10/12/1902	Unnamed	Extratropical Storm	40
9/14/1904	Unnamed	Tropical Storm	69
9/23/1907	Unnamed	Extratropical Storm	40
9/3/1913	Unnamed	Tropical Storm	46
8/4/1915	Unnamed	Tropical Storm	46
9/23/1920	Unnamed	Tropical Storm	40
10/2/1929	Unnamed	Extratropical Storm	58
9/6/1935	Unnamed	Tropical Storm	58
8/2/1944	Unnamed	Tropical Storm	69
10/20/1944	Unnamed	Extratropical Storm	58
9/18/1945	Unnamed	Tropical Storm	58
9/1/1952	Able	Tropical Storm	46
10/15/1954	Hazel	Category 4	132
8/17/1955	Diane	Tropical Storm	63
7/10/1959	Cindy	Tropical Storm	40
9/5/1979	David	Tropical Storm	52
7/25/1985	Bob	Tropical Storm	52
9/6/1996	Fran	Category 3	115
9/5/1999	Dennis	Tropical Storm	40
9/6/2008	Hanna	Tropical Storm	69
6/7/2013	Andrea	Tropical Storm	46

\*Reports the most intense category that occurred within 50 miles of the Region, not for the storm event overall.

Source: Office of Coastal Management, 2019. <https://marinecadastre.gov/data/>

The above list of storms is not an exhaustive list of hurricanes that have affected the Region. Several storms, including Hurricane Floyd and Tropical Storm Hermine passed further than 50 miles away from the Region yet had strong enough wind or rain impacts to affect the county. Additionally, several storms have impacted the planning area since 2016. Storms with hurricane and tropical storm force winds that impacted the Eno-Haw Region from 1999 through 2018 are noted in Table 4.56, as identified by NCEI.

**Table 4.56 – Recorded Winds in Eno-Haw Region, 1999-2018**

Date	Type	Storm	Deaths/ Injuries	Property Damage	Crop Damage
9/4/1999	Hurricane (Typhoon)	Hurricane Dennis	0/0	\$0	\$3,000,000
9/15/1999	Hurricane (Typhoon)	Hurricane Floyd	0/0	\$3,000,000,000*	\$5,000,000,000*
9/18/2003	Hurricane (Typhoon)	Hurricane Isabel	0/0	\$309,000	\$0
9/14/2018	Tropical Storm	Hurricane Florence	0/0	\$0	\$25,000
10/11/2018	Tropical Storm	Tropical Storm Michael	0/0	\$1,700,000	\$0
<b>Total</b>			<b>0/0</b>	<b>\$3,002,009,000</b>	<b>\$5,003,025,000</b>

Source: NCEI

\*Note: Damage estimates provided by NCEI for Hurricane Floyd are for the entire state; however, counties within the Raleigh warning area were thought to have sustained more than half the state total.

**Hurricane Dennis (1999)** – The Triangle received from 6 to 8 inches of rain with Chapel Hill peaking out at 12 inches. The I-40 corridor of counties also got dumped on with totals in the 6 to 10 inch range. This water caused considerable urban and lowland flooding. Several main stem rivers also went into flood.

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The winds with the remnants of Dennis were generally not a significant problem. There were many old, larger trees uprooted and widespread limb damage was reported. However, the wind and rain combination caused considerable crop damage.

**Hurricane Florence (2018)** – A ridge of high pressure over eastern North America stalled Florence's forward motion a few miles off the southeast North Carolina coast on September 13th. Hurricane Florence made landfall near Wrightsville Beach early on September 15 and weakened further as it moved slowly inland. Despite making landfall as a weakened Category 1 hurricane, Florence still produced 40 to 70 mph wind gusts, enough wind speed to uproot trees and cause widespread power outages throughout the Carolinas. As the storm moved inland, from September 15 to 17, heavy rain of 10 to 25 inches caused widespread inland flooding, inundating cities such as Fayetteville, Smithfield, Goldsboro, Durham, and Chapel Hill, and causing major river flooding on main-stem rivers such as the Neuse, Cape Fear, and Little River. Most major roads and highways in the area experienced some flooding, with large stretches of I-40 and I-95 remaining impassable for days after the storm had passed. The storm also spawned tornadoes in several places along its path. There were 3 direct and 6 indirect deaths attributed to the storm within the Raleigh Weather Forecast Office County Warning Area.

**Tropical Storm Michael (2018)** – 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 scores of trees, leading to blocked roadways and thousands without power. In the Eno-Haw Region, tropical storm wind gusts downed numerous trees, caused widespread power outages, and produced a variety of damage to homes and structures. At the peak of the storm, total peak outages were around 33,000 customers in Alamance County, 22,000 in Orange County, and 20,000 in Durham County.

### Probability of Future Occurrence

#### *Probability: 3 – Likely*

In the 20-year period from 1999 through 2018, five hurricanes and tropical storms have impacted the Eno-Haw Region, which equates to a 25 percent annual probability of hurricane winds impacting the county. This probability does not account for impacts from hurricane rains, which may also be severe. Two additional storms passed within 50 miles of the Region during this period; these storms did not have significant wind impacts but may have brought heavy rains. Overall, the probability of a hurricane or tropical storm impacting the Region is likely.

### 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.



## SECTION 4: RISK ASSESSMENT

### Vulnerability Assessment

#### Methodologies and Assumptions

Property at risk to hurricanes was estimated using data from the North Carolina Emergency Management (NCEM) IRISK database, which was compiled in NCEM's Risk Management Tool. The vulnerability data displayed below is for wind-related damages. Hurricanes may also cause substantial damages from heavy rains and subsequent flooding, which is addressed in Section 4.5.5 Flood.

#### People

The very young, the elderly and disabled individuals are more vulnerable to harm from hurricanes, as are those who are unable to evacuate for medical reasons, including special-needs patients and those in hospitals and nursing homes. Many of these patients are either oxygen-dependent, insulin-dependent, or in need of intensive or ongoing treatment. For all affected populations, the stress from disasters such as a hurricane can result in immediate and long-term physical and emotional health problems among victims.

People exposed to the elements are also more vulnerable to wind hazards. The availability of sheltered locations, such as buildings constructed using wind-resistant materials and public storm shelters, reduces the exposure of the population. Individuals in mobile home housing are particularly susceptible to wind hazards. According to the 2017 American Community Survey (ACS), 19,000 occupied housing units (7.5%) in the Eno-Haw Region are classified as "mobile homes or other types of housing." Based on an estimated average of 2.4 persons per household from the 2017 ACS, there are approximately 45,000 people in the Region living in mobile homes. Table 4.57 details the number of mobile home units in each jurisdiction.

**Table 4.57 – Mobile Home Units in the Eno-Haw Region, 2017**

County	Occupied Mobile Home Units	Total Occupied Housing Units	Percent of Occupied Housing
<b>Alamance County</b>	<b>8,705</b>	<b>69,049</b>	<b>12.6%</b>
Unincorporated Alamance County	6,576	25,462	25.8%
Burlington	781	24,471	3.2%
Graham	586	6,581	8.9%
Mebane	84	6,138	1.4%
Elon	46	3,108	1.5%
Green Level	325	824	39.4%
Haw River	230	1,126	20.4%
Ossipee	45	211	21.3%
Swepsonville	30	694	4.3%
Alamance	2	434	0.5%
<b>Durham County</b>	<b>1,826</b>	<b>130,691</b>	<b>1.4%</b>
Unincorporated Durham County	922	17,125	5.4%
Durham	904	113,566	0.8%
<b>Orange County</b>	<b>4,328</b>	<b>56,941</b>	<b>7.6%</b>
Unincorporated Orange County	3,875	22,840	17.0%
Carrboro	69	9,585	0.7%
Chapel Hill	218	21,685	1.0%
Hillsborough	166	2,831	5.9%
<b>Person County</b>	<b>4,141</b>	<b>18,371</b>	<b>22.5%</b>
Unincorporated Person County	3,579	14,231	25.1%
Roxboro	562	4,140	13.6%

Source: American Community Survey 2013-2017 5-Year Estimates

Unincorporated area counts are estimated by subtracting incorporated areas from the county total.

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### Property

Hurricanes can cause catastrophic damage to coastlines and several hundred miles inland. Hurricanes can produce winds exceeding 157 mph as well as tornadoes and microbursts. Additionally, hurricanes often bring intense rainfall that can result in flash flooding. Floods and flying debris from the excessive winds are often the deadly and most destructive results of hurricanes.

Hurricanes and tropical storms can also cause agricultural damages. For the Eno-Haw Region, USDA RMA reports losses of \$37,689 from 2007-2017 due to hurricane and cyclone, which equates to an average annual loss of \$3,426. Table 4.58 summarizes these crop losses reported in the RMA system.

**Table 4.58 – Crop Losses Resulting from Hurricane and Cyclone, 2007-2017**

County	Total Affected Acres	Total Indemnity Paid	Average Indemnity Amount
Alamance	32.58	\$13,227.00	\$4,409.00
Orange	20.40	\$6,356.00	\$6,356.00
Person	10.40	\$18,106.00	\$9,053.00
<b>Region Total</b>	<b>11.50</b>	<b>\$37,689.00</b>	<b>\$6,606.00</b>

Source: USDA Risk Management Agency

The damage estimates for the 100-year hurricane wind event total \$165,377,598, which equates to a loss ratio of less than 1 percent. These damage estimates account for only wind impacts and actual damages would likely be higher due to flooding. Therefore, the Region would likely experience a higher overall loss ratio from the 100-year hurricane event and face difficulty recovering from such an event.

Table 4.59 through Table 4.63 detail the estimated building damages from varying magnitudes of hurricane events.



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**Table 4.59 – Estimated Buildings Impacted by 25-Year Hurricane Wind Event**

Jurisdiction	All Buildings	Residential Buildings at Risk			Commercial Buildings at Risk			Public Buildings at Risk			Total Buildings at Risk		
	Num	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages
<b>Alamance County</b>													
Unincorporated Alamance County	29,650	25,587	86.3%	\$1,517,967	3,425	11.6%	\$93,888	283	1%	\$30,176	29,295	98.8%	\$1,642,032
City of Burlington	24,403	21,461	87.9%	\$1,510,650	2,401	9.8%	\$293,499	320	1.3%	\$44,561	24,182	99.1%	\$1,848,710
City of Graham	7,269	6,512	89.6%	\$381,793	530	7.3%	\$38,766	155	2.1%	\$17,058	7,197	99%	\$437,617
City of Mebane	5,835	5,194	89%	\$374,873	465	8%	\$117,083	64	1.1%	\$14,644	5,723	98.1%	\$506,600
Town of Elon	2,760	2,432	88.1%	\$208,948	147	5.3%	\$23,513	174	6.3%	\$17,521	2,753	99.7%	\$249,981
Town of Green Level	1,177	1,049	89.1%	\$54,664	109	9.3%	\$5,043	10	0.8%	\$414	1,168	99.2%	\$60,121
Town of Haw River	2,352	2,121	90.2%	\$122,845	168	7.1%	\$8,549	31	1.3%	\$2,738	2,320	98.6%	\$134,131
Town of Ossipee	330	297	90%	\$17,195	21	6.4%	\$1,204	7	2.1%	\$448	325	98.5%	\$18,847
Town of Swepsonville	573	526	91.8%	\$41,834	24	4.2%	\$11,554	5	0.9%	\$1,142	555	96.9%	\$54,530
Village of Alamance	798	711	89.1%	\$41,010	66	8.3%	\$1,302	17	2.1%	\$1,398	794	99.5%	\$43,710
<b>Subtotal Alamance</b>	<b>75,147</b>	<b>65,890</b>	<b>87.7%</b>	<b>\$4,271,779</b>	<b>7,356</b>	<b>9.8%</b>	<b>\$594,401</b>	<b>1,066</b>	<b>1.4%</b>	<b>\$130,100</b>	<b>74,312</b>	<b>98.9%</b>	<b>\$4,996,279</b>
<b>Durham County</b>													
Unincorporated Durham County	21,038	17,863	84.9%	\$1,306,795	2,818	13.4%	\$394,394	234	1.1%	\$49,206	20,915	99.4%	\$1,750,395
City of Durham	75,588	66,993	88.6%	\$5,934,692	6,071	8%	\$1,288,346	1,667	2.2%	\$370,777	74,731	98.9%	\$7,593,815
<b>Subtotal Durham</b>	<b>96,626</b>	<b>84,856</b>	<b>87.82%</b>	<b>\$7,241,487</b>	<b>8,889</b>	<b>9.20%</b>	<b>\$1,682,740</b>	<b>1,901</b>	<b>1.97%</b>	<b>\$419,983</b>	<b>95,646</b>	<b>98.99%</b>	<b>\$9,344,210</b>
<b>Orange County</b>													
Unincorporated Orange County	24,533	21,439	87.4%	\$1,770,536	2,657	10.8%	\$171,290	246	1%	\$103,055	24,342	99.2%	\$2,044,881
Town of Carrboro	5,782	5,450	94.3%	\$729,711	261	4.5%	\$76,279	46	0.8%	\$65,644	5,757	99.6%	\$871,634
Town of Chapel Hill	15,108	3,405	87.7%	\$313,667	358	9.2%	\$42,195	111	2.9%	\$44,105	3,874	99.8%	\$399,967
Town of Hillsborough	3,883	518	13.3%	\$6,208	352	9.1%	\$46,427	105	2.7%	\$16,571	975	25.1%	\$69,206
<b>Subtotal Orange</b>	<b>49,306</b>	<b>30,812</b>	<b>62.49%</b>	<b>\$2,820,122</b>	<b>3,628</b>	<b>7.36%</b>	<b>\$336,191</b>	<b>508</b>	<b>1.03%</b>	<b>\$229,375</b>	<b>34,948</b>	<b>70.88%</b>	<b>\$3,385,688</b>
<b>Person County</b>													
Unincorporated Person County	17,714	14,626	82.6%	\$1,380,564	2,613	14.8%	\$79,184	156	0.9%	\$60,127	17,395	98.2%	\$1,519,875
City of Roxboro	6,617	5,742	86.8%	\$537,648	710	10.7%	\$104,442	144	2.2%	\$45,812	6,596	99.7%	\$687,902
<b>Subtotal Person</b>	<b>24,331</b>	<b>20,368</b>	<b>83.7%</b>	<b>\$1,918,212</b>	<b>3,323</b>	<b>13.7%</b>	<b>\$183,626</b>	<b>300</b>	<b>1.2%</b>	<b>\$105,939</b>	<b>23,991</b>	<b>98.6%</b>	<b>\$2,207,777</b>
<b>Total</b>	<b>245,410</b>	<b>215,293</b>	<b>87.7%</b>	<b>\$18,874,641</b>	<b>23,461</b>	<b>9.6%</b>	<b>\$2,945,820</b>	<b>4,198</b>	<b>1.7%</b>	<b>\$1,108,496</b>	<b>242,952</b>	<b>99%</b>	<b>\$22,928,955</b>

Source: NCEM Risk Management Tool

## SECTION 4: RISK ASSESSMENT

**Table 4.60 – Estimated Buildings Impacted by 50-Year Hurricane Wind Event**

Jurisdiction	All Buildings	Residential Buildings at Risk			Commercial Buildings at Risk			Public Buildings at Risk			Total Buildings at Risk		
	Num	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages
<b>Alamance County</b>													
Unincorporated Alamance County	29,650	25,610	86.4%	\$1,789,093	3,425	11.6%	\$130,010	283	1%	\$38,710	29,318	98.9%	\$1,957,812
City of Burlington	24,403	21,461	87.9%	\$1,510,650	2,401	9.8%	\$293,499	320	1.3%	\$44,561	24,182	99.1%	\$1,848,710
City of Graham	7,269	6,512	89.6%	\$381,793	530	7.3%	\$38,766	155	2.1%	\$17,058	7,197	99%	\$437,617
City of Mebane	5,835	5,194	89%	\$374,873	465	8%	\$117,083	64	1.1%	\$14,644	5,723	98.1%	\$506,600
Town of Elon	2,760	2,432	88.1%	\$208,948	147	5.3%	\$23,513	174	6.3%	\$17,521	2,753	99.7%	\$249,981
Town of Green Level	1,177	1,049	89.1%	\$54,664	109	9.3%	\$5,043	10	0.8%	\$414	1,168	99.2%	\$60,121
Town of Haw River	2,352	2,121	90.2%	\$122,845	168	7.1%	\$8,549	31	1.3%	\$2,738	2,320	98.6%	\$134,131
Town of Ossipee	330	297	90%	\$17,195	21	6.4%	\$1,204	7	2.1%	\$448	325	98.5%	\$18,847
Town of Swepsonville	573	526	91.8%	\$41,834	24	4.2%	\$11,554	5	0.9%	\$1,142	555	96.9%	\$54,530
Village of Alamance	798	711	89.1%	\$41,010	66	8.3%	\$1,302	17	2.1%	\$1,398	794	99.5%	\$43,710
<b>Subtotal Alamance</b>	<b>75,147</b>	<b>65,913</b>	<b>87.7%</b>	<b>\$4,542,905</b>	<b>7,356</b>	<b>9.8%</b>	<b>\$630,523</b>	<b>1,066</b>	<b>1.4%</b>	<b>\$138,634</b>	<b>74,335</b>	<b>98.9%</b>	<b>\$5,312,059</b>
<b>Durham County</b>													
Unincorporated Durham County	21,038	17,962	85.4%	\$4,475,661	2,818	13.4%	\$1,151,975	234	1.1%	\$159,541	21,014	99.9%	\$5,787,176
City of Durham	75,588	67,732	89.6%	\$21,431,914	6,071	8%	\$4,529,119	1,667	2.2%	\$1,323,180	75,470	99.8%	\$27,284,213
<b>Subtotal Durham</b>	<b>96,626</b>	<b>84,856</b>	<b>87.82%</b>	<b>\$7,241,487</b>	<b>8,889</b>	<b>9.20%</b>	<b>\$1,682,740</b>	<b>1,901</b>	<b>1.97%</b>	<b>\$419,983</b>	<b>95,646</b>	<b>98.99%</b>	<b>\$9,344,210</b>
<b>Orange County</b>													
Unincorporated Orange County	24,533	21,602	88.1%	\$3,884,109	2,657	10.8%	\$364,999	246	1%	\$172,678	24,505	99.9%	\$4,421,786
Town of Carrboro	5,782	5,464	94.5%	\$2,558,836	261	4.5%	\$341,439	46	0.8%	\$288,628	5,771	99.8%	\$3,188,903
Town of Chapel Hill	15,108	13,922	92.1%	\$8,698,323	617	4.1%	\$822,592	528	3.5%	\$1,017,789	15,067	99.7%	\$10,538,703
Town of Hillsborough	3,883	3,405	87.7%	\$424,422	358	9.2%	\$76,275	111	2.9%	\$46,923	3,874	99.8%	\$547,620
<b>Subtotal Orange</b>	<b>49,306</b>	<b>44,393</b>	<b>90.04%</b>	<b>\$15,565,690</b>	<b>3,893</b>	<b>7.90%</b>	<b>\$1,605,305</b>	<b>931</b>	<b>1.89%</b>	<b>\$1,526,018</b>	<b>49,217</b>	<b>99.82%</b>	<b>\$18,697,012</b>
<b>Person County</b>													
Unincorporated Person County	17,714	14,626	82.6%	\$1,380,564	2,613	14.8%	\$79,184	156	0.9%	\$60,127	17,395	98.2%	\$1,519,875
City of Roxboro	6,617	5,742	86.8%	\$537,648	710	10.7%	\$104,442	144	2.2%	\$45,812	6,596	99.7%	\$687,902
<b>Subtotal Person</b>	<b>24,331</b>	<b>20,368</b>	<b>83.7%</b>	<b>\$1,918,212</b>	<b>3,323</b>	<b>13.7%</b>	<b>\$183,626</b>	<b>300</b>	<b>1.2%</b>	<b>\$105,939</b>	<b>23,991</b>	<b>98.6%</b>	<b>\$2,207,777</b>
<b>Total</b>	<b>245,410</b>	<b>216,368</b>	<b>88.2%</b>	<b>\$47,934,382</b>	<b>23,461</b>	<b>9.6%</b>	<b>\$8,100,548</b>	<b>4,198</b>	<b>1.7%</b>	<b>\$3,253,312</b>	<b>244,027</b>	<b>99.4%</b>	<b>\$59,288,237</b>

Source: NCEM Risk Management Tool

## SECTION 4: RISK ASSESSMENT

**Table 4.61 – Estimated Buildings Impacted by 100-Year Hurricane Wind Event**

Jurisdiction	All Buildings	Residential Buildings at Risk			Commercial Buildings at Risk			Public Buildings at Risk			Total Buildings at Risk		
	Num	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages
<b>Alamance County</b>													
Unincorporated Alamance County	29,650	25,610	86.4%	\$1,789,093	3,425	11.6%	\$130,010	283	1%	\$38,710	29,318	98.9%	\$1,957,812
City of Burlington	24,403	21,461	87.9%	\$1,510,650	2,401	9.8%	\$293,499	320	1.3%	\$44,561	24,182	99.1%	\$1,848,710
City of Graham	7,269	6,512	89.6%	\$381,793	530	7.3%	\$38,766	155	2.1%	\$17,058	7,197	99%	\$437,617
City of Mebane	5,835	5,194	89%	\$374,873	465	8%	\$117,083	64	1.1%	\$14,644	5,723	98.1%	\$506,600
Town of Elon	2,760	2,432	88.1%	\$208,948	147	5.3%	\$23,513	174	6.3%	\$17,521	2,753	99.7%	\$249,981
Town of Green Level	1,177	1,049	89.1%	\$54,664	109	9.3%	\$5,043	10	0.8%	\$414	1,168	99.2%	\$60,121
Town of Haw River	2,352	2,121	90.2%	\$122,845	168	7.1%	\$8,549	31	1.3%	\$2,738	2,320	98.6%	\$134,131
Town of Ossipee	330	297	90%	\$17,195	21	6.4%	\$1,204	7	2.1%	\$448	325	98.5%	\$18,847
Town of Swepsonville	573	526	91.8%	\$41,834	24	4.2%	\$11,554	5	0.9%	\$1,142	555	96.9%	\$54,530
Village of Alamance	798	711	89.1%	\$41,010	66	8.3%	\$1,302	17	2.1%	\$1,398	794	99.5%	\$43,710
<b>Subtotal Alamance</b>	<b>75,147</b>	<b>65,913</b>	<b>87.7%</b>	<b>\$4,542,905</b>	<b>7,356</b>	<b>9.8%</b>	<b>\$630,523</b>	<b>1,066</b>	<b>1.4%</b>	<b>\$138,634</b>	<b>74,335</b>	<b>98.9%</b>	<b>\$5,312,059</b>
<b>Durham County</b>													
Unincorporated Durham County	21,038	17,968	85.4%	\$10,744,559	2,818	13.4%	\$3,484,762	234	1.1%	\$457,730	21,020	99.9%	\$14,687,051
City of Durham	75,588	67,732	89.6%	\$54,054,072	6,071	8%	\$14,961,703	1,667	2.2%	\$4,475,993	75,470	99.8%	\$73,491,768
<b>Subtotal Durham</b>	<b>96,626</b>	<b>85,700</b>	<b>88.69%</b>	<b>\$64,798,631</b>	<b>8,889</b>	<b>9.20%</b>	<b>\$18,446,465</b>	<b>1,901</b>	<b>1.97%</b>	<b>\$4,933,723</b>	<b>96,490</b>	<b>99.86%</b>	<b>\$88,178,819</b>
<b>Orange County</b>													
Unincorporated Orange County	24,533	21,624	88.1%	\$10,744,116	2,657	10.8%	\$1,183,862	246	1%	\$568,397	24,527	100%	\$12,496,375
Town of Carrboro	5,782	5,464	94.5%	\$6,312,753	261	4.5%	\$1,150,600	46	0.8%	\$854,587	5,771	99.8%	\$8,317,940
Town of Chapel Hill	15,108	13,922	92.1%	\$21,129,165	617	4.1%	\$3,009,976	528	3.5%	\$3,703,606	15,067	99.7%	\$27,842,747
Town of Hillsborough	3,883	3,408	87.8%	\$1,046,140	358	9.2%	\$155,091	111	2.9%	\$138,551	3,877	99.8%	\$1,339,782
<b>Subtotal Orange</b>	<b>49,306</b>	<b>44,418</b>	<b>90.09%</b>	<b>\$39,232,174</b>	<b>3,893</b>	<b>7.90%</b>	<b>\$5,499,529</b>	<b>931</b>	<b>1.89%</b>	<b>\$5,265,141</b>	<b>49,242</b>	<b>99.87%</b>	<b>\$49,996,844</b>
<b>Person County</b>													
Unincorporated Person County	17,714	14,893	84.1%	\$4,680,293	2,613	14.8%	\$268,918	156	0.9%	\$216,901	17,662	99.7%	\$5,166,112
City of Roxboro	6,617	5,754	87%	\$1,770,266	710	10.7%	\$412,257	144	2.2%	\$178,831	6,608	99.9%	\$2,361,354
<b>Subtotal Person</b>	<b>24,331</b>	<b>20,647</b>	<b>84.9%</b>	<b>\$6,450,559</b>	<b>3,323</b>	<b>13.7%</b>	<b>\$681,175</b>	<b>300</b>	<b>1.2%</b>	<b>\$395,732</b>	<b>24,270</b>	<b>99.7%</b>	<b>\$7,527,466</b>
<b>Total</b>	<b>245,410</b>	<b>217,361</b>	<b>88.6%</b>	<b>\$126,862,827</b>	<b>23,461</b>	<b>9.6%</b>	<b>\$27,297,853</b>	<b>4,198</b>	<b>1.7%</b>	<b>\$11,216,917</b>	<b>245,020</b>	<b>99.8%</b>	<b>\$165,377,598</b>

Source: NCEM Risk Management Tool

## SECTION 4: RISK ASSESSMENT

**Table 4.62 – Estimated Buildings Impacted by 300-Year Hurricane Wind Event**

Jurisdiction	All Buildings	Residential Buildings at Risk			Commercial Buildings at Risk			Public Buildings at Risk			Total Buildings at Risk		
	Num	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages
<b>Alamance County</b>													
Unincorporated Alamance County	29,650	25,911	87.4%	\$33,160,510	3,425	11.6%	\$6,483,967	283	1%	\$1,822,163	29,619	99.9%	\$41,466,641
City of Burlington	24,403	21,618	88.6%	\$30,834,890	2,401	9.8%	\$12,800,367	320	1.3%	\$2,679,425	24,339	99.7%	\$46,314,682
City of Graham	7,269	6,575	90.5%	\$8,234,848	530	7.3%	\$2,200,394	155	2.1%	\$1,140,007	7,260	99.9%	\$11,575,249
City of Mebane	5,835	5,303	90.9%	\$8,843,654	465	8%	\$5,169,882	64	1.1%	\$660,516	5,832	99.9%	\$14,674,052
Town of Elon	2,760	2,437	88.3%	\$4,528,752	147	5.3%	\$1,698,642	174	6.3%	\$998,717	2,758	99.9%	\$7,226,111
Town of Green Level	1,177	1,057	89.8%	\$1,044,769	109	9.3%	\$210,188	10	0.8%	\$40,438	1,176	99.9%	\$1,295,394
Town of Haw River	2,352	2,139	90.9%	\$2,728,522	168	7.1%	\$350,117	31	1.3%	\$153,101	2,338	99.4%	\$3,231,741
Town of Ossipee	330	299	90.6%	\$307,230	21	6.4%	\$99,388	7	2.1%	\$15,674	327	99.1%	\$422,292
Town of Swepsonville	573	543	94.8%	\$833,748	24	4.2%	\$457,462	5	0.9%	\$29,685	572	99.8%	\$1,320,896
Village of Alamance	798	714	89.5%	\$916,534	66	8.3%	\$112,489	17	2.1%	\$72,462	797	99.9%	\$1,101,485
<b>Subtotal Alamance</b>	<b>75,147</b>	<b>66,596</b>	<b>88.6%</b>	<b>\$91,433,457</b>	<b>7,356</b>	<b>9.8%</b>	<b>\$29,582,896</b>	<b>1,066</b>	<b>1.4%</b>	<b>\$7,612,188</b>	<b>75,018</b>	<b>99.8%</b>	<b>\$128,628,543</b>
<b>Durham County</b>													
Unincorporated Durham County	21,038	17,968	85.4%	\$28,552,841	2,818	13.4%	\$10,587,535	234	1.1%	\$1,498,459	21,020	99.9%	\$40,638,835
City of Durham	75,588	67,732	89.6%	\$134,627,064	6,071	8%	\$43,654,889	1,667	2.2%	\$13,158,313	75,470	99.8%	\$191,440,266
<b>Subtotal Durham</b>	<b>96,626</b>	<b>85,700</b>	<b>88.69%</b>	<b>\$163,179,905</b>	<b>8,889</b>	<b>9.20%</b>	<b>\$54,242,424</b>	<b>1,901</b>	<b>1.97%</b>	<b>\$14,656,772</b>	<b>96,490</b>	<b>99.86%</b>	<b>\$232,079,101</b>
<b>Orange County</b>													
Unincorporated Orange County	24,533	21,624	88.1%	\$36,985,891	2,657	10.8%	\$5,170,896	246	1%	\$2,988,282	24,527	100%	\$45,145,069
Town of Carrboro	5,782	5,464	94.5%	\$16,504,977	261	4.5%	\$2,826,506	46	0.8%	\$1,705,569	5,771	99.8%	\$21,037,051
Town of Chapel Hill	15,108	13,922	92.1%	\$52,706,532	617	4.1%	\$9,162,755	528	3.5%	\$10,466,470	15,067	99.7%	\$72,335,758
Town of Hillsborough	3,883	3,408	87.8%	\$6,263,186	358	9.2%	\$1,860,930	111	2.9%	\$989,004	3,877	99.8%	\$9,113,119
<b>Subtotal Orange</b>	<b>49,306</b>	<b>44,418</b>	<b>90.09%</b>	<b>\$112,460,586</b>	<b>3,893</b>	<b>7.90%</b>	<b>\$19,021,087</b>	<b>931</b>	<b>1.89%</b>	<b>\$16,149,325</b>	<b>49,242</b>	<b>99.87%</b>	<b>\$147,630,997</b>
<b>Person County</b>													
Unincorporated Person County	17,714	14,893	84.1%	\$25,609,387	2,613	14.8%	\$2,017,581	156	0.9%	\$1,870,455	17,662	99.7%	\$29,497,423
City of Roxboro	6,617	5,754	87%	\$10,323,182	710	10.7%	\$4,616,560	144	2.2%	\$1,747,326	6,608	99.9%	\$16,687,068
<b>Subtotal Person</b>	<b>24,331</b>	<b>20,647</b>	<b>84.9%</b>	<b>\$35,932,569</b>	<b>3,323</b>	<b>13.7%</b>	<b>\$6,634,141</b>	<b>300</b>	<b>1.2%</b>	<b>\$3,617,781</b>	<b>24,270</b>	<b>99.7%</b>	<b>\$46,184,491</b>
<b>Total</b>	<b>245,410</b>	<b>217,361</b>	<b>88.6%</b>	<b>\$403,006,517</b>	<b>23,461</b>	<b>9.6%</b>	<b>\$109,480,548</b>	<b>4,198</b>	<b>1.7%</b>	<b>\$42,036,066</b>	<b>245,020</b>	<b>99.8%</b>	<b>\$554,523,132</b>

Source: NCEM Risk Management Tool

## SECTION 4: RISK ASSESSMENT

**Table 4.63 – Estimated Buildings Impacted by 700-Year Hurricane Wind Event**

Jurisdiction	All Buildings	Residential Buildings at Risk			Commercial Buildings at Risk			Public Buildings at Risk			Total Buildings at Risk		
	Num	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages
<b>Alamance County</b>													
Unincorporated Alamance County	29,650	25,911	87.4%	\$94,272,463	3,425	11.6%	\$18,047,917	283	1%	\$5,059,879	29,619	99.9%	\$117,380,259
City of Burlington	24,403	21,618	88.6%	\$84,166,459	2,401	9.8%	\$38,513,551	320	1.3%	\$7,622,960	24,339	99.7%	\$130,302,971
City of Graham	7,269	6,575	90.5%	\$22,373,018	530	7.3%	\$7,115,467	155	2.1%	\$3,388,298	7,260	99.9%	\$32,876,783
City of Mebane	5,835	5,303	90.9%	\$26,014,943	465	8%	\$13,227,786	64	1.1%	\$1,810,433	5,832	99.9%	\$41,053,162
Town of Elon	2,760	2,437	88.3%	\$13,297,174	147	5.3%	\$4,578,421	174	6.3%	\$3,062,159	2,758	99.9%	\$20,937,754
Town of Green Level	1,177	1,057	89.8%	\$2,864,467	109	9.3%	\$539,952	10	0.8%	\$128,133	1,176	99.9%	\$3,532,553
Town of Haw River	2,352	2,139	90.9%	\$8,242,257	168	7.1%	\$1,186,380	31	1.3%	\$397,558	2,338	99.4%	\$9,826,195
Town of Ossiipee	330	299	90.6%	\$818,587	21	6.4%	\$285,184	7	2.1%	\$41,749	327	99.1%	\$1,145,519
Town of Swepsonville	573	543	94.8%	\$2,460,882	24	4.2%	\$1,265,495	5	0.9%	\$86,248	572	99.8%	\$3,812,625
Village of Alamance	798	714	89.5%	\$2,404,949	66	8.3%	\$327,395	17	2.1%	\$219,007	797	99.9%	\$2,951,351
<b>Subtotal Alamance</b>	<b>75,147</b>	<b>66,596</b>	<b>88.6%</b>	<b>\$256,915,199</b>	<b>7,356</b>	<b>9.8%</b>	<b>\$85,087,548</b>	<b>1,066</b>	<b>1.4%</b>	<b>\$21,816,424</b>	<b>75,018</b>	<b>99.8%</b>	<b>\$363,819,172</b>
<b>Durham County</b>													
Unincorporated Durham County	21,038	17,968	85.4%	\$82,605,462	2,818	13.4%	\$29,439,410	234	1.1%	\$4,371,221	21,020	99.9%	\$116,416,092
City of Durham	75,588	67,732	89.6%	\$399,885,839	6,071	8%	\$128,990,087	1,667	2.2%	\$37,609,907	75,470	99.8%	\$566,485,833
<b>Subtotal Durham</b>	<b>96,626</b>	<b>85,700</b>	<b>88.69%</b>	<b>\$482,491,301</b>	<b>8,889</b>	<b>9.20%</b>	<b>\$158,429,497</b>	<b>1,901</b>	<b>1.97%</b>	<b>\$41,981,128</b>	<b>96,490</b>	<b>99.86%</b>	<b>\$682,901,925</b>
<b>Orange County</b>													
Unincorporated Orange County	24,533	21,624	88.1%	\$100,677,530	2,657	10.8%	\$11,431,191	246	1%	\$6,547,506	24,527	100%	\$118,656,228
Town of Carrboro	5,782	5,464	94.5%	\$51,932,481	261	4.5%	\$6,251,671	46	0.8%	\$2,954,468	5,771	99.8%	\$61,138,620
Town of Chapel Hill	15,108	13,922	92.1%	\$156,317,237	617	4.1%	\$26,750,005	528	3.5%	\$28,013,943	15,067	99.7%	\$211,081,185
Town of Hillsborough	3,883	3,408	87.8%	\$18,467,270	358	9.2%	\$5,493,604	111	2.9%	\$2,463,959	3,877	99.8%	\$26,424,833
<b>Subtotal Orange</b>	<b>49,306</b>	<b>44,418</b>	<b>90.09%</b>	<b>\$327,394,518</b>	<b>3,893</b>	<b>7.90%</b>	<b>\$49,926,471</b>	<b>931</b>	<b>1.89%</b>	<b>\$39,979,876</b>	<b>49,242</b>	<b>99.87%</b>	<b>\$417,300,866</b>
<b>Person County</b>													
Unincorporated Person County	17,714	14,893	84.1%	\$77,634,827	2,613	14.8%	\$4,888,642	156	0.9%	\$5,169,015	17,662	99.7%	\$87,692,484
City of Roxboro	6,617	5,754	87%	\$32,040,587	710	10.7%	\$13,113,608	144	2.2%	\$5,186,820	6,608	99.9%	\$50,341,015
<b>Subtotal Person</b>	<b>24,331</b>	<b>20,647</b>	<b>84.9%</b>	<b>\$109,675,414</b>	<b>3,323</b>	<b>13.7%</b>	<b>\$18,002,250</b>	<b>300</b>	<b>1.2%</b>	<b>\$10,355,835</b>	<b>24,270</b>	<b>99.7%</b>	<b>\$138,033,499</b>
<b>Total</b>	<b>245,410</b>	<b>217,361</b>	<b>88.6%</b>	<b>\$1,176,476,432</b>	<b>23,461</b>	<b>9.6%</b>	<b>\$311,445,766</b>	<b>4,198</b>	<b>1.7%</b>	<b>\$114,133,263</b>	<b>245,020</b>	<b>99.8%</b>	<b>\$1,602,055,462</b>

Source: NCEM Risk Management Tool



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### Environment

Hurricane winds can cause massive damage to the natural environment, uprooting trees and other debris within the storm's path. Animals can either be killed directly by the storm or impacted indirectly through changes in habitat and food availability caused by high winds and intense rainfall. Endangered species can be dramatically impacted. Forests can be completely defoliated by strong winds.

### Consequence Analysis

Table 4.64 summarizes the potential negative consequences of hurricanes and tropical storms.

**Table 4.64 – Consequence Analysis – Hurricane and Tropical Storm**

Category	Consequences
Public	Impacts include injury or death, loss of property, outbreak of diseases, mental trauma and loss of livelihoods. Power outages and flooding are likely to displace people from their homes. Water can become polluted such that if consumed, diseases and infection can be easily spread. Residential, commercial, and public buildings, as well as critical infrastructure such as transportation, water, energy, and communication systems may be damaged or destroyed, resulting in cascading impacts on the public.
Responders	Localized impact expected to limit damage to personnel in the inundation area at the time of the incident.
Continuity of Operations (including Continued Delivery of Services)	Damage to facilities/personnel from flooding or wind may require temporary relocation of some operations. Operations may be interrupted by power outages. Disruption of roads and/or utilities may postpone delivery of some services. Regulatory waivers may be needed locally. Fulfillment of some contracts may be difficult. Impact may reduce deliveries.
Property, Facilities and Infrastructure	Structural damage to buildings may occur; loss of glass windows and doors by high winds and debris; loss of roof coverings, partial wall collapses, and other damages requiring significant repairs are possible in a major (category 3 to 5) hurricane.
Environment	Hurricanes can devastate wooded ecosystems and remove all the foliage from forest canopies, and they can change habitats so drastically that the indigenous animal populations suffer as a result. Specific foods can be taken away as high winds will often strip fruits, seeds and berries from bushes and trees. Secondary impacts may occur; for example, high winds and debris may result in damage to an above-ground fuel tank, resulting in a significant chemical spill.
Economic Condition of the Jurisdiction	Local economy and finances adversely affected, possibly for an extended period of time, depending on damages. Intangible impacts also likely, including business interruption and additional living expenses.
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.

### Hazard Summary by Jurisdiction

The following table summarizes hurricane and tropical storm hazard risk by jurisdiction. Most aspects of hurricane risk do not vary substantially by jurisdiction; however, impacts may be greater in more highly developed areas with greater amounts of impervious surface and higher exposure in terms of both property and population density. Additionally, mobile home units are more vulnerable to wind damage. Mobile home units comprise over 10 percent of the occupied housing in unincorporated Alamance County, unincorporated Orange County, unincorporated Person County, Green Level, Haw River, Ossipee, and Roxboro; therefore, these jurisdictions may face more severe impacts from wind.

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Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	Score	Priority
Alamance County	3	4	4	1	2	3.2	H
Burlington	3	3	4	1	2	2.9	H
Graham	3	3	4	1	2	2.9	H
Mebane	3	3	4	1	2	2.9	H
Elon	3	3	4	1	2	2.9	H
Green Level	3	4	4	1	2	3.2	H
Haw River	3	4	4	1	2	3.2	H
Ossipee	3	4	4	1	2	3.2	H
Sweepsonville	3	3	4	1	2	2.9	H
Alamance	3	3	4	1	2	2.9	H
Durham County	3	3	4	1	2	2.9	H
Durham	3	3	4	1	2	2.9	H
Orange County	3	4	4	1	2	3.2	H
Carrboro	3	3	4	1	2	2.9	H
Chapel Hill	3	3	4	1	2	2.9	H
Hillsborough	3	3	4	1	2	2.9	H
Person County	3	4	4	1	2	3.2	H
Roxboro	3	4	4	1	2	3.2	H

### 4.5.7 Landslide

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Landslide	Unlikely	Minor	Negligible	6 to 12 hours	Less than 6 hrs	1.2

#### Hazard Background

A landslide is the downhill movement of masses of soil and rock, driven by gravity. Landslides occur when susceptible rock, earth, or debris moves down a slope under the force of gravity and water. They can be triggered by natural changes, such as heavy rains, snow melt, fires, and earthquakes; and human-caused changes, such as slope or drainage modifications. Landslides may be very small or very large and can move at slow to very high speeds.

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 accompany 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.

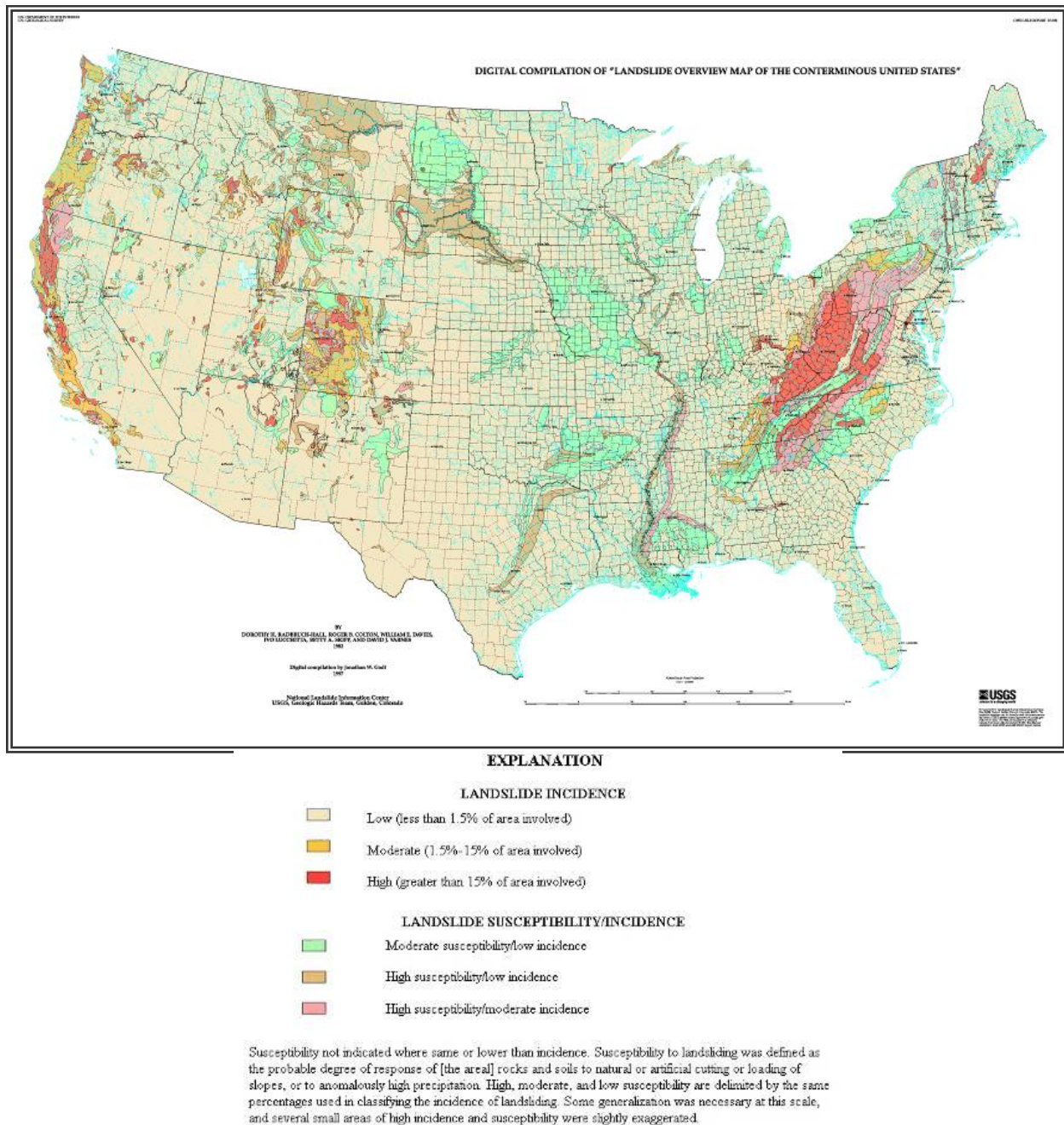
*Warning Time: 3 – 6 to 12 hours*

*Duration: 1 – Less than 6 hours*

#### Location

The U.S. Geological Survey (USGS) has produced landslide susceptibility and incidence mapping of the U.S., as shown in Figure 4.30. The USGS determines susceptibility based on the probable degree of response to cutting or loading of slopes or to anomalously high precipitation. Incidence is measured by the rate of past occurrences. According to the USGS definition and mapping, most of the region faces moderate susceptibility with low to moderate incidence of landslide.

**Figure 4.30 – Landslide Incidence and Susceptibility**



Source: USGS

### Extent

Landslide extent can be defined by susceptibility and incidence, which are defined and depicted in Figure 4.30. Event magnitude is also dependent on topography; landslide risk is higher in areas with steeper slopes. Given the gentle topography of most of the region, the magnitude of any landslides in the planning area would be minor.

*Impact: 1 – Minor*

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### *Spatial Extent: 1 – Negligible*

#### Historical Occurrences

According to the region's previous plan, there are no records of historical occurrences of significant landslides in the planning area. The North Carolina Geologic Survey does not have any record of past landslide events in the planning area.

The HMPC noted a landslide that occurred in Chapel Hill on September 17, 2018 during Hurricane Florence when a landslide occurred on an embankment off of East Franklin Street, spilling significant debris onto the Bolin Creek Trail.

#### Probability of Future Occurrence

Given the moderate susceptibility rating and lack of historical occurrences, the probability of a significant landslide event is unlikely. It is possible, that a minor event may occur in the future, but it would be unlikely to produce significant damages.

### *Probability: 1 – Unlikely*

#### 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.

#### Vulnerability Assessment

##### **People**

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People are unlikely to sustain serious physical harm as a result of landslides in the Eno-Haw Region. Impacts would be relatively minor and highly localized. An individual using an impacted structure or infrastructure at the time of a landslide event may sustain minor injuries.

##### **Property**

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Landslides in the Piedmont are infrequent and occur in small, highly localized instances relative to the general area of risk. Additionally, these events are generally small scale in terms of the magnitude of impacts. As a result, it is difficult to estimate the property at risk to landslide. On average, a landslide event in the planning area may cause minor to moderate property damage to one or more buildings or cause localized damage to infrastructure. A landslide event may also result in the need for debris removal.

##### **Environment**

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Because landslides are essentially a mass movement of sediment, they may result in changes to terrain, damage to trees in the slide area, changes to drainage patterns, and increases in sediment loads in nearby waterways. Landslides in the Eno-Haw Region are unlikely to cause any more severe impacts.

##### **Consequence Analysis**

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Table 4.65 summarizes the potential negative consequences of landslide.



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**Table 4.65 – Consequence Analysis - Landslide**

Category	Consequences
Public	Any impacts to the public are expected to be minor. Individuals may sustain injuries if they are in an affected structure or using affected infrastructure when the event occurs.
Responders	Impacts to responders are unlikely. Personnel responsible for debris cleanup or roadway closures may face increased risk.
Continuity of Operations (including Continued Delivery of Services)	Landslide is unlikely to affect continuity of operations.
Property, Facilities and Infrastructure	Buildings and infrastructure may incur minor damages as a result of landslide; however, vulnerability in the Region is low.
Environment	Environmental impacts are expected to be minimal. Landslide may cause terrain and drainage changes and may temporarily increase sediment loads in nearby waterways.
Economic Condition of the Jurisdiction	Economic impacts are not expected.
Public Confidence in the Jurisdiction's Governance	Any landslide occurring in the Region is unlikely to be severe and would not be expected to affect public confidence.

### Hazard Summary by Jurisdiction

The following table summarizes landslide hazard risk by jurisdiction. Given the lack of historical records and the limited data on susceptibility, risk was considered uniform across the planning area.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	Score	Priority
Alamance County	1	1	1	3	1	1.2	L
Burlington	1	1	1	3	1	1.2	L
Graham	1	1	1	3	1	1.2	L
Mebane	1	1	1	3	1	1.2	L
Elon	1	1	1	3	1	1.2	L
Green Level	1	1	1	3	1	1.2	L
Haw River	1	1	1	3	1	1.2	L
Ossipee	1	1	1	3	1	1.2	L
Sweepsonville	1	1	1	3	1	1.2	L
Alamance	1	1	1	3	1	1.2	L
Durham County	1	1	1	3	1	1.2	L
Durham	1	1	1	3	1	1.2	L
Orange County	1	1	1	3	1	1.2	L
Carrboro	1	1	1	3	1	1.2	L
Chapel Hill	1	1	1	3	1	1.2	L
Hillsborough	1	1	1	3	1	1.2	L
Person County	1	1	1	3	1	1.2	L
Roxboro	1	1	1	3	1	1.2	L

### 4.5.8 Severe Weather (Thunderstorm Winds, Lightning & Hail)

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Severe Weather: Hail	Highly Likely	Minor	Small	Less than 6 hrs	Less than 6 hours	2.4
Severe Weather: Lightning	Highly Likely	Minor	Negligible	Less than 6 hrs	Less than 6 hours	2.2
Severe Weather: Thunderstorm Winds	Highly Likely	Limited	Large	Less than 6 hrs	Less than 6 hours	3.1

#### Hazard Background

##### Thunderstorm Winds

Thunderstorms result from the rapid upward movement of warm, moist air. They can occur inside warm, moist air masses and at fronts. As the warm, moist air moves upward, it cools, condenses, and forms cumulonimbus clouds that can reach heights of greater than 35,000 ft. As the rising air reaches its dew point, water droplets and ice form and begin falling the long distance through the clouds towards earth's surface. As the droplets fall, they collide with other droplets and become larger. The falling droplets create a downdraft of air that spreads out at earth's surface and causes strong winds associated with thunderstorms.

There are four ways in which thunderstorms can organize: single cell, multi-cell cluster, multi-cell lines (squall lines), and supercells. Even though supercell thunderstorms are most frequently associated with severe weather phenomena, thunderstorms most frequently organize into clusters or lines. Warm, humid conditions are favorable for the development of thunderstorms. The average single cell thunderstorm is approximately 15 miles in diameter and lasts less than 30 minutes at a single location. However, thunderstorms, especially when organized into clusters or lines, can travel intact for distances exceeding 600 miles.

Thunderstorms are responsible for the development and formation of many severe weather phenomena, posing great hazards to the population and landscape. Damage that results from thunderstorms is mainly inflicted by downburst winds, large hailstones, and flash flooding caused by heavy precipitation. Stronger thunderstorms are capable of producing tornadoes and waterspouts. While conditions for thunderstorm conditions may be anticipated within a few hours, severe conditions are difficult to predict. Regardless of severity, storms generally pass within a few hours.

*Warning Time: 4 – Less than six hours*

*Duration: 1 – Less than six hours*

##### Lightning

Lightning is a sudden electrical discharge released from the atmosphere that follows a course from cloud to ground, cloud to cloud, or cloud to surrounding air, with light illuminating its path. Lightning's unpredictable nature causes it to be one of the most feared weather elements.

All thunderstorms produce lightning, which often strikes outside of the area where it is raining and is known to fall more than 10 miles away from the rainfall area. When lightning strikes, electricity shoots through the air and causes vibrations creating the sound of thunder. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Nationwide, lightning kills 75 to 100 people each year. Lightning strikes can also start building fires and wildland fires, and damage electrical systems and equipment.

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The watch/warning time for a given storm is usually a few hours. There is no warning time for any given lightning strike. Lightning strikes are instantaneous. Storms that cause lightning usually pass within a few hours.

*Warning Time: 4 – Less than six hours*

*Duration: 1 – Less than six hours*

### Hail

According to the National Oceanic and Atmospheric Administration (NOAA), hail is precipitation that is formed when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere causing them to freeze. The raindrops form into small frozen droplets and then continue to grow as they come into contact with super-cooled water which will freeze on contact with the frozen rain droplet. This frozen rain droplet can continue to grow and form hail. As long as the updraft forces can support or suspend the weight of the hailstone, hail can continue to grow.

At the time when the updraft can no longer support the hailstone, it will fall down to the earth. For example, a ¼" diameter or pea sized hail requires updrafts of 24 mph, while a 2 ¾" diameter or baseball sized hail requires an updraft of 81 mph. The largest hailstone recorded in the United States was found in Vivian, South Dakota on July 23, 2010; it measured eight inches in diameter, almost the size of a soccer ball. While soccer-ball-sized hail is the exception, but even small pea sized hail can do damage.

Hailstorms in North Carolina cause damage to property, crops, and the environment, and kill and injure livestock. In the United States, hail causes more than \$1 billion in damage to property and crops each year. Much of the damage inflicted by hail is to crops. Even relatively small hail can shred plants to ribbons in a matter of minutes. Vehicles, roofs of buildings and homes, and landscaping are the other things most commonly damaged by hail. Hail has been known to cause injury to humans; occasionally, these injuries can be fatal.

The onset of thunderstorms with hail is generally rapid. However, advancements in meteorological forecasting allow for some warning. Storms usually pass in a few hours.

*Warning Time: 4 – Less than six hours*

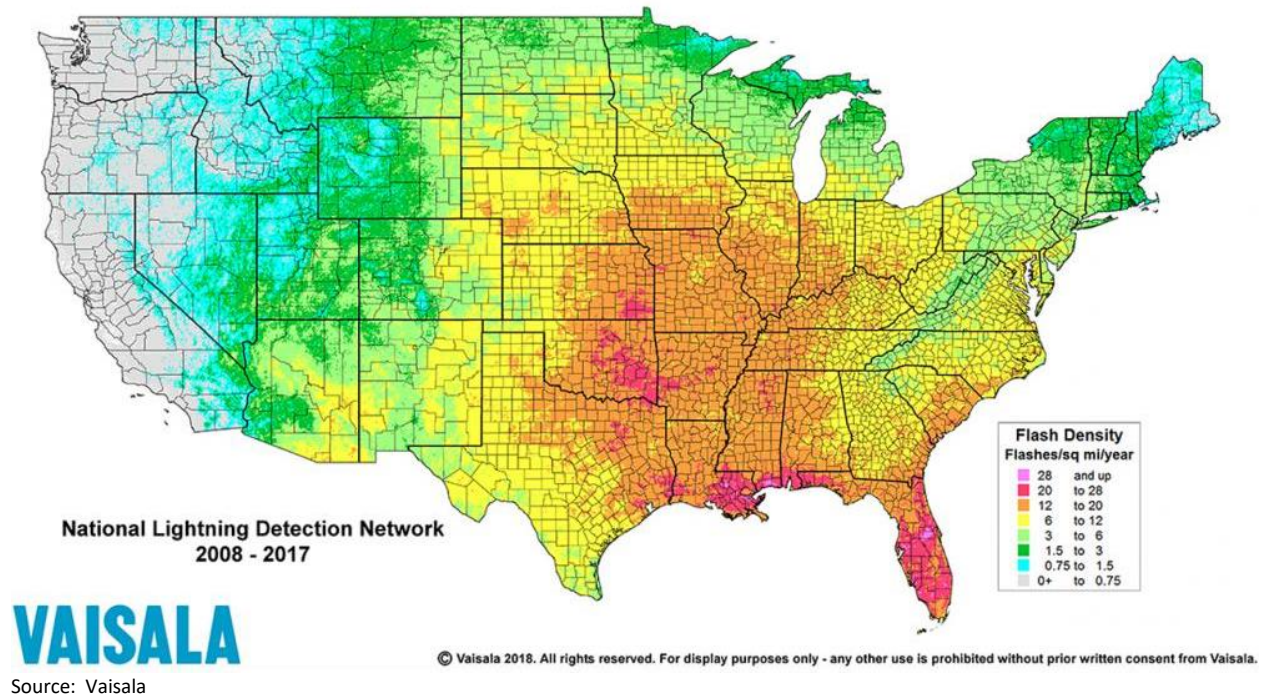
*Duration: 1 – Less than six hours*

### Location

Thunderstorm wind, lightning, and hail events do not have a defined vulnerability zone. The scope of lightning and hail is generally defined to the footprint of its associated thunderstorm. The entirety of the Eno-Haw Region shares equal risk to the threat of severe weather.

According to the Vaisala flash density map, shown in Figure 4.31, the Eno-Haw Region is located in an area that experiences 3 to 12 lightning flashes per square mile per year. It should be noted that future lightning occurrences may exceed these figures.

Figure 4.31 – Lightning Flash Density (2008-2017)



#### Extent

##### Thunderstorm Winds

The magnitude of a thunderstorm event can be defined by the storm's maximum wind speed and its impacts. NCEI divides wind events into several types including High Wind, Strong Wind, Thunderstorm Wind, Tornado and Hurricane. For this severe weather risk assessment, High Wind, Strong Wind and Thunderstorm Wind data was collected. Hurricane Wind and Tornadoes are addressed as individual hazards. The following definitions come from the NCEI Storm Data Preparation document.

- ▶ **High Wind** – Sustained non-convective winds of 40mph or greater lasting for one hour or longer or winds (sustained or gusts) of 58 mph for any duration on a widespread or localized basis.
- ▶ **Strong Wind** – Non-convective winds gusting less than 58 mph, or sustained winds less than 40 mph, resulting in a fatality, injury, or damage.
- ▶ **Thunderstorm Wind** – Winds, arising from convection (occurring within 30 minutes of lightning being observed or detected), with speeds of at least 58 mph, or winds of any speed (non-severe thunderstorm winds below 58 mph) producing a fatality, injury or damage.

The strongest recorded thunderstorm wind event in the Eno-Haw Region occurred on May 25, 2000 with a measured gust of 70 mph on the western side of the city of Burlington and gusts of 60 mph elsewhere across the region. The event caused two injuries.

*Impact: 2 – Limited*

*Spatial Extent: 4 – Large*

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### Lightning

Lightning is measured by the Lightning Activity Level (LAL) scale, created by the National Weather Service to define lightning activity into a specific categorical scale. The LAL is a common parameter that is part of fire weather forecasts nationwide.

**Table 4.66 – Lightning Activity Level Scale**

Lightning Activity Level Scale	
LAL 1	No thunderstorms
LAL 2	Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, 1 to 5 cloud to ground lightning strikes in a five minute period
LAL 3	Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, 6 to 10 cloud to ground strikes in a five minute period
LAL 4	Scattered thunderstorms. Moderate rain is commonly produced. Lightning is frequent, 11 to 15 cloud to ground strikes in a five minute period
LAL 5	Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 cloud to ground strikes in a five minute period
LAL 6	Dry lightning (same as LAL 3 but without rain). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with a Red Flag warning

Source: National Weather Service

With the right conditions in place, the entire Region is susceptible to each lightning activity level as defined by the LAL. Most lightning strikes cause limited damage to specific structures in a limited area, and cause very few injuries or fatalities, and minimal disruption on quality of life.

*Impact: 1 – Minor*

While the total area vulnerable to a lightning strike corresponds to the footprint of a given thunderstorm, a specific lightning strike is usually a localized event and occurs randomly. It should be noted that while lightning is most often affiliated with severe thunderstorms, it may also strike outside of heavy rain and might occur as far as 10 miles away from any rainfall. All of the Region is uniformly exposed to the threat of lightning.

*Spatial Extent: 1 – Negligible*

### Hail

The National Weather Service classifies hail by diameter size, and corresponding everyday objects to help relay scope and severity to the population. Table 4.67 indicates the hailstone measurements utilized by the National Weather Service.

**Table 4.67 – Hailstone Measurement Comparison Chart**

Average Diameter	Corresponding Household Object
.25 inch	Pea
.5 inch	Marble/Mothball
.75 inch	Dime/Penny
.875 inch	Nickel
1.0 inch	Quarter
1.5 inch	Ping-pong ball
1.75 inch	Golf ball
2.0 inch	Hen egg
2.5 inch	Tennis ball
2.75 inch	Baseball



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Average Diameter	Corresponding Household Object
3.00 inch	Teacup
4.00 inch	Grapefruit
4.5 inch	Softball

Source: National Weather Service

The Tornado and Storm Research Organization (TORRO) has further described hail sizes by their typical damage impacts. Table 4.68 describes typical intensity and damage impacts of the various sizes of hail.

**Table 4.68 – Tornado and Storm Research Organization Hailstorm Intensity Scale**

Intensity Category	Diameter (mm)	Diameter (inches)	Size Description	Typical Damage Impacts
Hard Hail	5-9	0.2-0.4	Pea	No damage
Potentially Damaging	10-15	0.4-0.6	Mothball	Slight general damage to plants, crops
Significant	16-20	0.6-0.8	Marble, grape	Significant damage to fruit, crops, vegetation
Severe	21-30	0.8-1.2	Walnut	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
Severe	31-40	1.2-1.6	Pigeon's egg > squash ball	Widespread glass damage, vehicle bodywork damage
Destructive	41-50	1.6-2.0	Golf ball > Pullet's egg	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
Destructive	51-60	2.0-2.4	Hen's egg	Bodywork of grounded aircraft dented, brick walls pitted
Destructive	61-75	2.4-3.0	Tennis ball > cricket ball	Severe roof damage, risk of serious injuries
Destructive	76-90	3.0-3.5	Large orange > softball	Severe damage to aircraft bodywork
Super Hailstorms	91-100	3.6-3.9	Grapefruit	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
Super Hailstorms	>100	4.0+	Melon	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Source: Tornado and Storm Research Organization (TORRO), Department of Geography, Oxford Brookes University

Notes: In addition to hail diameter, factors including number and density of hailstones, hail fall speed and surface wind speeds affect severity.

The average hailstone size recorded between 1999 and 2018 in the Haw-Eno Region was a little over 1" in diameter; the largest hailstone recorded was 2.5", recorded on June 23, 2016. Very little damage was reported due to hail in the region. The worst instance occurred on July 1, 2012 in Person County. The hail damaged 300 acres of tobacco causing \$2,000,000 worth of damage.

### *Impact: 1 – Minor*

Hailstorms frequently accompany thunderstorms, so their locations and spatial extents coincide. The Eno-Haw Region is uniformly exposed to severe thunderstorms; therefore, the entire planning area is equally exposed to hail which may be produced by such storms. However, large-scale hail tends to occur in a more localized area within the storm.

### *Spatial Extent: 2 – Small*

#### Historical Occurrences

#### Thunderstorm Winds

Between January 1, 1999 and December 31, 2018, the NCEI recorded 493 separate incidents of thunderstorm winds, occurring on 214 separate days. These events caused \$2,279,250 in recorded

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property damage, 5 injuries and 2 fatalities. The recorded gusts averaged 50.4 mph, with the highest gusts recorded at 70 mph. Gusts of 70 mph were recorded three times in the region, twice during a storm on May 25, 2000. Of these events, 139 caused reported property damage. Wind gusts with property damage recorded averaged \$4,600 in damage, with three gusts causing over a reported \$250,000 in damage each (at Elon College on July 27, 2012, in Huckleberry Spring on February 24, 2016 and in Quail Roost on June 13, 2013). These incidents are recorded below:

**Table 4.69 – Recorded Thunderstorm Winds with Property Damages in Eno-Haw Region, 1999-2018**

Location	Date	Time	Wind Speed (mph)	Fatalities	Injuries	Property Damage
Roxboro	6/2/2006	1458	50	0	0	\$65,000
Roxboro	4/8/2010	2000	50	0	0	\$1,000
Oak Grove	5/22/2010	1710	50	0	0	\$4,000
Hillsborough	5/28/2010	2106	50	0	0	\$50,000
Few	5/28/2010	2100	50	0	0	\$10,000
Triple Springs	6/13/2010	1458	50	0	0	\$2,000
Brooksdale	6/13/2010	1501	50	0	0	\$2,000
Durham	6/23/2010	1255	50	0	0	\$15,000
Cheeks Crossroads	7/13/2010	1935	50	0	0	\$3,000
Elon College	7/17/2010	1010	50	0	0	\$20,000
Snow Camp	7/17/2010	1315	50	0	1	\$2,000
Hyco	7/25/2010	1903	50	0	0	\$10,000
Swepsonville	8/5/2010	1415	50	0	0	\$30,000
Mebane	8/5/2010	1700	50	0	0	\$15,000
Roseville	8/5/2010	1620	50	0	0	\$10,000
Snow Camp	11/16/2010	2245	50	0	0	\$10,000
Burlington Airport	4/5/2011	203	52	0	0	\$75,000
Durham	4/5/2011	236	50	0	0	\$25,000
Occoneechee	4/27/2011	1210	50	0	0	\$5,000
Timberlake	5/13/2011	1825	50	0	0	\$500
Carr	6/18/2011	1705	50	0	0	\$500
Chapel Hill Williams Airport	5/9/2012	1457	50	0	0	\$2,500
Mebane	6/1/2012	1400	50	0	0	\$110,000
Surf	6/1/2012	1505	50	0	0	\$20,000
Glenn	6/1/2012	1544	50	0	0	\$10,000
West Durham	6/29/2012	2202	50	0	0	\$10,000
Surf	6/29/2012	2125	50	0	0	\$5,000
Saxapahaw	6/29/2012	2155	50	0	0	\$4,000
Cavel	7/1/2012	1305	50	0	0	\$3,000
Mc Gehees Mill	7/1/2012	1258	50	0	0	\$2,000
Schley	7/5/2012	1255	50	0	0	\$5,000
Schley	7/5/2012	1257	50	0	0	\$5,000
Hyco	7/19/2012	1515	50	0	0	\$1,000
Union Ridge	7/21/2012	1730	50	0	0	\$1,000
Bahama	7/23/2012	1714	50	0	0	\$3,000
Graham	7/23/2012	1618	50	0	0	\$2,000
Chapel Hill	7/24/2012	1426	50	0	0	\$20,000
Chapel Hill	7/24/2012	1426	50	0	0	\$10,000
Snow Camp	7/24/2012	1358	50	0	0	\$5,000
Chapel Hill	7/24/2012	1425	50	0	0	\$4,000

## SECTION 4: RISK ASSESSMENT

Location	Date	Time	Wind Speed (mph)	Fatalities	Injuries	Property Damage
Snow Camp	7/24/2012	1345	50	0	0	\$2,000
Snow Camp	7/24/2012	1350	50	0	0	\$2,000
Teer	7/24/2012	1410	50	0	0	\$2,000
Elon College	7/27/2012	1635	50	0	0	\$313,000
Triple Springs	9/2/2012	1403	50	0	0	\$750
West Durham	9/8/2012	1645	50	0	0	\$750
Hillsborough	1/30/2013	2218	50	0	0	\$1,500
Hurdle Mills	1/30/2013	2245	50	0	0	\$1,000
Orange Factory	4/19/2013	1740	50	0	0	\$1,500
Quail Roost	6/13/2013	1610	61	0	0	\$250,000
Snow Camp	6/13/2013	1554	50	0	0	\$200,000
Ceffo	6/13/2013	1548	50	0	0	\$10,000
Chapel Hill	6/13/2013	1615	61	1	0	\$3,000
Helena	6/26/2013	1652	50	0	0	\$1,000
Quail Roost	6/28/2013	1645	50	0	0	\$2,500
Chapel Hill	6/30/2013	1422	50	0	0	\$5,000
Kimesville	7/2/2013	950	50	0	0	\$10,000
Altamahaw	7/28/2013	2205	50	0	0	\$1,000
Hope Valley	1/11/2014	1350	50	0	0	\$5,000
Chapel Hill Williams Airport	1/11/2014	1340	50	0	0	\$1,000
Hope Valley	3/12/2014	1730	50	1	0	\$8,000
Mt Tirzah	5/15/2014	1752	50	0	0	\$1,000
Calvander	5/27/2014	1457	50	0	0	\$1,000
Durham	6/11/2014	1406	50	0	0	\$25,000
Hope Valley	6/11/2014	1644	50	0	0	\$10,000
Snow Camp	6/11/2014	1645	50	0	0	\$2,000
Graham	6/11/2014	1715	50	0	0	\$2,000
Schley	6/11/2014	1725	50	0	0	\$2,000
West Hillsboro	6/19/2014	1556	50	0	0	\$10,000
Durham	6/19/2014	1615	50	0	0	\$8,000
Occoneetchee	7/15/2014	1500	50	0	0	\$5,000
Huckleberry Spring	8/12/2014	1710	50	0	0	\$1,000
Ceffo	6/17/2015	1854	50	0	0	\$25,000
Roxboro	6/20/2015	1824	50	0	0	\$2,500
Chapel Hill	6/26/2015	2223	50	0	0	\$2,000
Carr	6/30/2015	1749	50	0	0	\$10,000
Kimesville	7/8/2015	1851	50	0	0	\$25,000
Union Ridge	7/13/2015	1946	50	0	0	\$10,000
Chapel Hill Williams Airport	7/21/2015	1750	50	0	0	\$5,000
Oak Grove	7/23/2015	925	50	0	0	\$1,000
Hurdle Mills Airport	8/11/2015	1633	50	0	0	\$1,250
Sutphin	9/10/2015	1618	50	0	0	\$5,000
Huckleberry Spring	2/24/2016	1600	70	0	0	\$250,000
Chapel Hill	2/24/2016	1550	50	0	0	\$3,000
Hyco Jct	4/28/2016	1730	50	0	0	\$1,000
Altamahaw	5/12/2016	1826	50	0	0	\$5,000
Woodsdale	6/5/2016	1741	50	0	0	\$10,000

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Location	Date	Time	Wind Speed (mph)	Fatalities	Injuries	Property Damage
Bethel Hill	6/5/2016	1750	50	0	0	\$7,500
Gentrys Store	6/5/2016	1747	50	0	0	\$2,500
Triple Springs	6/5/2016	1751	50	0	0	\$2,500
Cedar Grove	6/29/2016	1739	50	0	0	\$2,500
Hillsborough	7/8/2016	1953	50	0	0	\$5,000
Few	7/15/2016	1550	50	0	1	\$150,000
Burlington Airport	7/15/2016	1740	50	0	0	\$10,000
Buckhorn	7/31/2016	1912	50	0	0	\$10,000
Just Xrds	7/31/2016	1740	50	0	0	\$5,000
Longs Store	9/1/2016	1247	50	0	0	\$10,000
Longs Store	2/25/2017	1500	50	0	0	\$1,000
Hope Valley	5/5/2017	335	50	0	0	\$10,000
Mt Tirzah	5/5/2017	340	50	0	0	\$2,500
Hopedale	5/5/2017	300	50	0	0	\$1,000
West Durham	5/11/2017	2012	50	0	0	\$100,000
Fairntosh	5/19/2017	1642	50	0	0	\$3,000
Schley	5/19/2017	1624	50	0	0	\$2,000
Occoneechee	5/25/2017	1158	50	0	0	\$2,000
Mangum Store	6/16/2017	1918	50	0	0	\$750
Cedar Grove	6/19/2017	2035	50	0	0	\$4,000
Concord	7/13/2017	1703	50	0	0	\$4,000
Elon College	7/13/2017	1650	50	0	0	\$2,000
Cedar Grove	7/13/2017	1701	50	0	0	\$1,000
Chapel Hill	7/23/2017	1645	50	0	0	\$3,000
Burlington	4/15/2018	1646	50	0	0	\$5,000
Hurdle Mills	4/15/2018	1725	50	0	0	\$2,000
Mc Dade	4/15/2018	1715	50	0	0	\$1,000
Chapel Hill	4/15/2018	1725	50	0	0	\$1,000
Triple Springs	5/6/2018	1835	50	0	0	\$2,500
Blackwood	5/21/2018	1435	50	0	0	\$2,000
Union Ridge	5/21/2018	1608	50	0	0	\$1,000
Calvander	6/10/2018	2240	50	0	0	\$25,000
West Durham	6/10/2018	2246	50	0	0	\$1,000
Genlee	6/10/2018	2305	50	0	0	\$1,000
Roseville	6/21/2018	2229	50	0	0	\$4,000
Gorman	6/24/2018	1925	50	0	0	\$4,000
Calvander	7/4/2018	1820	50	0	0	\$2,500
Chapel Hill	7/4/2018	1821	50	0	0	\$1,500
Rougemont	7/6/2018	1525	50	0	0	\$10,000
Rougemont	7/6/2018	1540	50	0	0	\$5,000
Cedar Grove	7/6/2018	1450	50	0	0	\$2,500
Hillsborough	7/6/2018	1500	50	0	0	\$1,500
Longs Store	7/11/2018	1625	50	0	0	\$2,500
Mt Tirzah	7/22/2018	2042	50	0	0	\$10,000
Ceffo	7/22/2018	2056	50	0	0	\$10,000
Durham	7/22/2018	2005	50	0	0	\$5,000
Hope Valley	8/2/2018	1438	50	0	0	\$1,000
Alamance	8/7/2018	1840	50	0	0	\$10,000
Occoneechee	8/7/2018	1900	50	0	0	\$5,000

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Location	Date	Time	Wind Speed (mph)	Fatalities	Injuries	Property Damage
Etland	8/8/2018	1609	50	0	0	\$250
Swepsonville	8/8/2018	1609	50	0	0	\$250
Hope Valley	8/8/2018	1645	50	0	0	\$ 250
<b>Total</b>				<b>0</b>	<b>0</b>	<b>\$2,279,250</b>

Source: NCEI

During this time period, 17 events also caused crop damage totaling \$189,000. These incidents are recorded below:

**Table 4.70 – Recorded Wind Events with Crop Damages in the Eno-Haw Region, 1999-2018**

Location	Date	Time	Wind Speed (mph)	Fatalities	Injuries	Crop Damage
Altamahaw	7/13/2005	1815	50	0	0	\$150,000
Burlington Airport	7/15/2016	1740	50	0	0	\$10,000
Durham (Zone)	4/16/2007	854	42	0	0	\$5,000
Person (Zone)	4/16/2007	904	37	0	0	\$5,000
Orange (Zone)	4/16/2007	930	46	0	0	\$5,000
Alamance (Zone)	4/16/2007	1052	47	0	0	\$5,000
Longs Store	2/25/2017	1500	50	0	0	\$2,000
Hillsborough	5/11/2017	1955	50	0	0	\$2,000
Person (Zone)	11/22/2006	800	35	0	0	\$1,000
Durham (Zone)	11/22/2006	1000	35	0	0	\$1,000
Orange (Zone)	11/22/2006	1000	32	0	0	\$1,000
Alamance (Zone)	11/22/2006	1000	30	0	0	\$1,000
Allensville	6/23/2006	1930	50	0	0	\$1,000
<b>Total</b>				<b>2</b>	<b>2</b>	<b>\$189,000</b>

Source: NCEI

In addition to recorded thunderstorm wind events, NCEI reports 67 high wind and strong wind events during this same period that caused \$1,293,150 in property damage. Of all 560 wind events during this period, there were eight incidents that directly caused deaths or injuries. These incidents are recorded below:

**Table 4.71 – Recorded Wind Events with Injuries and/or Fatalities, 1999-2018**

Location	Event Type	Date	Wind Speed (mph)	Fatalities	Injuries	Property Damage
Orange County	Strong Wind	12/9/2009	40	0	2	\$30,000
Chapel Hill	Thunderstorm Wind	5/25/2000	60	0	2	\$0
Hillborough	Thunderstorm Wind	6/1/2002	50	0	1	\$0
Snow Camp	Thunderstorm Wind	7/17/2010	50	0	1	\$2,000
Chapel Hill	Thunderstorm Wind	6/13/2013	61	1	0	\$3,000
Hope Valley	Thunderstorm Wind	3/12/2014	50	1	0	\$8,000
Durham County	Strong Wind	4/9/2016	37	1	1	\$30,000
Few	Thunderstorm Wind	7/15/2006	50	0	1	\$150,000
<b>Total</b>				<b>3</b>	<b>8</b>	<b>\$223,000</b>

Source: NCEI



## SECTION 4: RISK ASSESSMENT

### Lightning

According to NCEI data, there were 25 lightning strikes reported between 1999 and 2018. Of these, 18 strikes caused recorded property damage totaling over \$3 million and 4 strikes directly caused 4 fatalities and 5 injuries. No injuries or crop damage was recorded by these strikes. It should be noted that lightning events recorded by the NCEI are only those that are reported; it is certain that additional lightning incidents have occurred in the Eno-Haw Region. Table 4.72 details NCEI-recorded lightning strikes from 1999 through 2018.

**Table 4.72 – Recorded Lightning Strikes in the Eno-Haw Region, 1999-2018**

Location	Date	Time	Fatalities	Injuries	Property Damage
Durham	3/21/1999	1400	0	0	\$20,000
Carrboro	8/14/1999	1500	0	1	\$0
Roxboro	4/8/2000	1530	0	0	\$110,000
Chapel Hill	7/2/2002	1515	0	0	\$880,000
Burlington	7/4/2002	1815	0	3	\$0
Mebane	7/4/2002	1827	0	0	\$20,000
Snow Camp	7/22/2003	1830	0	0	\$100,000
Cedar Grove	8/22/2003	1600	1	0	\$0
Hillsborough	6/11/2006	435	1	0	\$0
Roxboro	7/13/2006	1900	0	0	\$100,000
Durham	3/27/2007	2200	0	0	\$10,000
Chapel Hill	12/11/2008	1205	0	0	\$1,500,000
Huckleberry Spring	5/28/2010	2100	0	0	\$20,000
Mebane	6/2/2010	1645	0	0	\$25,000
Graham	6/15/2010	1845	1	1	\$0
Fairintosh	8/5/2010	1740	0	0	\$3,000
Graham	8/18/2010	0	0	0	\$7,000
Gorman	6/10/2011	2209	1	0	\$0
Union Ridge	9/6/2011	1230	0	0	\$75,000
Few	3/20/2012	2233	0	0	\$100,000
Cedar Grove	7/5/2012	1325	0	0	\$5,000
Hesters Store	6/13/2013	1605	0	0	\$10,000
Few	7/5/2015	2000	0	0	\$30,000
Occoneechee	7/5/2017	2035	0	0	\$10,000
Genlee	7/5/2018	1730	0	1	\$0
Total			4	5	\$3,025,000

Source: NCEI

The following are a selection of narrative descriptions recorded in NCEI for lightning events that occurred in Eno-Haw Region:

**June 11, 2006** – Tree fell on Interstate 85 near mile marker 168 when lightning struck a tree. One fatality when a motorcyclist struck the down tree.

**December 11, 2008** – Lightning struck a home in Chapel Hill and caught fire. The house burned to the ground when the lightning got into the gas lines of the home.

**May 28, 2010** – A lightning strike caused an electrical failure at a pump station near Durham, North Carolina. The electrical failure allowed 18,000 gallons of sewage to spill into the Eno River.

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**June 15, 2010** – A 19 year old male was struck by lightning and killed while taking shelter under a tree. It was not raining at the time.

**June 10, 2011** – A 45 year old male died when he was struck by lightning while feeding his livestock.

Eighteen of the 25 incidents recorded by the NCEI included property damage, which was mostly recorded as fire damage ignited by lightning. The highest rate of property damage recorded for a single incident was \$1,500,000.

### Hail

NCEI records 229 separate hail incidents across 131 days between January 1, 1999 and December 31, 2018 in the Eno-Haw Region. Of these, three events were reported to have caused property damage, two caused crop damage and none caused death or injury. The largest diameter hail recorded in the Eno-Haw Region was in Person County on June 23, 2016; the average hail size in all storms was a little over one inch in diameter.

**Table 4.73 – Summary of Hail Occurrences by County**

Location	Number of Occurrences	Average Hail Diameter
Alamance	57	1.02"
Durham	70	1.03"
Orange	41	1.04"
Person	61	1.10"

The following narratives provide detail on select hailstorms from the above list of NCEI recorded events:

**April 17, 2000** – Golfball sized hail reported at intersection of Highway 98 and Miami Blvd.

**March 28, 2007** - A back-door cold front combined with moderate to strong instability from afternoon heating...produced severe storms across northern portions of the piedmont. Minor flooding from heavy rainfall and hail blocking street drains.

**July 27, 2007** – Pea size hail resulted in the total loss of 6 acres of tobacco crop.

**July 1, 2012** – Large hail to the size of golf balls completely destroyed 300 acres of tobacco, with other surrounding areas experiencing a 30 to 50 percent loss. An upper level disturbance moved across central North Carolina during the late afternoon into the evening and interacted with a moist and unstable atmosphere to produce scattered showers and thunderstorms. Some of the thunderstorms became severe and produced damaging winds.

**April 28, 2016** – Quarter sized to golf ball sized hail fell along a one mile swath along highway 54 near the intersection of Orange Grove Road in Teer. The hail covered the road and was approximately half an inch deep, causing the road to be closed for a short period of time.

**June 23, 2016** – Golf ball to tennis ball size hail fell along a swath from the Virginia state line to Bethel Hill.

### Probability of Future Occurrence

Based on historical occurrences recorded by NCEI of 493 wind events over the 20-year period from 1999 through 2018, the Eno-Haw Region averages nearly 25 thunderstorm wind events per year. Over this same period, 25 lightning events were reported as having caused death, injury, or property damage, which equates to an average of 1.25 damaging lightning strikes per year.

The average hail storm in the Eno-Haw Region occurs in late afternoon and has a hail stone with a diameter of an inch. Over the 20-year period from 1999 through 2018, the Eno-Haw Region experienced 229

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reported hail incidents; this averages over eleven reported incidents per year somewhere in the planning area, or a 100% chance that the region will experience a hail incident each year.

Based on these historical occurrences, there is a 100% chance that the region will experience severe weather each year. The probability of a damaging impacts is highly likely.

*Probability: 4 – Highly Likely*

### Climate Change

According to the National Aeronautics and Space Administration (NASA), thunderstorm events in the future are likely to become more frequent in the southeast as a result of weather extremes. Thunderstorm potential is measured by an index that NASA created 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 the entire state is likely to experience at least some increase. This indicates that there will potentially be even more frequent thunderstorms in the state going forward.

### Vulnerability Assessment

#### Methodologies and Assumptions

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Population and property at risk to wind events was estimated using data from the North Carolina Emergency Management (NCEM) IRISK database, which was compiled in NCEM's Risk Management Tool.

#### People

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People and populations exposed to the elements are most vulnerable to severe weather. A common hazard associated with wind events is falling trees and branches. Risk of being struck by lightning is greater in open areas, at higher elevations, and on the water.

Lightning can also cause cascading hazards, including power loss. Loss of power could critically impact those relying on energy to service, including those that need powered medical devices. Additionally, the ignition of fires is always a concern with lightning strikes.

The availability of sheltered locations such as basements, buildings constructed using hail-resistant materials and methods, and public storm shelters, all reduce the exposure of the population. Individuals who work outdoors may face increased risk. Residents living in mobile homes are also more vulnerable to hail events due to the lack of shelter locations and the vulnerability of the housing unit to damages. According to the 2017 American Community Survey (ACS), 19,000 occupied housing units (7.5%) in the Eno-Haw Region are classified as "mobile homes or other types of housing." Based on an estimated average of 2.4 persons per household from the 2017 ACS, there are approximately 45,000 people in the Region living in mobile homes. See Table 4.57 in Section 4.5.6 for details on the number of mobile home units in each jurisdiction.

Since 1999, the NCEI records four fatalities and five injuries attributed to lightning in the Eno-Haw Region. NCEI records three fatalities and eight injuries attributed to wind events in the Eno-Haw Region. There are no injuries or fatalities attributed to hail.

#### Property

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Property damage caused by lightning usually occurs in one of two ways – either by direct damages through fires ignited by lightning, or by secondary impacts due to power loss. According to data collected on

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lightning strikes in Eno-Haw Region, the vast majority of recorded property damage was due to structure fires.

NCEI records lightning impacts over 20 years (1999-2018), with \$3,025,000 in property damage recorded (no incidents were recorded in 2001, 2004, 2005, 2009, 2014, or 2016). Historically, this has resulted in \$216,000 in property impacts annually in the Eno-Haw Region. The average impact from lightning per incident in the Eno-Haw Region is \$168,000.

General damages to property from hail are direct, including destroyed windows, dented cars, and building, roof and siding damage in areas exposed to hail. Hail can also cause enough damage to cars to cause them to be totaled. The level of damage is commensurate with both a material's ability to withstand hail impacts, and the size of the hailstones that are falling. Construction practices and building codes can help maximize the resistance of the structures to damage. Large amounts of hail may need to be physically cleared from roadways and sidewalks, depending on accumulation. Hail can cause other cascading impacts, including power loss.

During a 20-year span between January 1, 1999 and December 31, 2018 in the Eno-Haw Region, NCEI reported \$60,500 in property damage as a direct result of hail. This averages to \$3,025 per year in reported damages due to hail, though it should be noted that \$60,000 in recorded damage was all due to one storm.

According to a National Insurance Crime Bureau (NICB) study of insurance claims from the Insurance Services Office (ISO) ClaimSearch database, between 2014 and 2016, North Carolina saw 45,274 separate hail damage claims.

It should be noted that property damage due to hail is usually insured loss, with damages covered under most major comprehensive insurance plans. Because of this, hail losses are notoriously underreported by the NCEI. It is difficult to find an accurate repository of hail damages in the Eno-Haw Region, thus the NCEI is still used to form a baseline.

When strong enough, wind events can cause significant direct damage to buildings and infrastructure. NCEM's IRISK database estimates damages from increasing magnitudes of wind events, detailed in Table 4.74 through Table 4.77. Note that these tables sum the total estimated damage should every exposed property in each jurisdiction be impacted by an event of the given magnitude. Therefore, these tables are not an approximation of the total damages that would occur from an event of each magnitude because a thunderstorm wind event would not uniformly impact the entire Region. These tables should only be used to understand potential damages relative to storms of varying degrees of severity.

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**Table 4.74 – Estimated Buildings Impacted by 50-Year Thunderstorm Winds**

Jurisdiction	All Buildings	Residential Buildings at Risk			Commercial Buildings at Risk			Public Buildings at Risk			Total Buildings at Risk		
	Num	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages
<b>Alamance County</b>													
Unincorporated Alamance County	29,650	25,911	87.40%	\$9,113,652	3,425	11.60%	\$1,085,154	283	1%	\$297,999	29,619	99.90%	\$10,496,804
City of Burlington	24,403	21,618	88.60%	\$8,912,208	2,401	9.80%	\$2,164,023	320	1.30%	\$438,268	24,339	99.70%	\$11,514,499
City of Graham	7,269	6,575	90.50%	\$2,351,862	530	7.30%	\$309,603	155	2.10%	\$172,340	7,260	99.90%	\$2,833,806
City of Mebane	5,835	5,303	90.90%	\$2,350,875	465	8%	\$1,001,728	64	1.10%	\$121,817	5,832	99.90%	\$3,474,420
Town of Elon	2,760	2,437	88.30%	\$1,219,936	147	5.30%	\$288,850	174	6.30%	\$153,287	2,758	99.90%	\$1,662,072
Town of Green Level	1,177	1,057	89.80%	\$313,206	109	9.30%	\$40,743	10	0.80%	\$5,621	1,176	99.90%	\$359,570
Town of Haw River	2,352	2,139	90.90%	\$707,757	168	7.10%	\$53,849	31	1.30%	\$27,653	2,338	99.40%	\$789,258
Town of Ossipee	330	299	90.60%	\$95,720	21	6.40%	\$16,014	7	2.10%	\$2,907	327	99.10%	\$114,641
Town of Swepsonville	573	543	94.80%	\$234,417	24	4.20%	\$98,357	5	0.90%	\$5,274	572	99.80%	\$338,048
Village of Alamance	798	714	89.50%	\$270,376	66	8.30%	\$16,528	17	2.10%	\$11,541	797	99.90%	\$298,445
<b>Subtotal Alamance</b>	<b>75,147</b>	<b>66,596</b>	<b>88.60%</b>	<b>\$25,570,009</b>	<b>7,356</b>	<b>9.80%</b>	<b>\$5,074,849</b>	<b>1,066</b>	<b>1.40%</b>	<b>\$1,236,707</b>	<b>75,018</b>	<b>99.80%</b>	<b>\$31,881,563</b>
<b>Durham County</b>													
Unincorporated Durham County	21,038	17,968	85.40%	\$8,260,081	2,818	13.40%	\$2,151,962	234	1.10%	\$297,186	21,020	99.90%	\$10,709,230
City of Durham	75,588	67,732	89.60%	\$34,842,622	6,071	8%	\$8,383,949	1,667	2.20%	\$2,475,611	75,470	99.80%	\$45,702,182
<b>Subtotal Durham</b>	<b>96,626</b>	<b>85,700</b>	<b>88.69%</b>	<b>\$43,102,703</b>	<b>8,889</b>	<b>9.20%</b>	<b>\$10,535,911</b>	<b>1,901</b>	<b>1.97%</b>	<b>\$2,772,797</b>	<b>96,490</b>	<b>99.86%</b>	<b>\$56,411,412</b>
<b>Orange County</b>													
Unincorporated Orange County	24,533	21,624	88.10%	\$10,956,321	2,657	10.80%	\$1,201,269	246	1%	\$697,859	24,527	100%	\$12,855,449
Town of Carrboro	5,782	5,464	94.50%	\$4,096,444	261	4.50%	\$657,012	46	0.80%	\$525,469	5,771	99.80%	\$5,278,925
Town of Chapel Hill	15,108	13,922	92.10%	\$13,789,411	617	4.10%	\$1,621,761	528	3.50%	\$2,013,121	15,067	99.70%	\$17,424,293
Town of Hillsborough	3,883	3,408	87.80%	\$1,670,389	358	9.20%	\$303,111	111	2.90%	\$239,835	3,877	99.80%	\$2,213,335
<b>Subtotal Orange</b>	<b>49,306</b>	<b>44,418</b>	<b>89.20%</b>	<b>\$30,512,565</b>	<b>3,893</b>	<b>9.60%</b>	<b>\$3,783,153</b>	<b>931</b>	<b>1.20%</b>	<b>\$3,476,284</b>	<b>49,242</b>	<b>99.90%</b>	<b>\$37,772,002</b>
<b>Person County</b>													
Unincorporated Person County	17,714	14,893	84.10%	\$7,263,867	2,613	14.80%	\$477,046	156	0.90%	\$395,114	17,662	99.70%	\$8,136,027
City of Roxboro	6,617	5,754	87%	\$2,750,934	710	10.70%	\$807,474	144	2.20%	\$335,974	6,608	99.90%	\$3,894,381
<b>Subtotal Person</b>	<b>24,331</b>	<b>20,647</b>	<b>84.90%</b>	<b>\$10,014,801</b>	<b>3,323</b>	<b>13.70%</b>	<b>\$1,284,520</b>	<b>300</b>	<b>1.20%</b>	<b>\$731,088</b>	<b>24,270</b>	<b>99.70%</b>	<b>\$12,030,408</b>
<b>Total</b>	<b>245,410</b>	<b>217,361</b>	<b>88.60%</b>	<b>\$109,200,078</b>	<b>23,461</b>	<b>9.60%</b>	<b>\$20,678,433</b>	<b>4,198</b>	<b>1.70%</b>	<b>\$8,216,876</b>	<b>245,020</b>	<b>99.80%</b>	<b>\$138,095,385</b>

Source: NCEM Risk Management Tool



## SECTION 4: RISK ASSESSMENT

**Table 4.75 – Estimated Buildings Impacted by 100-Year Thunderstorm Winds**

Jurisdiction	All Buildings	Residential Buildings at Risk			Commercial Buildings at Risk			Public Buildings at Risk			Total Buildings at Risk		
	Num	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages
<b>Alamance County</b>													
Unincorporated Alamance County	29,650	25,911	87.40%	\$9,113,652	3,425	11.60%	\$1,085,154	283	1%	\$297,999	29,619	99.90%	\$10,496,804
City of Burlington	24,403	21,618	88.60%	\$8,912,208	2,401	9.80%	\$2,164,023	320	1.30%	\$438,268	24,339	99.70%	\$11,514,499
City of Graham	7,269	6,575	90.50%	\$2,351,862	530	7.30%	\$309,603	155	2.10%	\$172,340	7,260	99.90%	\$2,833,806
City of Mebane	5,835	5,303	90.90%	\$2,350,875	465	8%	\$1,001,728	64	1.10%	\$121,817	5,832	99.90%	\$3,474,420
Town of Elon	2,760	2,437	88.30%	\$1,219,936	147	5.30%	\$288,850	174	6.30%	\$153,287	2,758	99.90%	\$1,662,072
Town of Green Level	1,177	1,057	89.80%	\$313,206	109	9.30%	\$40,743	10	0.80%	\$5,621	1,176	99.90%	\$359,570
Town of Haw River	2,352	2,139	90.90%	\$707,757	168	7.10%	\$53,849	31	1.30%	\$27,653	2,338	99.40%	\$789,258
Town of Ossipee	330	299	90.60%	\$95,720	21	6.40%	\$16,014	7	2.10%	\$2,907	327	99.10%	\$114,641
Town of Swepsonville	573	543	94.80%	\$234,417	24	4.20%	\$98,357	5	0.90%	\$5,274	572	99.80%	\$338,048
Village of Alamance	798	714	89.50%	\$270,376	66	8.30%	\$16,528	17	2.10%	\$11,541	797	99.90%	\$298,445
<b>Subtotal Alamance</b>	<b>75,147</b>	<b>66,596</b>	<b>88.60%</b>	<b>\$25,570,009</b>	<b>7,356</b>	<b>9.80%</b>	<b>\$5,074,849</b>	<b>1,066</b>	<b>1.40%</b>	<b>\$1,236,707</b>	<b>75,018</b>	<b>99.80%</b>	<b>\$31,881,563</b>
<b>Durham County</b>													
Unincorporated Durham County	21,038	17,968	85.40%	\$8,260,081	2,818	13.40%	\$2,151,962	234	1.10%	\$297,186	21,020	99.90%	\$10,709,230
City of Durham	75,588	67,732	89.60%	\$34,842,622	6,071	8%	\$8,383,949	1,667	2.20%	\$2,475,611	75,470	99.80%	\$45,702,182
<b>Subtotal Durham</b>	<b>96,626</b>	<b>85,700</b>	<b>88.69%</b>	<b>\$43,102,703</b>	<b>8,889</b>	<b>9.20%</b>	<b>\$10,535,911</b>	<b>1,901</b>	<b>1.97%</b>	<b>\$2,772,797</b>	<b>96,490</b>	<b>99.86%</b>	<b>\$56,411,412</b>
<b>Orange County</b>													
Unincorporated Orange County	24,533	21,624	88.10%	\$10,956,321	2,657	10.80%	\$1,201,269	246	1%	\$697,859	24,527	100%	\$12,855,449
Town of Carrboro	5,782	5,464	94.50%	\$4,096,444	261	4.50%	\$657,012	46	0.80%	\$525,469	5,771	99.80%	\$5,278,925
Town of Chapel Hill	15,108	13,922	92.10%	\$13,789,411	617	4.10%	\$1,621,761	528	3.50%	\$2,013,121	15,067	99.70%	\$17,424,293
Town of Hillsborough	3,883	3,408	87.80%	\$1,670,389	358	9.20%	\$303,111	111	2.90%	\$239,835	3,877	99.80%	\$2,213,335
<b>Subtotal Orange</b>	<b>49,306</b>	<b>44,418</b>	<b>90.09%</b>	<b>\$30,512,565</b>	<b>3,893</b>	<b>7.90%</b>	<b>\$3,783,153</b>	<b>931</b>	<b>1.89%</b>	<b>\$3,476,284</b>	<b>49,242</b>	<b>99.87%</b>	<b>\$37,772,002</b>
<b>Person County</b>													
Unincorporated Person County	17,714	14,893	84.10%	\$7,263,867	2,613	14.80%	\$477,046	156	0.90%	\$395,114	17,662	99.70%	\$8,136,027
City of Roxboro	6,617	5,754	87%	\$2,750,934	710	10.70%	\$807,474	144	2.20%	\$335,974	6,608	99.90%	\$3,894,381
<b>Subtotal Person</b>	<b>24,331</b>	<b>20,647</b>	<b>84.90%</b>	<b>\$10,014,801</b>	<b>3,323</b>	<b>13.70%</b>	<b>\$1,284,520</b>	<b>300</b>	<b>1.20%</b>	<b>\$731,088</b>	<b>24,270</b>	<b>99.70%</b>	<b>\$12,030,408</b>
<b>Total</b>	<b>245,410</b>	<b>217,361</b>	<b>88.60%</b>	<b>\$109,200,078</b>	<b>23,461</b>	<b>9.60%</b>	<b>\$20,678,433</b>	<b>4,198</b>	<b>1.70%</b>	<b>\$8,216,876</b>	<b>245,020</b>	<b>99.80%</b>	<b>\$138,095,385</b>

Source: NCEM Risk Management Tool

## SECTION 4: RISK ASSESSMENT

**Table 4.76 – Estimated Buildings Impacted by 300-Year Thunderstorm Winds**

Jurisdiction	All Buildings	Residential Buildings at Risk			Commercial Buildings at Risk			Public Buildings at Risk			Total Buildings at Risk		
	Num	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages
<b>Alamance County</b>													
Unincorporated Alamance County	29,650	25,911	87.4%	\$29,422,337	3,425	11.6%	\$5,994,876	283	1%	\$1,637,855	29,619	99.9%	\$37,055,069
City of Burlington	24,403	21,618	88.6%	\$25,020,142	2,401	9.8%	\$10,721,802	320	1.3%	\$2,384,927	24,339	99.7%	\$38,126,871
City of Graham	7,269	6,575	90.5%	\$8,234,848	530	7.3%	\$2,200,394	155	2.1%	\$1,140,007	7,260	99.9%	\$11,575,249
City of Mebane	5,835	5,303	90.9%	\$8,843,654	465	8%	\$5,169,882	64	1.1%	\$660,516	5,832	99.9%	\$14,674,052
Town of Elon	2,760	2,437	88.3%	\$2,852,773	147	5.3%	\$1,002,673	174	6.3%	\$558,103	2,758	99.9%	\$4,413,549
Town of Green Level	1,177	1,057	89.8%	\$1,044,769	109	9.3%	\$210,188	10	0.8%	\$40,438	1,176	99.9%	\$1,295,394
Town of Haw River	2,352	2,139	90.9%	\$2,728,522	168	7.1%	\$350,117	31	1.3%	\$153,101	2,338	99.4%	\$3,231,741
Town of Ossipee	330	299	90.6%	\$205,256	21	6.4%	\$57,523	7	2.1%	\$9,343	327	99.1%	\$272,122
Town of Swepsonville	573	543	94.8%	\$833,748	24	4.2%	\$457,462	5	0.9%	\$29,685	572	99.8%	\$1,320,896
Village of Alamance	798	714	89.5%	\$916,534	66	8.3%	\$112,489	17	2.1%	\$72,462	797	99.9%	\$1,101,485
<b>Subtotal Alamance</b>	<b>75,147</b>	<b>66,596</b>	<b>88.6%</b>	<b>\$80,102,583</b>	<b>7,356</b>	<b>9.8%</b>	<b>\$26,277,406</b>	<b>1,066</b>	<b>1.4%</b>	<b>\$6,686,437</b>	<b>75,018</b>	<b>99.8%</b>	<b>\$113,066,428</b>
<b>Durham County</b>													
Unincorporated Durham County	21,038	17,968	85.4%	\$28,552,841	2,818	13.4%	\$10,587,535	234	1.1%	\$1,498,459	21,020	99.9%	\$40,638,835
City of Durham	75,588	67,732	89.6%	\$134,627,064	6,071	8%	\$43,654,889	1,667	2.2%	\$13,158,313	75,470	99.8%	\$191,440,266
<b>Subtotal Durham</b>	<b>96,626</b>	<b>85,700</b>	<b>88.7%</b>	<b>\$163,179,905</b>	<b>8,889</b>	<b>9.2%</b>	<b>\$54,242,424</b>	<b>1,901</b>	<b>2.0%</b>	<b>\$14,656,772</b>	<b>96,490</b>	<b>99.9%</b>	<b>\$232,079,101</b>
<b>Orange County</b>													
Unincorporated Orange County	24,533	21,624	88.1%	\$36,883,557	2,657	10.8%	\$5,166,059	246	1.0%	\$2,986,541	24,527	100%	\$45,036,157
Town of Carrboro	5,782	5,464	94.5%	\$16,504,977	261	4.5%	\$2,826,506	46	0.8%	\$1,705,569	5,771	99.8%	\$21,037,051
Town of Chapel Hill	15,108	13,922	92.1%	\$52,706,532	617	4.1%	\$9,162,755	528	3.5%	\$10,466,470	15,067	99.7%	\$72,335,758
Town of Hillsborough	3,883	3,408	87.8%	\$6,263,186	358	9.2%	\$1,860,930	111	2.9%	\$989,004	3,877	99.8%	\$9,113,119
<b>Subtotal Orange</b>	<b>49,306</b>	<b>44,418</b>	<b>90.1%</b>	<b>\$112,358,252</b>	<b>3,893</b>	<b>7.9%</b>	<b>\$19,016,250</b>	<b>931</b>	<b>1.9%</b>	<b>\$16,147,584</b>	<b>49,242</b>	<b>99.9%</b>	<b>\$147,522,085</b>
<b>Person County</b>													
Unincorporated Person County	17,714	14,893	84.1%	\$20,472,393	2,613	14.8%	\$1,731,936	156	0.9%	\$1,376,778	17,662	99.7%	\$23,581,107
City of Roxboro	6,617	5,754	87.0%	\$6,673,123	710	10.7%	\$3,141,581	144	2.2%	\$1,061,219	6,608	99.9%	\$10,875,923
<b>Subtotal Person</b>	<b>24,331</b>	<b>20,647</b>	<b>84.9%</b>	<b>\$27,145,516</b>	<b>3,323</b>	<b>13.7%</b>	<b>\$4,873,517</b>	<b>300</b>	<b>1.2%</b>	<b>\$2,437,997</b>	<b>24,270</b>	<b>99.7%</b>	<b>\$34,457,030</b>
<b>Total</b>	<b>245,410</b>	<b>217,361</b>	<b>88.6%</b>	<b>\$382,786,256</b>	<b>23,461</b>	<b>9.6%</b>	<b>\$104,409,597</b>	<b>4,198</b>	<b>1.7%</b>	<b>\$39,928,790</b>	<b>245,020</b>	<b>99.8%</b>	<b>\$527,124,644</b>

Source: NCEM Risk Management Tool

## SECTION 4: RISK ASSESSMENT

**Table 4.77 – Estimated Buildings Impacted by 700-Year Thunderstorm Winds**

Jurisdiction	All Buildings	Residential Buildings at Risk			Commercial Buildings at Risk			Public Buildings at Risk			Total Buildings at Risk		
	Num	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages
<b>Alamance County</b>													
Unincorporated Alamance County	29,650	25,911	87.4%	\$55,149,111	3,425	11.6%	\$10,994,118	283	1.0%	\$3,121,708	29,619	99.9%	\$69,264,937
City of Burlington	24,403	21,618	88.6%	\$51,099,779	2,401	9.8%	\$23,042,692	320	1.3%	\$4,678,992	24,339	99.7%	\$78,821,463
City of Graham	7,269	6,575	90.5%	\$13,583,852	530	7.3%	\$4,135,997	155	2.1%	\$2,038,322	7,260	99.9%	\$19,758,170
City of Mebane	5,835	5,303	90.9%	\$15,341,726	465	8.0%	\$8,503,744	64	1.1%	\$1,127,008	5,832	99.9%	\$24,972,477
Town of Elon	2,760	2,437	88.3%	\$7,841,694	147	5.3%	\$2,876,455	174	6.3%	\$1,818,876	2,758	99.9%	\$12,537,024
Town of Green Level	1,177	1,057	89.8%	\$1,741,418	109	9.3%	\$347,643	10	0.8%	\$74,568	1,176	99.9%	\$2,163,629
Town of Haw River	2,352	2,139	90.9%	\$4,830,103	168	7.1%	\$674,524	31	1.3%	\$254,448	2,338	99.4%	\$5,759,076
Town of Ossipee	330	299	90.6%	\$498,921	21	6.4%	\$173,836	7	2.1%	\$26,103	327	99.1%	\$698,860
Town of Swepsonville	573	543	94.8%	\$1,441,011	24	4.2%	\$775,764	5	0.9%	\$53,138	572	99.8%	\$2,269,913
Village of Alamance	798	714	89.5%	\$1,478,862	66	8.3%	\$197,596	17	2.1%	\$130,927	797	99.9%	\$1,807,385
<b>Subtotal Alamance</b>	<b>75,147</b>	<b>66,596</b>	<b>88.6%</b>	<b>\$153,006,477</b>	<b>7,356</b>	<b>9.8%</b>	<b>\$51,722,369</b>	<b>1,066</b>	<b>1.4%</b>	<b>\$13,324,090</b>	<b>75,018</b>	<b>99.8%</b>	<b>\$218,052,934</b>
<b>Durham County</b>													
Unincorporated Durham County	21,038	17,968	85.4%	\$48,412,027	2,818	13.4%	\$18,150,734	234	1.1%	\$2,628,431	21,020	99.9%	\$69,191,192
City of Durham	75,588	67,732	89.6%	\$234,241,246	6,071	8.0%	\$77,366,414	1,667	2.2%	\$22,933,440	75,470	99.8%	\$334,541,101
<b>Subtotal Durham</b>	<b>96,626</b>	<b>85,700</b>	<b>88.7%</b>	<b>\$282,653,273</b>	<b>8,889</b>	<b>9.2%</b>	<b>\$95,517,148</b>	<b>1,901</b>	<b>2.0%</b>	<b>\$25,561,871</b>	<b>96,490</b>	<b>99.9%</b>	<b>\$403,732,293</b>
<b>Orange County</b>													
Unincorporated Orange County	24,533	21,624	88.1%	\$60,742,010	2,657	10.8%	\$7,868,413	246	1.0%	\$4,536,056	24,527	100.0%	\$73,146,479
Town of Carrboro	5,782	5,464	94.5%	\$29,820,852	261	4.5%	\$4,303,170	46	0.8%	\$2,283,999	5,771	99.8%	\$36,408,020
Town of Chapel Hill	15,108	13,922	92.1%	\$91,918,912	617	4.1%	\$16,155,384	528	3.5%	\$17,582,425	15,067	99.7%	\$125,656,721
Town of Hillsborough	3,883	3,408	87.8%	\$10,765,680	358	9.2%	\$3,318,816	111	2.9%	\$1,597,144	3,877	99.8%	\$15,681,640
<b>Subtotal Orange</b>	<b>49,306</b>	<b>44,418</b>	<b>90.1%</b>	<b>\$193,247,454</b>	<b>3,893</b>	<b>7.9%</b>	<b>\$31,645,783</b>	<b>931</b>	<b>1.9%</b>	<b>\$25,999,624</b>	<b>49,242</b>	<b>99.9%</b>	<b>\$250,892,860</b>
<b>Person County</b>													
Unincorporated Person County	17,714	14,893	84.1%	\$44,672,005	2,613	14.8%	\$3,185,195	156	0.9%	\$3,171,655	17,662	99.7%	\$51,028,854
City of Roxboro	6,617	5,754	87.0%	\$18,387,907	710	10.7%	\$8,042,036	144	2.2%	\$3,060,295	6,608	99.9%	\$29,490,238
<b>Subtotal Person</b>	<b>24,331</b>	<b>20,647</b>	<b>84.9%</b>	<b>\$63,059,912</b>	<b>3,323</b>	<b>13.7%</b>	<b>\$11,227,231</b>	<b>300</b>	<b>1.2%</b>	<b>\$6,231,950</b>	<b>24,270</b>	<b>99.7%</b>	<b>\$80,519,092</b>
<b>Total</b>	<b>245,410</b>	<b>217,361</b>	<b>88.6%</b>	<b>\$691,967,116</b>	<b>23,461</b>	<b>9.6%</b>	<b>\$190,112,531</b>	<b>4,198</b>	<b>1.7%</b>	<b>\$71,117,535</b>	<b>245,020</b>	<b>99.8%</b>	<b>\$953,197,179</b>

Source: NCEM Risk Management Tool

## SECTION 4: RISK ASSESSMENT

Severe weather can also cause significant agricultural losses. Between 2007-2017, the sum of claims paid for crop damage due to hail and wind damages in the Eno-Haw Region was \$3,675,194 or an average of \$367,500 in losses every year. Table 4.82 summarizes the crop losses due to severe weather in reported in the RMA system.

**Table 4.78 – Crop Losses Resulting from Severe Weather, 2007-2017**

Year	Cause Description	Determined Acres	Indemnity Amount
2007	Hail	17.76	\$6,365
2008	Hail	339.28	\$522,767
2009	Hail	5.64	\$7,716
2011	Hail	8.70	\$1,474
2012	Hail	284.04	\$571,235
2013	Hail	62.40	\$9,608
2015	Hail	287.55	\$503,031.10
2016	Hail	421.08	\$775,615.45
2017	Hail	6.50	\$12,388
<b>Hail Subtotal</b>		<b>1,433</b>	<b>\$2,410,200</b>
2008	Wind/Excess Wind	243.78	\$418,020
2009	Wind/Excess Wind	37.65	\$7,397
2010	Wind/Excess Wind	53.70	\$78,777
2011	Wind/Excess Wind	14.50	\$7,827
2012	Wind/Excess Wind	17.33	\$11,491
2013	Wind/Excess Wind	572.20	\$72,210
2014	Wind/Excess Wind	9.70	\$11,228.50
2015	Wind/Excess Wind	143.93	\$198,019.36
2016	Wind/Excess Wind	158.55	\$404,779
2017	Wind/Excess Wind	68.31	\$55,246
<b>Wind Subtotal</b>		<b>1,320</b>	<b>\$1,264,995</b>
<b>Total</b>		<b>2,753</b>	<b>\$3,675,194</b>

Source: USDA Risk Management Agency

### Environment

The main environmental impact from wind is damage to trees or crops. Wind events can also bring down power lines, which could cause a fire and result in even greater environmental impacts. Lightning may also result in the ignition of wildfires. This is part of a natural process, however, and the environment will return to its original state in time.

Hail can cause extensive damage to the natural environment, pelting animals, trees and vegetation with hailstones. Melting hail can also increase both river and flash flood risk.

### Consequence Analysis

Table 4.79 summarizes the potential negative consequences of severe weather.

**Table 4.79 – Consequence Analysis – Severe Weather (Thunderstorm Winds, Lightning, and Hail)**

Category	Consequences
Public	Injuries; fatalities
Responders	Injuries; fatalities; potential impacts to response capabilities due to storm impacts

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Category	Consequences
Continuity of Operations (including Continued Delivery of Services)	Potential impacts to continuity of operations due to storm impacts; delays in providing services
Property, Facilities and Infrastructure	Possibility of structure fire ignition; potential for disruptions in power and communications infrastructure; destruction and/or damage to any exposed property, especially windows, cars and siding; mobile homes see increased risk
Environment	Potential fire ignition from lightning; hail damage to wildlife and foliage
Economic Condition of the Jurisdiction	Lightning damage contingent on target; can severely impact/destroy critical infrastructure and other economic drivers
Public Confidence in the Jurisdiction's Governance	Public confidence is not generally affected by severe weather events.

### Hazard Summary by Jurisdiction

The following table summarizes severe weather hazard risk by jurisdiction. Most aspects of severe weather risk do not vary substantially by jurisdiction; however, wind and hail impacts may be greater in more highly developed areas with higher exposure in terms of both property and population density. Additionally, mobile home units are more vulnerable to wind damage. Mobile home units comprise over 10 percent of the occupied housing in unincorporated Alamance County, unincorporated Orange County, unincorporated Person County, Green Level, Haw River, Ossipee, and Roxboro; therefore, these jurisdictions may face more severe impacts from wind. Where priority ratings vary between thunderstorm wind, lightning, and hail for impact and spatial extent, these scores represent an average rating with greater weight given to thunderstorm wind because it occurs much more frequently.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	Score	Priority
Alamance County	4	2	3	4	1	2.9	H
Burlington	4	1	3	4	1	2.6	H
Graham	4	1	3	4	1	2.6	H
Mebane	4	1	3	4	1	2.6	H
Elon	4	1	3	4	1	2.6	H
Green Level	4	2	3	4	1	2.9	H
Haw River	4	2	3	4	1	2.9	H
Ossipee	4	2	3	4	1	2.9	H
Sweepsonville	4	1	3	4	1	2.6	H
Alamance	4	1	3	4	1	2.6	H
Durham County	4	2	3	4	1	2.9	H
Durham	4	1	3	4	1	2.6	H
Orange County	4	2	3	4	1	2.9	H
Carrboro	4	1	3	4	1	2.6	H
Chapel Hill	4	1	3	4	1	2.6	H
Hillsborough	4	1	3	4	1	2.6	H
Person County	4	2	3	4	1	2.9	H
Roxboro	4	2	3	4	1	2.9	H



### 4.5.9 Severe Winter Storm

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Severe Winter Storm	Highly Likely	Critical	Large	More than 24 hrs	More than 1 week	3.3

#### Hazard Background

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

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

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

Advancements in meteorology and forecasting usually allow for mostly accurate forecasting a few days in advance of an impending storm. Most storms have a duration of a few hours; however, impacts can last a few days after the initial incident until cleanup is completed.

*Warning Time: 1 – More than 24 hours*

*Duration: 3 – Less than 1 week*

#### Location

Severe winter storms are usually a countywide or regional hazard, impacting the entire county at the same time. The risk of a severe winter storm occurring is uniform across the Eno-Haw Region.

#### Extent

The National Oceanic and Atmospheric Administration (NOAA) uses the Regional Snowfall Index (RSI) to assess the societal impact of winter storms in the six easternmost regions in the United States. The index makes use of population and regional differences to assess the impact of snowfall. For example, areas

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which receive very little snowfall on average may be more adversely affected than other regions, resulting in a higher severity. The Region may experience any level on the RSI scale. During the snowstorm of February 28 to March 3, 1980, which produced the greatest one-day snowfall amounts the region has experienced, the Region was classified as a Category 4 on the RSI scale. It is possible that more severe events and impacts could be felt in the future.

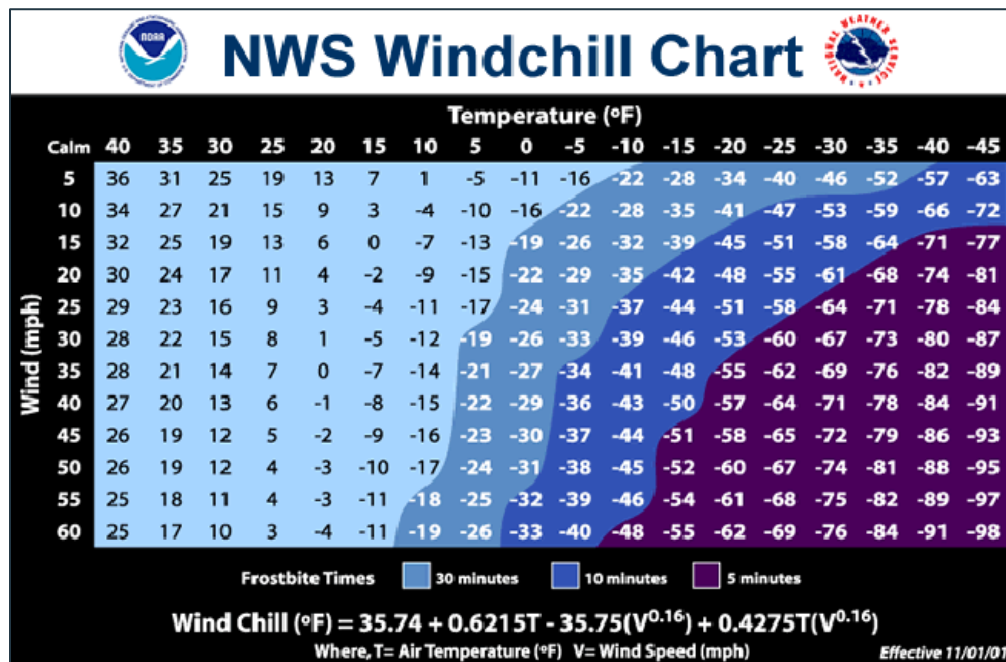
**Table 4.80 – Regional Snowfall Index (RSI) Values**

Category	RSI Value	Description
1	1-3	Notable
2	3-6	Significant
3	6-10	Major
4	10-18	Crippling
5	18+	Extreme

Source: NOAA

Severe winter storms often involve a mix of hazardous weather conditions. The magnitude of an event can be defined based on the severity of each of the involved factors, including precipitation type, precipitation accumulation amounts, temperature, and wind. The NWS Wind Chill Temperature Index, shown in Figure 4.32, provides a formula for calculating the dangers of winter winds and freezing temperatures.

**Figure 4.32 – NWS Wind Chill Temperature Index**



Source: <http://www.nws.noaa.gov/om/winter/windchill.shtml>

Table 4.81 notes greatest recorded one-day snowfall totals for each county in the Eno Haw Region.

**Table 4.81 – Greatest One-Day Snowfall by County**

County	Inches	Location	Date
Alamance	18.0	Graham 2 ENE	Jan 24, 1940
Durham	18.5	Rougemont	Dec 18, 1930

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County	Inches	Location	Date
Orange	12.0	Chapel Hill 2 W	Feb 15, 1902
Person	16.0	Roxboro 7 ESE	Jan 24, 1940

Source: North Carolina Climate Office

The most significant recorded snow depth over the last 20 years took place in January 2018 and December 2018, with recorded depths of up to 12.5 inches across the four-county region. The Region has received six emergency and disaster declarations related to severe winter weather, indicating the impacts can be extensive to the point that assistance is needed for recovery.

*Impact: 3 – Critical*

*Spatial Extent: 4 – Large*

The entirety of North Carolina 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 Eno Haw Region is accustomed to smaller scale 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.

### Historical Occurrences

To get a full picture of the range of impacts of a severe winter storm, data for the following weather types as defined by the National Weather Service (NWS) Raleigh Forecast Office and tracked by NCEI were collected:

- **Blizzard** – A winter storm which produces the following conditions for 3 consecutive hours or longer: (1) sustained winds or frequent gusts 30 knots (35 mph) or greater, and (2) falling and/or blowing snow reducing visibility frequently to less than 1/4 mile.
- **Cold/Wind Chill** – Period of low temperatures or wind chill temperatures reaching or exceeding locally/regionally defined advisory conditions of 0°F to -14°F with wind speeds 10 mph (9 kt) or greater.
- **Extreme Cold/Wind Chill** – A period of extremely low temperatures or wind chill temperatures reaching or exceeding locally/regionally defined warning criteria, defined as wind chill -15°F or lower with wind speeds 10 mph (9 kt) or greater.
- **Frost/Freeze** – A surface air temperature of 32°F or lower, or the formation of ice crystals on the ground or other surfaces, for a period of time long enough to cause human or economic impact, during the locally defined growing season.
- **Heavy Snow** – Snow accumulation meeting or exceeding 12 and/or 24 hour warning criteria of 3 and 4 inches, respectively.
- **Ice Storm** – Ice accretion meeting or exceeding locally/regionally defined warning criteria of ¼ inch or greater resulting in significant, widespread power outages, tree damage and dangerous travel. Issued only in those rare instances where just heavy freezing rain is expected and there will be no "mixed bag" precipitation meaning no snow, sleet or rain.
- **Sleet** – Sleet accumulations meeting or exceeding locally/regionally defined warning criteria of ½ inch or more.
- **Winter Storm** – A winter weather event that has more than one significant hazard and meets or exceeds locally/regionally defined 12 and/or 24 hour warning criteria for at least one of the precipitation elements. Defined by NWS Raleigh Forecast Office as snow accumulations 3 inches or greater in 12 hours (4 inches or more in 24 hours); Freezing rain accumulations ¼ inch (6 mm)

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or greater; Sleet accumulations ½ inch (13 mm) or more. Issued when there is at least a 60% forecast confidence of any one of the three criteria being met.

- **Winter Weather** – A winter precipitation event that causes a death, injury, or a significant impact to commerce or transportation, but does not meet locally/regionally defined warning criteria.

Table 4.82 summarizes the recorded severe winter storm events that have impacted each county in the Eno-Haw Region according to the NCEI Storm Events Database for the 20-year period from 1999 through 2018. Note that many events impacted all or multiple counties. Cumulatively, severe winter storms caused over \$6 million in property damage. In this timeframe, the county experienced no fatalities, injuries or crop damage from severe winter storm, though these types of impacts are possible in future events. No blizzard, cold/wind chill, extreme cold/wind chill, frost/freeze, or sleet events were recorded. Impacts in the Eno-Haw Region by incident are recorded in Table 4.83.

**Table 4.82 – Total Severe Winter Storm Impacts in Eno-Haw Region, 1999-2018**

Event Type	Number of Recorded Incidents	Total Fatalities	Total Injuries	Total Property Damage	Total Crop Damage
<b>Alamance</b>					
Winter Storm	30	0	0	\$500,000	\$0
Winter Weather	30	0	0	\$20,000	\$0
Ice Storm	1	0	0	\$0	\$0
Heavy Snow	1	0	0	\$0	\$0
<b>Durham</b>					
Winter Storm	25	0	0	\$1,000,000	\$0
Winter Weather	24	0	0	\$30,000	\$0
Ice Storm	1	0	0	\$400,000	\$0
Heavy Snow	1	0	0	\$0	\$0
<b>Orange</b>					
Winter Storm	30	0	0	\$1,000,000	\$0
Winter Weather	28	0	0	\$30,000	\$0
Ice Storm	1	0	0	\$2,700,000	\$0
Heavy Snow	1	0	0	\$0	\$0
<b>Person</b>					
Winter Storm	34	0	0	\$500,000	\$0
Winter Weather	24	0	0	\$15,000	\$0
Ice Storm	2	0	0	\$534,000	\$0
Heavy Snow	1	0	0	\$0	\$0
<b>Region Total</b>					
Winter Storm	37	0	0	\$3,000,000	\$0
Winter Weather	36	0	0	\$95,000	\$0
Ice Storm	2	0	0	\$3,634,000	\$0
Heavy Snow	1	0	0	\$0	\$0
<b>Total Events</b>	<b>76</b>	<b>0</b>	<b>0</b>	<b>\$6,729,000</b>	<b>\$0</b>

Source: NCEI

**Table 4.83 – Recorded Severe Winter Storm Impacts in Eno-Haw Region, 1999-2018**

Date	Event Type	Fatalities	Injuries	Property Damage	Crop Damage
1/2/1999	Ice Storm	0	0	\$0	\$0
1/18/2000	Winter Storm	0	0	\$0	\$0
1/20/2000	Winter Storm	0	0	\$0	\$0

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Date	Event Type	Fatalities	Injuries	Property Damage	Crop Damage
1/22/2000	Winter Storm	0	0	\$0	\$0
1/24/2000	Winter Storm	0	0	\$0	\$0
1/28/2000	Winter Storm	0	0	\$0	\$0
11/19/2000	Heavy Snow	0	0	\$0	\$0
1/3/2002	Winter Storm	0	0	\$0	\$0
1/6/2002	Winter Storm	0	0	\$0	\$0
12/4/2002	Winter Storm	0	0	\$0	\$0
1/23/2003	Winter Storm	0	0	\$0	\$0
2/16/2003	Winter Storm	0	0	\$0	\$0
2/27/2003	Winter Storm	0	0	\$0	\$0
12/13/2003	Winter Weather	0	0	\$0	\$0
1/26/2004	Winter Storm	0	0	\$0	\$0
2/15/2004	Winter Storm	0	0	\$0	\$0
2/27/2004	Winter Storm	0	0	\$0	\$0
1/30/2005	Winter Storm	0	0	\$0	\$0
12/15/2005	Winter Weather	0	0	\$0	\$0
1/18/2007	Winter Weather	0	0	\$0	\$0
1/21/2007	Winter Weather	0	0	\$0	\$0
12/7/2007	Winter Weather	0	0	\$95,000	\$0
1/17/2008	Winter Weather	0	0	\$0	\$0
1/19/2008	Winter Storm	0	0	\$0	\$0
1/19/2008	Winter Weather	0	0	\$0	\$0
2/13/2008	Winter Weather	0	0	\$0	\$0
2/13/2008	Winter Storm	0	0	\$0	\$0
1/20/2009	Winter Storm	0	0	\$0	\$0
1/22/2009	Winter Weather	0	0	\$0	\$0
3/1/2009	Winter Storm	0	0	\$0	\$0
12/18/2009	Winter Storm	0	0	\$0	\$0
12/30/2009	Winter Weather	0	0	\$0	\$0
1/29/2010	Winter Storm	0	0	\$0	\$0
2/5/2010	Winter Weather	0	0	\$0	\$0
2/5/2010	Winter Storm	0	0	\$0	\$0
2/12/2010	Winter Weather	0	0	\$0	\$0
3/2/2010	Winter Weather	0	0	\$0	\$0
3/2/2010	Winter Storm	0	0	\$0	\$0
12/4/2010	Winter Weather	0	0	\$0	\$0
12/16/2010	Winter Weather	0	0	\$0	\$0
12/18/2010	Winter Weather	0	0	\$0	\$0
12/18/2010	Winter Weather	0	0	\$0	\$0
12/25/2010	Winter Storm	0	0	\$0	\$0
1/7/2011	Winter Weather	0	0	\$0	\$0
1/10/2011	Winter Weather	0	0	\$0	\$0
1/17/2013	Winter Storm	0	0	\$0	\$0
11/26/2013	Winter Weather	0	0	\$0	\$0
12/26/2013	Winter Weather	0	0	\$0	\$0
1/21/2014	Winter Weather	0	0	\$0	\$0
1/28/2014	Winter Weather	0	0	\$0	\$0



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Date	Event Type	Fatalities	Injuries	Property Damage	Crop Damage
2/12/2014	Winter Storm	0	0	\$0	\$0
3/3/2014	Winter Weather	0	0	\$0	\$0
3/6/2014	Winter Storm	0	0	\$0	\$0
3/6/2014	Ice Storm	0	0	\$3,634,000	\$0
3/17/2014	Winter Weather	0	0	\$0	\$0
1/13/2015	Winter Weather	0	0	\$0	\$0
1/27/2015	Winter Weather	0	0	\$0	\$0
2/16/2015	Winter Storm	0	0	\$0	\$0
2/24/2015	Winter Weather	0	0	\$0	\$0
2/25/2015	Winter Storm	0	0	\$3,000,000	\$0
3/1/2015	Winter Weather	0	0	\$0	\$0
1/20/2016	Winter Weather	0	0	\$0	\$0
1/22/2016	Winter Storm	0	0	\$0	\$0
2/14/2016	Winter Storm	0	0	\$0	\$0
2/15/2016	Winter Weather	0	0	\$0	\$0
1/6/2017	Winter Storm	0	0	\$0	\$0
12/8/2017	Winter Weather	0	0	\$0	\$0
12/8/2017	Winter Storm	0	0	\$0	\$0
1/3/2018	Winter Weather	0	0	\$0	\$0
1/17/2018	Winter Storm	0	0	\$0	\$0
3/12/2018	Winter Storm	0	0	\$0	\$0
3/12/2018	Winter Weather	0	0	\$0	\$0
3/21/2018	Winter Weather	0	0	\$0	\$0
3/24/2018	Winter Storm	0	0	\$0	\$0
3/24/2018	Winter Weather	0	0	\$0	\$0
12/9/2018	Winter Storm	0	0	\$0	\$0
	<b>Total</b>	<b>0</b>	<b>0</b>	<b>\$6,729,000</b>	<b>\$0</b>

Source: NCEI

Several storm impacts from NCEI are summarized below:

**December 7, 2007** – A brief period of light freezing rain fell across central North Carolina. Most of the freezing rain accumulation occurred from southern Wake County, east to Smithfield and north to Wilson, Rock Mount and Roanoke Rapids. Portions of Interstate 40 and Highway 70 in Johnston County were closed due to numerous accidents. Over 150 automobile accidents were reported across central North Carolina due to icy bridges. The storm caused \$415,000 in damage across the region; The Eno-Haw region itself suffered \$95,000 in recorded damage.

**March 6, 2014** – A strong surface low deepening off the Carolina coast brought a wintry mix of snow, sleet, and freezing rain to the northern-northwestern Piedmont counties. Snowfall amounts of 4 to 7 inches fell in Person. Just to the south and east of this area, a corridor of mainly sleet mixed with freezing rain produced significant icing of a quarter to half inch. This icing produced widespread downed trees and power outages over the northwest Piedmont. At the peak of the storm, over 400,000 customers were without power. In Person County, One quarter of an inch of ice from freezing rain resulted in widespread downed trees and power-lines. Additionally, snowfall of 4 to 7 inches fell across the county. Orange and Durham Counties saw one quarter to one half of an inch of ice, leading to widespread downed trees and power lines.

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**February 25, 2015** – As a low pressure system tracked along the southeast coast, wintry precipitation spread into Central North Carolina. A winter storm warning was issued for the majority of the area. Snowfall/sleet amounts of 5 to 9 inches fell across the region. The heavy wet snow caused extensive power outages from falling trees and power lines. At the peak of the storm, over 45,000 customers were without power.

The Eno-Haw Region received six emergency declarations and presidential disaster declarations since 1968 for incidents related to severe winter storms. As a state, North Carolina received eight disaster declarations related to severe winter storms during this timeframe.

**Table 4.84 – Emergency & Disaster Declarations in Eno-Haw Region due to Severe Winter Storms**

County	Disaster Number	Date	Disaster Type	Incident Start	Incident End
A,D,O,P	3110	1993	Severe Snowfall & Winter Storm	3/13/1993	3/17/1993
A,D,O,P	1087	1996	Blizzard	1/6/1996	1/12/1996
A,D,O,P	1312	2000	Severe Winter Storm	1/24/2000	2/1/2000
A,D,O,P	1448	2002	Severe Ice Storm	12/4/2002	12/6/2002
A,O,P	1457	2003	Severe Ice Storm	2/27/2003	2/28/2003
A,O,P	4167	2014	Severe Ice Storm	3/6/2014	3/7/2014

Source: FEMA, December 20, 2018

\*County code: A = Alamance, D = Durham, O = Orange, P = Person

### Probability of Future Occurrence

NCEI records 76 severe winter storm related events during the 20-year period from 1999 through 2018, which is an average of 3.8 events per year or more than 100 percent probability in any given year.

*Probability: 4 – Highly Likely*

### Climate Change

Per the 2018 North Carolina Hazard Mitigation Plan, there is uncertainty associated with climate change impacts on future severe winter storms. Global temperature rise could cause shorter and warmer winters in many areas; however, the likelihood of dangerously low temperatures may increase due to continuing trends of temperature extremes. Warmer winters, however, mean that precipitation that would normally fall as snow may begin to fall as rain or freezing rain instead.

### Vulnerability Assessment

#### People

Winter storms are considered deceptive killers because most deaths are indirectly related to the storm event. The leading cause of death during winter storms is from automobile or other transportation accidents due to poor visibility and/or slippery roads. Additionally, exhaustion and heart attacks caused by overexertion may result from winter storms.

Power outages during very cold winter storm conditions can also create potentially dangerous situations. Elderly people account for the largest percentage of hypothermia victims. In addition, if the power is out for an extended period, residents are forced to find alternative means to heat their homes. The danger arises from carbon monoxide released from improperly ventilated heating sources such as space or kerosene heaters, furnaces, and blocked chimneys. House fires also occur more frequently in the winter due to lack of proper safety precautions when using an alternative heating source.

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### Property

According to reported data of storm impacts recorded by the NCEI, between 1999 and 2018 the Eno-Haw Region experienced \$6.7 million in property damage related to the impacts of severe winter storm. Based on this data, the Region experiences average annual losses of \$336,450 due to severe winter storm events.

### Environment

Winter storm events may include ice or snow accumulation on trees which can cause large limbs, or even whole trees, to snap and potentially fall on buildings, cars, or power lines. This potential for winter debris creates a dangerous environment to be outside in; significant injury or fatality may occur if a large limb snaps while a local resident is out driving or walking underneath it.

### Consequence Analysis

Table 4.85 summarizes the potential negative consequences of severe winter storm.

**Table 4.85 – Consequence Analysis – Severe Winter Storm**

Category	Consequences
Public	Localized impact expected to be severe for affected areas and moderate to light for other less affected areas.
Responders	Adverse impact expected to be severe for unprotected personnel and moderate to light for trained, equipped, and protected personnel.
Continuity of Operations (including Continued Delivery of Services)	Localized disruption of roads and/or utilities caused by incident may postpone delivery of some services.
Property, Facilities and Infrastructure	Localized impact to facilities and infrastructure in the areas of the incident. Power lines and roads most adversely affected.
Environment	Environmental damage to trees, bushes, etc.
Economic Condition of the Jurisdiction	Local economy and finances may be adversely affected, depending on damage.
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.

### Hazard Summary by Jurisdiction

The following table summarizes severe winter storm hazard risk by jurisdiction. Severe winter storm risk does not vary substantially by jurisdiction because these events are typically regional in nature.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	Score	Priority
Alamance County	4	2	4	1	3	3.0	H
Burlington	4	2	4	1	3	3.0	H
Graham	4	2	4	1	3	3.0	H
Mebane	4	2	4	1	3	3.0	H
Elon	4	2	4	1	3	3.0	H
Green Level	4	2	4	1	3	3.0	H
Haw River	4	2	4	1	3	3.0	H
Ossipee	4	2	4	1	3	3.0	H
Sweepsonville	4	2	4	1	3	3.0	H
Alamance	4	2	4	1	3	3.0	H
Durham County	4	2	4	1	3	3.0	H
Durham	4	2	4	1	3	3.0	H
Orange County	4	2	4	1	3	3.0	H

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Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	Score	Priority
Carrboro	4	2	4	1	3	3.0	H
Chapel Hill	4	2	4	1	3	3.0	H
Hillsborough	4	2	4	1	3	3.0	H
Person County	4	2	4	1	3	3.0	H
Roxboro	4	2	4	1	3	3.0	H

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### 4.5.10 Tornado




Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Tornado	Likely	Critical	Small	Less than 6 hrs	Less than 6 hours	2.7

#### Hazard Background

According to the Glossary of Meteorology (AMS 2000), a tornado is "a violently rotating column of air, pendant from a cumuliform cloud or underneath a cumuliform cloud, and often (but not always) visible as a funnel cloud." Tornadoes can appear from any direction. Most move from southwest to northeast, or west to east. Some tornadoes have changed direction amid path, or even backtracked.

Tornadoes are commonly produced by land falling tropical cyclones. Those making landfall along the Gulf coast traditionally produce more tornadoes than those making landfall along the Atlantic coast. Tornadoes that form within hurricanes are more common in the right front quadrant with respect to the forward direction but can occur in other areas as well. According to the NHC, about 10% of the tropical cyclone-related fatalities are caused by tornadoes. Tornadoes are more likely to be spawned within 24 hours of landfall and are usually within 30 miles of the tropical cyclone's center.

Tornadoes have the potential to produce winds in excess of 200 mph (EF5 on the Enhanced Fujita Scale) and can be very expansive – some in the Great Plains have exceeded two miles in width. Tornadoes associated with tropical cyclones, however, tend to be of lower intensity (EF0 to EF2) and much smaller in size than ones that form in the Great Plains.

 <small>Chuck Doowell III</small>	 <small>Wikimedia/Jarlin Hobson</small>	 <small>Wikimedia/Joshua Jans</small>
<b>Weak Tornadoes</b>	<b>Strong Tornadoes</b>	<b>Violent Tornadoes</b>
<ul style="list-style-type: none"><li>■ 88% of all tornadoes</li><li>■ Less than 5% of tornado deaths</li><li>■ Lifetime 1 – 10+ minutes</li><li>■ Winds less than 110 mph</li><li>■ Produces EF0 or EF1 damage</li></ul>	<ul style="list-style-type: none"><li>■ 11% of all tornadoes</li><li>■ Nearly 30% of all tornado deaths</li><li>■ May last 20 minutes or longer</li><li>■ Winds 111-165 mph</li><li>■ Produces EF2 or EF3 damage</li></ul>	<ul style="list-style-type: none"><li>■ Less than 1% of all tornadoes</li><li>■ 70% of all tornado deaths</li><li>■ Can exceed 1 hour</li><li>■ Winds greater than 166 mph</li><li>■ Produces EF4 or EF5 damage</li></ul>

Source: NOAA National Weather Service

**Warning Time:** 4 – Less than 6 hours

**Duration:** 1 – Less than 6 hours

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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). The below figure shows tornado activity in the United States based on the number of recorded tornadoes per 1,000 square miles.

Figure 4.33 – Tornado Activity in the U.S.

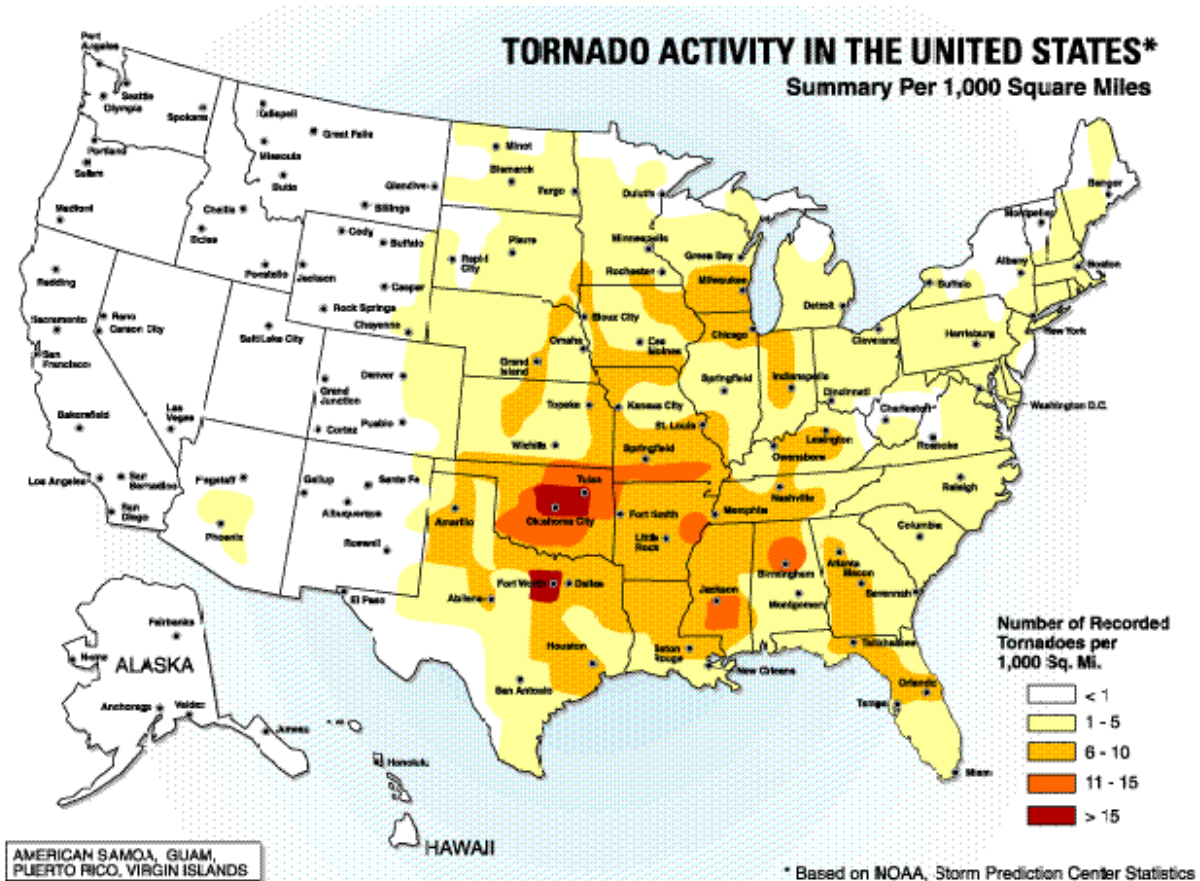


Figure 1.1 The number of tornadoes recorded per 1,000 square miles

Source: American Society of Civil Engineers

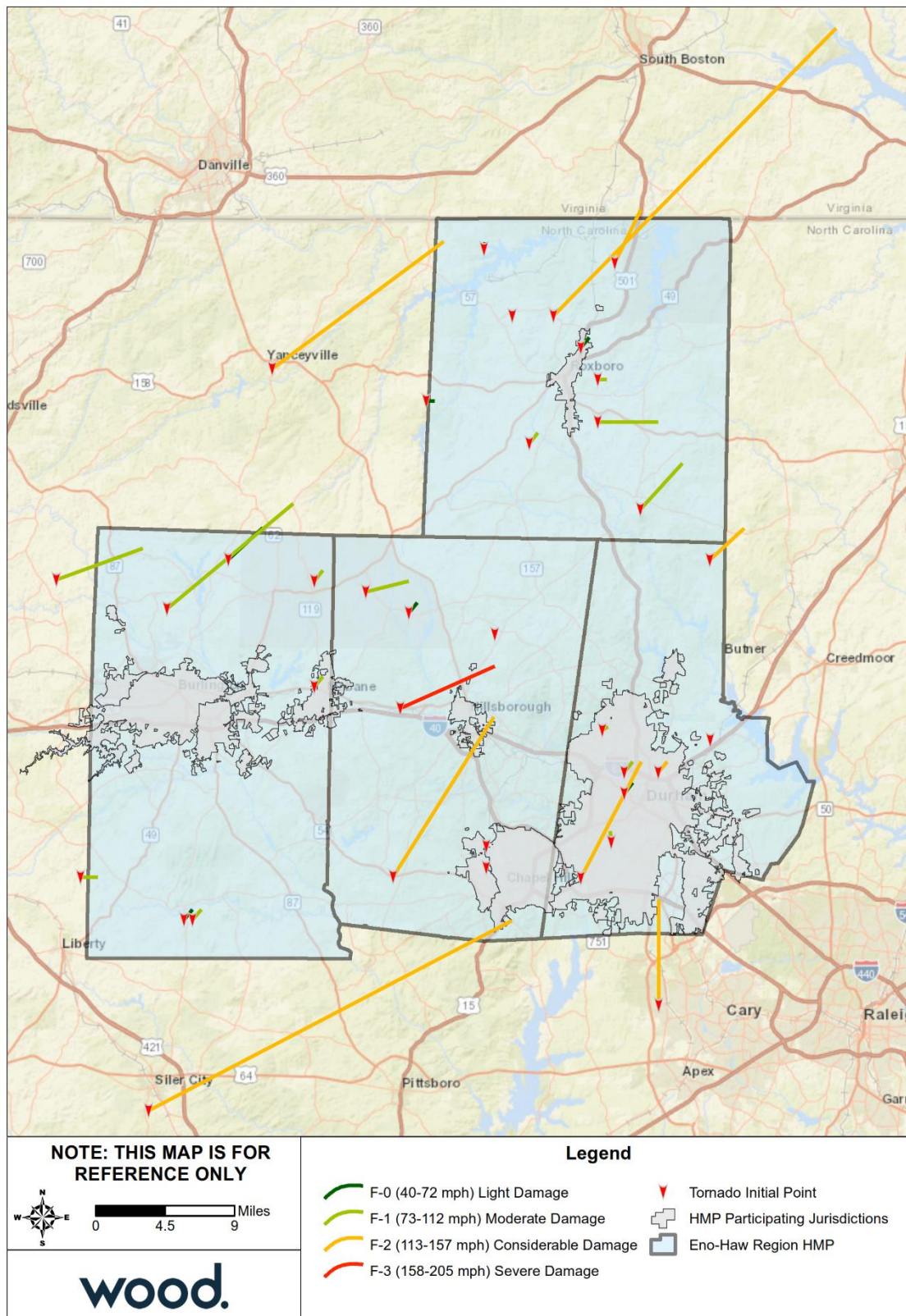
### Location

Figure 4.34 reflects the tracks of past tornados that passed through the Eno-Haw region from 1950 through 2017 according to data from the NOAA/National Weather Service Storm Prediction Center.

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Figure 4.34 – Tornado Paths Through Eno-Haw Region, 1950-2017



Source: NOAA/NWS Storm Prediction Center

## SECTION 4: RISK ASSESSMENT

Tornados can occur anywhere in the Region. Tornadoes typically impact a small area, but damage may be extensive. Tornado locations are completely random, meaning risk to tornado isn't increased in one area of the county versus another. All of the Eno-Haw Region is uniformly exposed to this hazard.

### Extent

Prior to February 1, 2007, tornado intensity was measured by the Fujita (F) scale. This scale was revised and is now the Enhanced Fujita (EF) scale. Both scales are sets of wind estimates (not measurements) based on damage. The new scale provides more damage indicators (28) and associated degrees of damage, allowing for more detailed analysis, better correlation between damage and wind speed. It is also more precise because it takes into account the materials affected and the construction of structures damaged by a tornado. Table 4.86 shows the wind speeds associated with the enhanced Fujita scale ratings and the damage that could result at different levels of intensity.

**Table 4.86 – Enhanced Fujita Scale**

EF Number	3 Second Gust (mph)	Damage
0	65-85	<b>Light damage.</b> Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
1	96-110	<b>Moderate damage.</b> Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
2	111-135	<b>Considerable damage.</b> Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
3	136-165	<b>Severe damage.</b> Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
4	166-200	<b>Devastating damage.</b> Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
5	Over 200	<b>Incredible damage.</b> Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m; high-rise buildings have significant structural deformation; incredible phenomena will occur.

The most intense tornado to pass through the Eno-Haw Region in the past 20 years was an EF2 in Person County in 2011; this tornado caused \$400,000 in property damage and caused the only 2 tornado related injuries. It was also the longest (9.66 miles) and widest (300 yards) tornado the region has experienced. Another tornado on the same day in Alamance County caused the most property damage (\$580,000).

*Impact: 3 – Critical*

*Spatial Extent: 2 – Small*

### Historical Occurrences

NCEI storm reports were reviewed from 1999 through 2019 to assess whether recent trends varied from the longer historical record. According to NCEI, the Eno-Haw Region experienced 16 tornado incidents between 1999 and 2019, causing no fatalities, 2 injuries, \$4.2 million in property damage and \$10,000 in crop damage. Table 4.87 shows historical tornadoes in the Eno-Haw Region during this time period.



## SECTION 4: RISK ASSESSMENT

**Table 4.87 – Recorded Tornadoes in Eno-Haw Region, 1999-2019**

Location	Date	Time	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Carrboro	6/19/2000	1305	F0	0	0	\$0	\$0
Carrboro	9/8/2004	1145	F0	0	0	\$0	\$0
Schley	1/14/2005	445	F0	0	0	\$0	\$0
Ceffo	7/7/2005	1442	F0	0	0	\$0	\$0
Gorman	5/14/2006	1710	F0	0	0	\$0	\$0
Union Ridge	3/4/2008	1654	EF0	0	0	\$150,000	\$0
Mt Tirzah	3/28/2010	2255	EF1	0	0	\$250,000	\$0
Hesters Store	10/27/2010	1458	EF0	0	0	\$0	\$10,000
Brooksdale	10/27/2010	1513	EF1	0	0	\$75,000	\$0
Carr	10/27/2010	1630	EF1	0	0	\$250,000	\$0
Altamahaw	4/16/2011	1306	EF1	0	0	\$580,000	\$0
Hyco	4/16/2011	1340	EF2	0	2	\$400,000	\$0
Cunningham	7/2/2013	1125	EF0	0	0	\$100,000	\$0
Hope Vly	5/15/2014	1710	EF1	0	0	\$250,000	\$0
Huckleberry Spg	2/24/2016	1600	EF1	0	0	\$100,000	\$0
Teer	04/19/2019	1500	EF2	0	0	\$2,000,000	
<b>Total</b>				<b>0</b>	<b>2</b>	<b>\$4,155,000</b>	<b>\$10,000</b>

Source: NCEI

Specific incidents with some level of impact include:

**March 4, 2008** – A weak EF 0 tornado touched down in northern Alamance County just northeast of the Union Ridge community. The tornado initially touched down about a half mile south of Willie Pace Road. On the north side of Willie Pace Road the tornado blew the roof off of a tobacco barn, lifted a carport, destroyed one shed and caused roof and porch damage to a home. The tornado continued to track northeast into Caswell County for approximately 2 miles. Further north the tornado destroyed a barn on Vinson Road and damaged a tractor and irrigation system. Numerous trees were also blown down in the area. The tornado blew a large oak tree into a brick home on Blaney Road, resulting in substantial roof damage. A garage in the back yard was also destroyed. A single wide mobile home on Baynes Road lost its roof from the high wind. The roof was tossed about 70 feet before becoming wrapped around a tree.

**October 27, 2010** – Five weak tornadoes occurred across Person, Orange, Granville and Vance counties during the afternoon and evening. In Person County, a supercell thunderstorm produced a short lived EF-1 tornado which produced significant damage to a double wide modular home along Apple Tree Lane near Allensville Road. Nearby modular homes sustained minor damage to the roof and siding. Numerous trees were either snapped off or uprooted at this location. Winds were estimated to be between 86 to 90 mph. The tornado then tracked eastward and across a wooded area before crossing Ruff Davis Road, where several trees were snapped off and downed in different directions. The tornado lifted as it moved into another wooded area east of Ruff Davis Road.

In Orange County, the tornado produced EF-1 damage with winds between 90 to 95 mph along Carr Store Road near Allie Mae Road in northern Orange County. At this location a church sustained significant damage, with two walls made of cinder blocks blown down and numerous hard and soft wood trees were

also snapped off and uprooted. The tornado continued to track east northeast and damaged two homes along Pentecost Road. Both homes sustained roof damage, including a partially collapsed chimney, and numerous trees were snapped and uprooted. Two individuals were home at the time of the tornado and were not injured. Numerous trees were snapped off and uprooted at this location as well. Winds were estimated to range from 86 to 90 mph. The tornado weakened as it continued to track east north-east across McDade Store Road and Efland-Cedar Grove Road before lifting.

**April 16, 2011** – A strong storm system produced nine tornadoes in the Raleigh CWA, including two EF3s and four EF2s. The tornadoes left eight dead with approximately 275 injuries. In Altamahaw, an EF1 tornado first touched down at Bethel Methodist Church Road. As it moved through the area, it caused damage to many homes, including collapsing walls, ripping off roofs, and shattering windows. The tornado also caused damages to vehicles and uprooted and snapped many trees, some of which exceeded four feet in diameter. In total, 20 homes were damaged, including 6 homes that were completely destroyed. Another tornado initially touched down 4 miles north northwest of Roxboro as an EF0 but strengthened to an EF2 with intermittent EF1 damage. There were two schools damaged, two homes destroyed, 10 homes with minor damage, and two reported injuries as a result of this incident.

**May 15, 2014** – Scattered storms impacted central North Carolina that lead to flash flooding as many areas received 2-4 inches of rain, with isolated amounts up to 5-6 inches. In addition, some isolated wind damage occurred and an isolated EF1 tornado formed near Durham. Damage consisted of dozens of snapped and uprooted trees and approximately 40 homes that experienced roof or other structural damage. Most of the damage to the homes was caused by falling trees and other debris. However, there were at least a half a dozen homes that experienced minor roof damage solely from the wind. In one case, a large oak tree was uprooted and fell onto a home, slicing through the roof and an exterior wall.

**April 19, 2019** – A deepening upper-level trough brought severe thunderstorms that produced 7 tornadoes across central NC. The strongest tornado formed in southwestern Orange County and reached EF-2 strength as it neared Hillsborough. The tornado initially touched down in the White Cross area and Leslie Drive area of southwest Orange County. Considerable tree damage occurred in this area, including the snapping and splitting of healthy large-trunk trees. Subsequent damage to vehicles and homes occurred as the trees fell. Given the magnitude and nature of the damage, wind speeds were estimated at 110 mph. The tornado then tracked north-northeast eventually crossing Dodsons Cross Road, Dairlyland Road, Arthur Minnis Road, and Borland Roads, all while producing similar tree damage. The tornado finally began to lift and/or dissipate near Hillsborough just north of I-40 near exit 261, but not before producing considerable damage to several homes just south of exit 261. The roof and several exterior walls of one home were completely destroyed. Damage at this location was estimated at 115 mph.

### Probability of Future Occurrence

Probability of future occurrence was calculated based on past occurrences and was assumed to be uniform across the county.

In a twenty-year span between 1999 and 2018, the Eno-Haw Region experienced 15 separate tornado incidents over 12 separate days. This correlates to a 75 percent annual probability that the Region will experience a tornado somewhere in its boundaries. Only one of these past tornado events was a magnitude EF2 or greater; therefore, the annual probability of a significant tornado event is approximately 5 percent.

*Probability: 3 – Likely*

### Climate Change

There presently is not enough data or research to quantify the magnitude of change that climate change may have related to tornado frequency and intensity. NASA’s Earth Observatory has conducted studies which aim to understand the interaction between climate change and tornadoes. Based on these studies meteorologists are unsure why some thunderstorms generate tornadoes and others don’t, beyond knowing that they require a certain type of wind shear. Tornadoes spawn from approximately one percent of thunderstorms, usually supercell thunderstorms that are in a wind shear environment that promotes rotation. Some studies show a potential for a decrease in wind shear in mid-latitude areas. Because of uncertainty with the influence of climate change on tornadoes, future updates to the mitigation plan should include the latest research on how the tornado hazard frequency and severity could change. The level of significance of this hazard should be revisited over time.

### Vulnerability Assessment

#### People

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People and populations exposed to the elements are most vulnerable to tornados. The availability of sheltered locations such as basements, buildings constructed using tornado-resistant materials and methods, and public storm shelters, all reduce the exposure of the population. According to the 2017 American Community Survey (ACS), 19,000 occupied housing units (7.5%) in the Eno-Haw Region are classified as “mobile homes or other types of housing.” Based on an estimated average of 2.4 persons per household from the 2017 ACS, there are approximately 45,000 people in the Region living in mobile homes. See Table 4.57 in Section 4.5.6 for details on the amount of mobile home units in each jurisdiction.

Since 1950, the NCEI database records 2 injuries attributed to tornadoes in the Eno-Haw Region.

#### Property

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General damages to property are both direct (what the tornado physically destroys) and indirect, which focuses on additional costs, damages and losses attributed to secondary hazards spawned by the tornado, or due to the damages caused by the tornado. Depending on the size of the tornado and its path, a tornado is capable of damaging and eventually destroying almost anything. Construction practices and building codes can help maximize the resistance of the structures to damage.

Secondary impacts of tornado damage often result from damage to infrastructure. Downed power and communications transmission lines, coupled with disruptions to transportation, create difficulties in reporting and responding to emergencies. These indirect impacts of a tornado put tremendous strain on a community. In the immediate aftermath, the focus is on emergency services.

Since 1950, damaging tornadoes in the County are directly responsible for \$33.6 million worth of damage to property and \$10,000 in damage to crops, according to NCEI data.

Table 4.88 through Table 4.92 detail the estimated buildings impacted from tornado events of magnitudes ranging from EF0 to EF4. Note that these tables provide an estimate of building damages should all exposed property be impacted by an event of the stated magnitude. Actual damages resulting from a tornado event of each magnitude would be lower because the event would impact only a fraction of the Region.



## SECTION 4: RISK ASSESSMENT

**Table 4.88 – Estimated Buildings Impacted by EF0 Tornado**

Jurisdiction	All Buildings	Residential Buildings at Risk			Commercial Buildings at Risk			Public Buildings at Risk			Total Buildings at Risk		
	Num	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages
<b>Alamance County</b>													
Unincorporated Alamance County	29,650	25,911	87.4%	\$166,142,190	3,425	11.6%	\$38,959,396	283	1%	\$6,870,494	29,619	99.9%	\$211,972,080
City of Burlington	24,403	21,618	88.6%	\$136,928,807	2,401	9.8%	\$115,309,319	320	1.3%	\$10,719,010	24,339	99.7%	\$262,957,136
City of Graham	7,269	6,575	90.5%	\$41,631,328	530	7.3%	\$19,412,298	155	2.1%	\$4,267,932	7,260	99.9%	\$65,311,558
City of Mebane	5,835	5,303	90.9%	\$40,737,269	465	8%	\$35,465,046	64	1.1%	\$2,624,545	5,832	99.9%	\$78,826,860
Town of Elon	2,760	2,437	88.3%	\$19,742,907	147	5.3%	\$6,545,156	174	6.3%	\$3,988,785	2,758	99.9%	\$30,276,848
Town of Green Level	1,177	1,057	89.8%	\$5,250,796	109	9.3%	\$1,403,519	10	0.8%	\$67,770	1,176	99.9%	\$6,722,086
Town of Haw River	2,352	2,139	90.9%	\$11,602,722	168	7.1%	\$4,480,324	31	1.3%	\$464,746	2,338	99.4%	\$16,547,792
Town of Ossipee	330	299	90.6%	\$1,540,046	21	6.4%	\$409,088	7	2.1%	\$112,991	327	99.1%	\$2,062,126
Town of Swepsonville	573	543	94.8%	\$3,978,658	24	4.2%	\$2,275,968	5	0.9%	\$232,647	572	99.8%	\$6,487,273
Village of Alamance	798	714	89.5%	\$4,986,272	66	8.3%	\$1,275,871	17	2.1%	\$394,410	797	99.9%	\$6,656,553
<b>Subtotal Alamance</b>	<b>75,147</b>	<b>66,596</b>	<b>88.6%</b>	<b>\$432,540,995</b>	<b>7,356</b>	<b>9.8%</b>	<b>\$225,535,985</b>	<b>1,066</b>	<b>1.4%</b>	<b>\$29,743,330</b>	<b>75,018</b>	<b>99.8%</b>	<b>\$687,820,312</b>
<b>Durham County</b>													
Unincorporated Durham County	21,038	17,968	85.4%	\$157,359,493	2,818	13.4%	\$128,314,558	234	1.1%	\$10,473,253	21,020	99.9%	\$296,147,303
City of Durham	75,588	67,732	89.6%	\$650,105,392	6,071	8%	\$394,548,411	1,667	2.2%	\$65,890,002	75,470	99.8%	\$1,110,543,805
<b>Subtotal Durham</b>	<b>96,626</b>	<b>85,700</b>	<b>88.69%</b>	<b>\$807,464,885</b>	<b>8,889</b>	<b>9.20%</b>	<b>\$522,862,969</b>	<b>1,901</b>	<b>1.97%</b>	<b>\$76,363,255</b>	<b>96,490</b>	<b>99.86%</b>	<b>\$1,406,691,108</b>
<b>Orange County</b>													
Unincorporated Orange County	24,533	21,624	88.1%	\$241,863,256	2,657	10.8%	\$48,758,037	246	1%	\$16,589,379	24,527	100%	\$307,210,671
Town of Carrboro	5,782	5,464	94.5%	\$75,803,920	261	4.5%	\$11,260,171	46	0.8%	\$6,282,145	5,771	99.8%	\$93,346,236
Town of Chapel Hill	15,108	13,922	92.1%	\$243,832,227	617	4.1%	\$55,780,702	528	3.5%	\$36,529,467	15,067	99.7%	\$336,142,396
Town of Hillsborough	3,883	3,408	87.8%	\$30,772,972	358	9.2%	\$18,696,740	111	2.9%	\$8,332,215	3,877	99.8%	\$57,801,928
<b>Subtotal Orange</b>	<b>49,306</b>	<b>44,418</b>	<b>90.09%</b>	<b>\$592,272,375</b>	<b>3,893</b>	<b>7.90%</b>	<b>\$134,495,650</b>	<b>931</b>	<b>1.89%</b>	<b>\$67,733,206</b>	<b>49,242</b>	<b>99.87%</b>	<b>\$794,501,231</b>
<b>Person County</b>													
Unincorporated Person County	17,714	14,893	84.1%	\$132,188,535	2,613	14.8%	\$21,275,483	156	0.9%	\$8,981,136	17,662	99.7%	\$162,445,153
City of Roxboro	6,617	5,754	87%	\$46,846,920	710	10.7%	\$41,838,462	144	2.2%	\$10,113,865	6,608	99.9%	\$98,799,247
<b>Subtotal Person</b>	<b>24,331</b>	<b>20,647</b>	<b>84.9%</b>	<b>\$179,035,455</b>	<b>3,323</b>	<b>13.7%</b>	<b>\$63,113,945</b>	<b>300</b>	<b>1.2%</b>	<b>\$19,095,001</b>	<b>24,270</b>	<b>99.7%</b>	<b>\$261,244,400</b>
<b>Total</b>	<b>245,410</b>	<b>217,361</b>	<b>88.6%</b>	<b>\$2,011,313,710</b>	<b>23,461</b>	<b>9.6%</b>	<b>\$946,008,549</b>	<b>4,198</b>	<b>1.7%</b>	<b>\$192,934,792</b>	<b>245,020</b>	<b>99.8%</b>	<b>\$3,150,257,051</b>

Source: NCEM Risk Management Tool

## SECTION 4: RISK ASSESSMENT

**Table 4.89 – Estimated Buildings Impacted by EF1 Tornado**

Jurisdiction	All Buildings	Residential Buildings at Risk			Commercial Buildings at Risk			Public Buildings at Risk			Total Buildings at Risk		
	Num	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages
<b>Alamance County</b>													
Unincorporated Alamance County	29,650	25,911	87.4%	\$1,199,435,283	3,425	11.6%	\$257,670,367	283	1%	\$38,487,642	29,619	99.9%	\$1,495,593,292
City of Burlington	24,403	21,618	88.6%	\$992,713,821	2,401	9.8%	\$715,529,497	320	1.3%	\$63,915,578	24,339	99.7%	\$1,772,158,896
City of Graham	7,269	6,575	90.5%	\$301,322,610	530	7.3%	\$123,040,252	155	2.1%	\$26,800,426	7,260	99.9%	\$451,163,289
City of Mebane	5,835	5,303	90.9%	\$293,610,650	465	8%	\$229,881,612	64	1.1%	\$15,761,180	5,832	99.9%	\$539,253,442
Town of Elon	2,760	2,437	88.3%	\$142,999,357	147	5.3%	\$53,946,784	174	6.3%	\$29,473,326	2,758	99.9%	\$226,419,466
Town of Green Level	1,177	1,057	89.8%	\$37,321,119	109	9.3%	\$8,910,581	10	0.8%	\$545,592	1,176	99.9%	\$46,777,292
Town of Haw River	2,352	2,139	90.9%	\$83,387,807	168	7.1%	\$30,271,855	31	1.3%	\$3,394,721	2,338	99.4%	\$117,054,383
Town of Ossipee	330	299	90.6%	\$11,184,995	21	6.4%	\$2,499,366	7	2.1%	\$726,465	327	99.1%	\$14,410,826
Town of Swepsonville	573	543	94.8%	\$29,036,656	24	4.2%	\$17,350,502	5	0.9%	\$1,095,062	572	99.8%	\$47,482,219
Village of Alamance	798	714	89.5%	\$36,565,204	66	8.3%	\$8,608,292	17	2.1%	\$2,074,076	797	99.9%	\$47,247,572
<b>Subtotal Alamance</b>	<b>75,147</b>	<b>66,596</b>	<b>88.6%</b>	<b>\$3,127,577,502</b>	<b>7,356</b>	<b>9.8%</b>	<b>\$1,447,709,108</b>	<b>1,066</b>	<b>1.4%</b>	<b>\$182,274,068</b>	<b>75,018</b>	<b>99.8%</b>	<b>\$4,757,560,677</b>
<b>Durham County</b>													
Unincorporated Durham County	21,038	17,968	85.4%	\$1,161,038,559	2,818	13.4%	\$868,665,334	234	1.1%	\$60,558,884	21,020	99.9%	\$2,090,262,777
City of Durham	75,588	67,732	89.6%	\$4,681,106,982	6,071	8%	\$2,425,252,901	1,667	2.2%	\$418,667,079	75,470	99.8%	\$7,525,026,961
<b>Subtotal Durham</b>	<b>96,626</b>	<b>85,700</b>	<b>88.69%</b>	<b>\$5,842,145,541</b>	<b>8,889</b>	<b>9.20%</b>	<b>\$3,293,918,235</b>	<b>1,901</b>	<b>1.97%</b>	<b>\$479,225,963</b>	<b>96,490</b>	<b>99.86%</b>	<b>\$9,615,289,738</b>
<b>Orange County</b>													
Unincorporated Orange County	24,533	21,624	88.1%	\$1,748,461,726	2,657	10.8%	\$319,405,019	246	1%	\$91,580,103	24,527	100%	\$2,159,446,848
Town of Carrboro	5,782	5,464	94.5%	\$541,716,527	261	4.5%	\$72,023,960	46	0.8%	\$29,305,655	5,771	99.8%	\$643,046,141
Town of Chapel Hill	15,108	13,922	92.1%	\$1,748,266,135	617	4.1%	\$341,890,557	528	3.5%	\$231,729,609	15,067	99.7%	\$2,321,886,301
Town of Hillsborough	3,883	3,408	87.8%	\$222,355,911	358	9.2%	\$112,156,341	111	2.9%	\$41,634,386	3,877	99.8%	\$376,146,638
<b>Subtotal Orange</b>	<b>49,306</b>	<b>44,418</b>	<b>90.09%</b>	<b>\$4,260,800,299</b>	<b>3,893</b>	<b>7.90%</b>	<b>\$845,475,877</b>	<b>931</b>	<b>1.89%</b>	<b>\$394,249,753</b>	<b>49,242</b>	<b>99.87%</b>	<b>\$5,500,525,928</b>
<b>Person County</b>													
Unincorporated Person County	17,714	14,893	84.1%	\$951,094,656	2,613	14.8%	\$135,901,815	156	0.9%	\$52,943,723	17,662	99.7%	\$1,139,940,194
City of Roxboro	6,617	5,754	87%	\$337,429,945	710	10.7%	\$273,640,829	144	2.2%	\$53,186,889	6,608	99.9%	\$664,257,662
<b>Subtotal Person</b>	<b>24,331</b>	<b>20,647</b>	<b>84.9%</b>	<b>\$1,288,524,601</b>	<b>3,323</b>	<b>13.7%</b>	<b>\$409,542,644</b>	<b>300</b>	<b>1.2%</b>	<b>\$106,130,612</b>	<b>24,270</b>	<b>99.7%</b>	<b>\$1,804,197,856</b>
<b>Total</b>	<b>245,410</b>	<b>217,361</b>	<b>88.6%</b>	<b>\$14,519,047,943</b>	<b>23,461</b>	<b>9.6%</b>	<b>\$5,996,645,864</b>	<b>4,198</b>	<b>1.7%</b>	<b>\$1,161,880,396</b>	<b>245,020</b>	<b>99.8%</b>	<b>\$21,677,574,199</b>

Source: NCEM Risk Management Tool

## SECTION 4: RISK ASSESSMENT

**Table 4.90 – Estimated Buildings Impacted by EF2 Tornado**

Jurisdiction	All Buildings	Residential Buildings at Risk			Commercial Buildings at Risk			Public Buildings at Risk			Total Buildings at Risk		
	Num	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages
<b>Alamance County</b>													
Unincorporated Alamance County	29,650	25,911	87.4%	\$2,152,312,869	3,425	11.6%	\$530,898,994	283	1%	\$121,857,316	29,619	99.9%	\$2,805,069,179
City of Burlington	24,403	21,618	88.6%	\$1,934,437,747	2,401	9.8%	\$1,720,489,541	320	1.3%	\$208,120,631	24,339	99.7%	\$3,863,047,919
City of Graham	7,269	6,575	90.5%	\$585,042,814	530	7.3%	\$290,783,348	155	2.1%	\$89,155,573	7,260	99.9%	\$964,981,735
City of Mebane	5,835	5,303	90.9%	\$572,668,639	465	8%	\$546,352,865	64	1.1%	\$51,477,017	5,832	99.9%	\$1,170,498,521
Town of Elon	2,760	2,437	88.3%	\$280,873,786	147	5.3%	\$133,106,846	174	6.3%	\$103,920,025	2,758	99.9%	\$517,900,656
Town of Green Level	1,177	1,057	89.8%	\$64,524,039	109	9.3%	\$21,136,002	10	0.8%	\$1,974,262	1,176	99.9%	\$87,634,302
Town of Haw River	2,352	2,139	90.9%	\$150,510,662	168	7.1%	\$70,917,508	31	1.3%	\$11,925,119	2,338	99.4%	\$233,353,289
Town of Ossipee	330	299	90.6%	\$20,365,015	21	6.4%	\$6,203,240	7	2.1%	\$2,439,170	327	99.1%	\$29,007,424
Town of Swepsonville	573	543	94.8%	\$54,287,234	24	4.2%	\$37,109,512	5	0.9%	\$3,157,442	572	99.8%	\$94,554,188
Village of Alamance	798	714	89.5%	\$68,473,459	66	8.3%	\$19,430,817	17	2.1%	\$6,365,484	797	99.9%	\$94,269,759
<b>Subtotal Alamance</b>	<b>75,147</b>	<b>66,596</b>	<b>88.6%</b>	<b>\$5,883,496,264</b>	<b>7,356</b>	<b>9.8%</b>	<b>\$3,376,428,673</b>	<b>1,066</b>	<b>1.4%</b>	<b>\$600,392,039</b>	<b>75,018</b>	<b>99.8%</b>	<b>\$9,860,316,972</b>
<b>Durham County</b>													
Unincorporated Durham County	21,038	17,968	85.4%	\$2,529,869,988	2,818	13.4%	\$2,324,419,926	234	1.1%	\$328,417,209	21,020	99.9%	\$5,182,707,123
City of Durham	75,588	67,732	89.6%	\$10,624,724,413	6,071	8%	\$7,584,677,591	1,667	2.2%	\$2,341,289,284	75,470	99.8%	\$20,550,691,288
<b>Subtotal Durham</b>	<b>96,626</b>	<b>85,700</b>	<b>88.69%</b>	<b>\$13,154,594,401</b>	<b>8,889</b>	<b>9.20%</b>	<b>\$9,909,097,517</b>	<b>1,901</b>	<b>1.97%</b>	<b>\$2,669,706,493</b>	<b>96,490</b>	<b>99.86%</b>	<b>\$25,733,398,411</b>
<b>Orange County</b>													
Unincorporated Orange County	24,533	21,624	88.1%	\$3,214,244,532	2,657	10.8%	\$680,602,468	246	1%	\$288,179,167	24,527	100%	\$4,183,026,168
Town of Carrboro	5,782	5,464	94.5%	\$1,091,118,771	261	4.5%	\$172,140,967	46	0.8%	\$84,030,692	5,771	99.8%	\$1,347,290,431
Town of Chapel Hill	15,108	13,922	92.1%	\$3,529,705,528	617	4.1%	\$827,226,638	528	3.5%	\$795,048,600	15,067	99.7%	\$5,151,980,766
Town of Hillsborough	3,883	3,408	87.8%	\$428,175,191	358	9.2%	\$279,835,936	111	2.9%	\$124,321,322	3,877	99.8%	\$832,332,449
<b>Subtotal Orange</b>	<b>49,306</b>	<b>44,418</b>	<b>90.09%</b>	<b>\$8,263,244,022</b>	<b>3,893</b>	<b>7.90%</b>	<b>\$1,959,806,009</b>	<b>931</b>	<b>1.89%</b>	<b>\$1,291,579,781</b>	<b>49,242</b>	<b>99.87%</b>	<b>\$11,514,629,814</b>
<b>Person County</b>													
Unincorporated Person County	17,714	14,893	84.1%	\$1,689,469,662	2,613	14.8%	\$332,024,227	156	0.9%	\$171,491,334	17,662	99.7%	\$2,192,985,223
City of Roxboro	6,617	5,754	87%	\$632,571,764	710	10.7%	\$646,571,425	144	2.2%	\$163,188,103	6,608	99.9%	\$1,442,331,292
<b>Subtotal Person</b>	<b>24,331</b>	<b>20,647</b>	<b>84.9%</b>	<b>\$2,322,041,426</b>	<b>3,323</b>	<b>13.7%</b>	<b>\$978,595,652</b>	<b>300</b>	<b>1.2%</b>	<b>\$334,679,437</b>	<b>24,270</b>	<b>99.7%</b>	<b>\$3,635,316,515</b>
<b>Total</b>	<b>245,410</b>	<b>217,361</b>	<b>88.6%</b>	<b>\$29,623,376,113</b>	<b>23,461</b>	<b>9.6%</b>	<b>\$16,223,927,851</b>	<b>4,198</b>	<b>1.7%</b>	<b>\$4,896,357,750</b>	<b>245,020</b>	<b>99.8%</b>	<b>\$50,743,661,712</b>

Source: NCEM Risk Management Tool

## SECTION 4: RISK ASSESSMENT

**Table 4.91 – Estimated Buildings Impacted by EF3 Tornado**

Jurisdiction	All Buildings	Residential Buildings at Risk			Commercial Buildings at Risk			Public Buildings at Risk			Total Buildings at Risk		
	Num	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages
<b>Alamance County</b>													
Unincorporated Alamance County	29,650	25,911	87.4%	\$2,487,029,632	3,425	11.6%	\$630,358,188	283	1%	\$189,931,114	29,619	99.9%	\$3,307,318,933
City of Burlington	24,403	21,618	88.6%	\$2,417,060,798	2,401	9.8%	\$2,176,925,295	320	1.3%	\$325,855,955	24,339	99.7%	\$4,919,842,049
City of Graham	7,269	6,575	90.5%	\$730,839,150	530	7.3%	\$361,530,908	155	2.1%	\$140,061,154	7,260	99.9%	\$1,232,431,213
City of Mebane	5,835	5,303	90.9%	\$724,668,108	465	8%	\$658,808,326	64	1.1%	\$80,636,670	5,832	99.9%	\$1,464,113,104
Town of Elon	2,760	2,437	88.3%	\$354,331,614	147	5.3%	\$177,245,511	174	6.3%	\$164,685,188	2,758	99.9%	\$696,262,313
Town of Green Level	1,177	1,057	89.8%	\$74,210,137	109	9.3%	\$25,714,925	10	0.8%	\$3,140,283	1,176	99.9%	\$103,065,345
Town of Haw River	2,352	2,139	90.9%	\$176,927,587	168	7.1%	\$81,931,597	31	1.3%	\$18,887,914	2,338	99.4%	\$277,747,098
Town of Ossipee	330	299	90.6%	\$23,591,695	21	6.4%	\$7,818,555	7	2.1%	\$3,837,345	327	99.1%	\$35,247,594
Town of Swepsonville	573	543	94.8%	\$64,072,184	24	4.2%	\$42,164,538	5	0.9%	\$4,842,102	572	99.8%	\$111,078,824
Village of Alamance	798	714	89.5%	\$80,107,337	66	8.3%	\$21,659,137	17	2.1%	\$9,869,977	797	99.9%	\$111,636,451
<b>Subtotal Alamance</b>	<b>75,147</b>	<b>66,596</b>	<b>88.6%</b>	<b>\$7,132,838,242</b>	<b>7,356</b>	<b>9.8%</b>	<b>\$4,184,156,980</b>	<b>1,066</b>	<b>1.4%</b>	<b>\$941,747,702</b>	<b>75,018</b>	<b>99.8%</b>	<b>\$12,258,742,924</b>
<b>Durham County</b>													
Unincorporated Durham County	21,038	17,968	85.4%	\$2,589,086,376	2,818	13.4%	\$2,324,419,926	234	1.1%	\$328,417,209	21,020	99.9%	\$5,241,923,510
City of Durham	75,588	67,732	89.6%	\$12,434,227,951	6,071	8%	\$7,589,695,227	1,667	2.2%	\$2,342,456,981	75,470	99.8%	\$22,366,380,159
<b>Subtotal Durham</b>	<b>96,626</b>	<b>85,700</b>	<b>88.69%</b>	<b>\$15,023,314,327</b>	<b>8,889</b>	<b>9.20%</b>	<b>\$9,914,115,153</b>	<b>1,901</b>	<b>1.97%</b>	<b>\$2,670,874,190</b>	<b>96,490</b>	<b>99.86%</b>	<b>\$27,608,303,669</b>
<b>Orange County</b>													
Unincorporated Orange County	24,533	21,624	88.1%	\$3,803,114,902	2,657	10.8%	\$826,821,271	246	1%	\$448,364,911	24,527	100%	\$5,078,301,084
Town of Carrboro	5,782	5,464	94.5%	\$1,445,444,137	261	4.5%	\$229,615,650	46	0.8%	\$128,734,094	5,771	99.8%	\$1,803,793,881
Town of Chapel Hill	15,108	13,922	92.1%	\$4,582,606,601	617	4.1%	\$1,143,791,302	528	3.5%	\$1,218,954,181	15,067	99.7%	\$6,945,352,084
Town of Hillsborough	3,883	3,408	87.8%	\$532,364,636	358	9.2%	\$363,042,252	111	2.9%	\$191,853,741	3,877	99.8%	\$1,087,260,629
<b>Subtotal Orange</b>	<b>49,306</b>	<b>44,418</b>	<b>90.09%</b>	<b>\$10,363,530,276</b>	<b>3,893</b>	<b>7.90%</b>	<b>\$2,563,270,475</b>	<b>931</b>	<b>1.89%</b>	<b>\$1,987,906,927</b>	<b>49,242</b>	<b>99.87%</b>	<b>\$14,914,707,678</b>
<b>Person County</b>													
Unincorporated Person County	17,714	14,893	84.1%	\$1,947,887,687	2,613	14.8%	\$411,520,220	156	0.9%	\$268,286,254	17,662	99.7%	\$2,627,694,161
City of Roxboro	6,617	5,754	87%	\$771,414,967	710	10.7%	\$779,740,838	144	2.2%	\$253,020,495	6,608	99.9%	\$1,804,176,301
<b>Subtotal Person</b>	<b>24,331</b>	<b>20,647</b>	<b>84.9%</b>	<b>\$2,719,302,654</b>	<b>3,323</b>	<b>13.7%</b>	<b>\$1,191,261,058</b>	<b>300</b>	<b>1.2%</b>	<b>\$521,306,749</b>	<b>24,270</b>	<b>99.7%</b>	<b>\$4,431,870,462</b>
<b>Total</b>	<b>245,410</b>	<b>217,361</b>	<b>88.6%</b>	<b>\$35,238,985,499</b>	<b>23,461</b>	<b>9.6%</b>	<b>\$17,852,803,666</b>	<b>4,198</b>	<b>1.7%</b>	<b>\$6,121,835,568</b>	<b>245,020</b>	<b>99.8%</b>	<b>\$59,213,624,733</b>

Source: NCEM Risk Management Tool

## SECTION 4: RISK ASSESSMENT

**Table 4.92 – Estimated Buildings Impacted by EF4 Tornado**

Jurisdiction	All Buildings	Residential Buildings at Risk			Commercial Buildings at Risk			Public Buildings at Risk			Total Buildings at Risk		
	Num	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages
<b>Alamance County</b>													
Unincorporated Alamance County	29,650	25,911	87.4%	\$2,489,407,280	3,425	11.6%	\$646,628,811	283	1%	\$203,849,721	29,619	99.9%	\$3,339,885,811
City of Burlington	24,403	21,618	88.6%	\$2,454,675,492	2,401	9.8%	\$2,259,677,120	320	1.3%	\$346,997,520	24,339	99.7%	\$5,061,350,131
City of Graham	7,269	6,575	90.5%	\$742,338,329	530	7.3%	\$373,949,908	155	2.1%	\$148,278,625	7,260	99.9%	\$1,264,566,863
City of Mebane	5,835	5,303	90.9%	\$738,200,254	465	8%	\$678,712,544	64	1.1%	\$85,796,647	5,832	99.9%	\$1,502,709,446
Town of Elon	2,760	2,437	88.3%	\$360,522,097	147	5.3%	\$181,537,479	174	6.3%	\$171,709,082	2,758	99.9%	\$713,768,658
Town of Green Level	1,177	1,057	89.8%	\$74,397,746	109	9.3%	\$26,613,523	10	0.8%	\$3,252,974	1,176	99.9%	\$104,264,243
Town of Haw River	2,352	2,139	90.9%	\$177,823,301	168	7.1%	\$83,937,634	31	1.3%	\$19,712,118	2,338	99.4%	\$281,473,054
Town of Ossipee	330	299	90.6%	\$23,604,936	21	6.4%	\$8,176,015	7	2.1%	\$4,052,387	327	99.1%	\$35,833,338
Town of Swepsonville	573	543	94.8%	\$64,304,068	24	4.2%	\$42,538,986	5	0.9%	\$5,344,274	572	99.8%	\$112,187,328
Village of Alamance	798	714	89.5%	\$80,201,494	66	8.3%	\$21,877,126	17	2.1%	\$10,689,059	797	99.9%	\$112,767,678
<b>Subtotal Alamance</b>	<b>75,147</b>	<b>66,596</b>	<b>88.6%</b>	<b>\$7,205,474,997</b>	<b>7,356</b>	<b>9.8%</b>	<b>\$4,323,649,146</b>	<b>1,066</b>	<b>1.4%</b>	<b>\$999,682,407</b>	<b>75,018</b>	<b>99.8%</b>	<b>\$12,528,806,550</b>
<b>Durham County</b>													
Unincorporated Durham County	21,038	17,968	85.4%	\$2,589,086,376	2,818	13.4%	\$2,324,419,926	234	1.1%	\$328,417,209	21,020	99.9%	\$5,241,923,510
City of Durham	75,588	67,732	89.6%	\$12,434,227,951	6,071	8%	\$7,590,798,683	1,667	2.2%	\$2,342,569,833	75,470	99.8%	\$22,367,596,468
<b>Subtotal Durham</b>	<b>96,626</b>	<b>85,700</b>	<b>88.69%</b>	<b>\$15,023,314,327</b>	<b>8,889</b>	<b>9.20%</b>	<b>\$9,915,218,609</b>	<b>1,901</b>	<b>1.97%</b>	<b>\$2,670,987,042</b>	<b>96,490</b>	<b>99.86%</b>	<b>\$27,609,519,978</b>
<b>Orange County</b>													
Unincorporated Orange County	24,533	21,624	88.1%	\$3,823,989,828	2,657	10.8%	\$849,324,545	246	1%	\$482,111,367	24,527	100%	\$5,155,425,740
Town of Carrboro	5,782	5,464	94.5%	\$1,485,802,409	261	4.5%	\$239,506,927	46	0.8%	\$142,333,389	5,771	99.8%	\$1,867,642,726
Town of Chapel Hill	15,108	13,922	92.1%	\$4,690,742,042	617	4.1%	\$1,194,488,017	528	3.5%	\$1,286,782,219	15,067	99.7%	\$7,172,012,277
Town of Hillsborough	3,883	3,408	87.8%	\$540,389,208	358	9.2%	\$379,563,608	111	2.9%	\$209,480,982	3,877	99.8%	\$1,129,433,797
<b>Subtotal Orange</b>	<b>49,306</b>	<b>44,418</b>	<b>90.09%</b>	<b>\$10,540,923,487</b>	<b>3,893</b>	<b>7.90%</b>	<b>\$2,662,883,097</b>	<b>931</b>	<b>1.89%</b>	<b>\$2,120,707,957</b>	<b>49,242</b>	<b>99.87%</b>	<b>\$15,324,514,540</b>
<b>Person County</b>													
Unincorporated Person County	17,714	14,893	84.1%	\$1,950,079,217	2,613	14.8%	\$428,732,875	156	0.9%	\$286,100,406	17,662	99.7%	\$2,664,912,497
City of Roxboro	6,617	5,754	87%	\$780,609,400	710	10.7%	\$804,007,921	144	2.2%	\$274,031,484	6,608	99.9%	\$1,858,648,805
<b>Subtotal Person</b>	<b>24,331</b>	<b>20,647</b>	<b>84.9%</b>	<b>\$2,730,688,617</b>	<b>3,323</b>	<b>13.7%</b>	<b>\$1,232,740,796</b>	<b>300</b>	<b>1.2%</b>	<b>\$560,131,890</b>	<b>24,270</b>	<b>99.7%</b>	<b>\$4,523,561,302</b>
<b>Total</b>	<b>245,410</b>	<b>217,361</b>	<b>88.6%</b>	<b>\$35,500,401,428</b>	<b>23,461</b>	<b>9.6%</b>	<b>\$18,134,491,648</b>	<b>4,198</b>	<b>1.7%</b>	<b>\$6,351,509,296</b>	<b>245,020</b>	<b>99.8%</b>	<b>\$59,986,402,370</b>

Source: NCEM Risk Management Tool

## SECTION 4: RISK ASSESSMENT

### Environment

Tornadoes can cause massive damage to the natural environment, uprooting trees and other debris within the tornado's path. This is part of a natural process, however, and the environment will return to its original state in time.

### Consequence Analysis

Table 4.93 summarizes the potential negative consequences of tornado.

**Table 4.93 – Consequence Analysis - Tornado**

Category	Consequences
Public	Injuries; fatalities
Responders	Injuries; fatalities; potential impacts to response capabilities due to storm impacts
Continuity of Operations (including Continued Delivery of Services)	Potential impacts to continuity of operations due to storm impacts; delays in providing services
Property, Facilities and Infrastructure	The weakest tornadoes, EF0, can cause minor roof damage, while strong tornadoes can destroy frame buildings and even badly damage steel reinforced concrete structures. Buildings are vulnerable to direct impact from tornadoes and also from wind borne debris. Mobile homes are particularly susceptible to damage during tornadoes.
Environment	Potential devastating impacts in storm's path
Economic Condition of the Jurisdiction	Contingent on tornado's path; can severely impact/destroy critical infrastructure and other economic drivers
Public Confidence in the Jurisdiction's Governance	Public confidence in the jurisdiction's governance may be influenced by severe tornado events if response and recovery are not timely and effective.

### Hazard Summary by Jurisdiction

The following table summarizes tornado hazard risk by jurisdiction. Tornado hazard risk does not vary substantially by jurisdiction.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	Score	Priority
Alamance County	3	3	2	4	1	2.7	H
Burlington	3	3	2	4	1	2.7	H
Graham	3	3	2	4	1	2.7	H
Mebane	3	3	2	4	1	2.7	H
Elon	3	3	2	4	1	2.7	H
Green Level	3	3	2	4	1	2.7	H
Haw River	3	3	2	4	1	2.7	H
Ossipee	3	3	2	4	1	2.7	H
Sweepsonville	3	3	2	4	1	2.7	H
Alamance	3	3	2	4	1	2.7	H
Durham County	3	3	2	4	1	2.7	H
Durham	3	3	2	4	1	2.7	H
Orange County	3	3	2	4	1	2.7	H
Carrboro	3	3	2	4	1	2.7	H
Chapel Hill	3	3	2	4	1	2.7	H
Hillsborough	3	3	2	4	1	2.7	H
Person County	3	3	2	4	1	2.7	H
Roxboro	3	3	2	4	1	2.7	H



### 4.5.11 Wildfire

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Wildfire	Possible	Limited	Moderate	Less than 6 hrs	Less than 1 week	2.5

#### Hazard Background

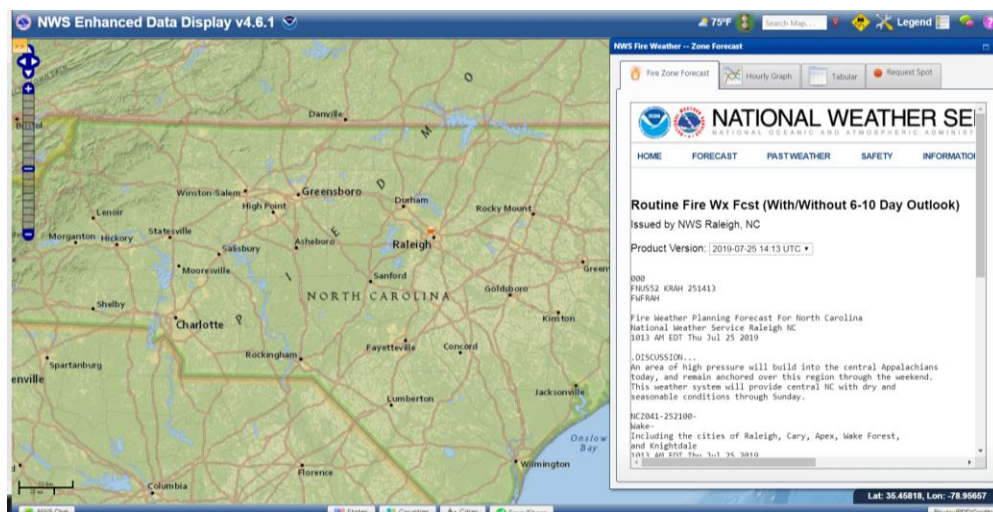
A wildfire is an uncontained fire that spreads through the environment. Wildfires have the ability to consume large areas, including infrastructure, property, and resources. When massive fires, or conflagrations, develop near populated areas, evacuations possibly ensue. Not only do the flames impact the environment, but the massive volumes of smoke spread by certain atmospheric conditions also impact the health of nearby populations. There are three general types of fire spread that are recognized.

- ▶ **Ground fires** – burn organic matter in the soil beneath surface litter and are sustained by glowing combustion.
- ▶ **Surface fires** – spread with a flaming front and burn leaf litter, fallen branches and other fuels located at ground level.
- ▶ **Crown fires** – burn through the top layer of foliage on a tree, known as the canopy or crown fires. Crown fires, the most intense type of fire and often the most difficult to contain, need strong winds, steep slopes and a heavy fuel load to continue burning.

Generally, wildfires are started by humans, either through arson or carelessness. Fire intensity is controlled by both short-term weather conditions and longer-term vegetation conditions. During intense fires, understory vegetation, such as leaves, small branches, and other organic materials that accumulate on the ground, can become additional fuel for the fire. The most explosive conditions occur when dry, gusty winds blow across dry vegetation.

Weather plays a major role in the birth, growth and death of a wildfire. In support of forecasting for fire weather, the National Weather Service Fire Weather Program emerged in response to a need for weather support to large and dangerous wildfires. This service is provided to federal and state land management agencies for the prevention, suppression, and management of forest and rangeland fires. As shown in Figure 4.35, the National Weather Service Raleigh Forecast Office provides year-round fire weather forecasts for the region.

Figure 4.35 – Fire Weather Forecast, Eno-Haw Region



Source: National Weather Service

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## SECTION 4: RISK ASSESSMENT

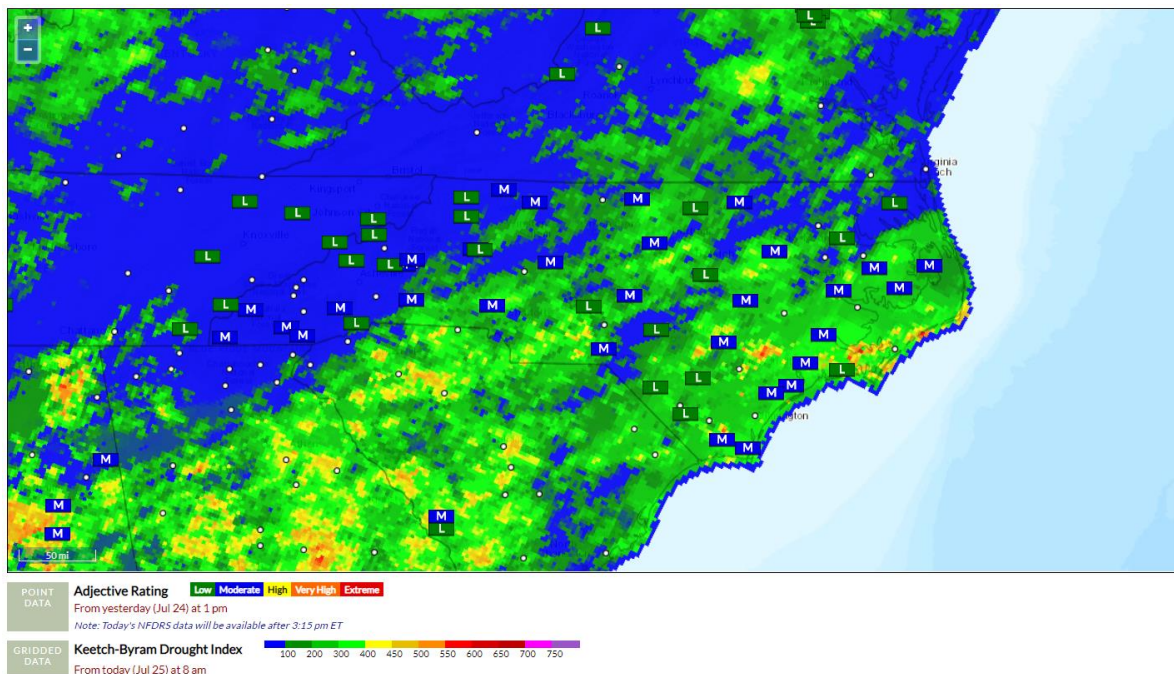
Weather conditions favorable to wildfire include drought, which increases flammability of surface fuels, and winds, which aid a wildfire's progress. The combination of wind, temperature, and humidity affects how fast wildland fires can spread. Rapid response can contain wildfires and limit their threat to property.

The Eno-Haw Region experiences a variety of wildfire conditions found in the Keetch-Byram Drought Index, which is described in Table 4.94. The Keetch-Byram Drought Index (KBDI) for July 24, 2019 is shown in Figure 4.36 along with a Daily Fire Danger Estimate Adjective Rating for certain points across the state. The KBDI for the Eno-Haw Region at this time was between 0 and 500, and the Fire Danger Estimate for the nearby area was "Low" to "Medium."

**Table 4.94 – Keetch-Byram Drought Index Fire Danger Rating System**

KBDI	Description
0-200	Soil and fuel moisture are high. Most fuels will not readily ignite or burn. However, with sufficient sunlight and wind, cured grasses and some light surface fuels will burn in spots and patches.
200-400	Fires more readily burn and will carry across an area with no gaps. Heavier fuels will still not readily ignite and burn. Also, expect smoldering and the resulting smoke to carry into and possibly through the night.
400-600	Fire intensity begins to significantly increase. Fires will readily burn in all directions exposing mineral soils in some locations. Larger fuels may burn or smolder for several days creating possible smoke and control problems.
600-800	Fires will burn to mineral soil. Stumps will burn to the end of underground roots and spotting will be a major problem. Fires will burn through the night and heavier fuels will actively burn and contribute to fire intensity.

**Figure 4.36 – Keetch-Byram Drought Index, July 2019**



Source: USFS Wildland Fire Assessment System

*Warning Time: 4 – Less than 6 hours*

*Duration: 3 – Less than 1 week*

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### Location

The location of wildfire risk can be defined by the acreage of Wildland Urban Interface (WUI). The WUI is described as the area where structures and other human improvements meet and intermingle with undeveloped wildland or vegetative fuels, and thus demarcates the spatial extent of wildfire risk. The WUI is essentially all the land in the county that is not heavily urbanized. The Southern Wildfire Risk Assessment (SWRA) estimates that 89.9 percent of the Eno-Haw Region's population lives within the WUI. The expansion of residential development from urban centers out into rural landscapes increases the potential for wildland fire threat to public safety and the potential for damage to forest resources and dependent industries. Population growth within the WUI substantially increases the risk of wildfire. Table 4.95 details the extent of the WUI in the Eno-Haw Region, and Figure 4.37 maps the WUI.

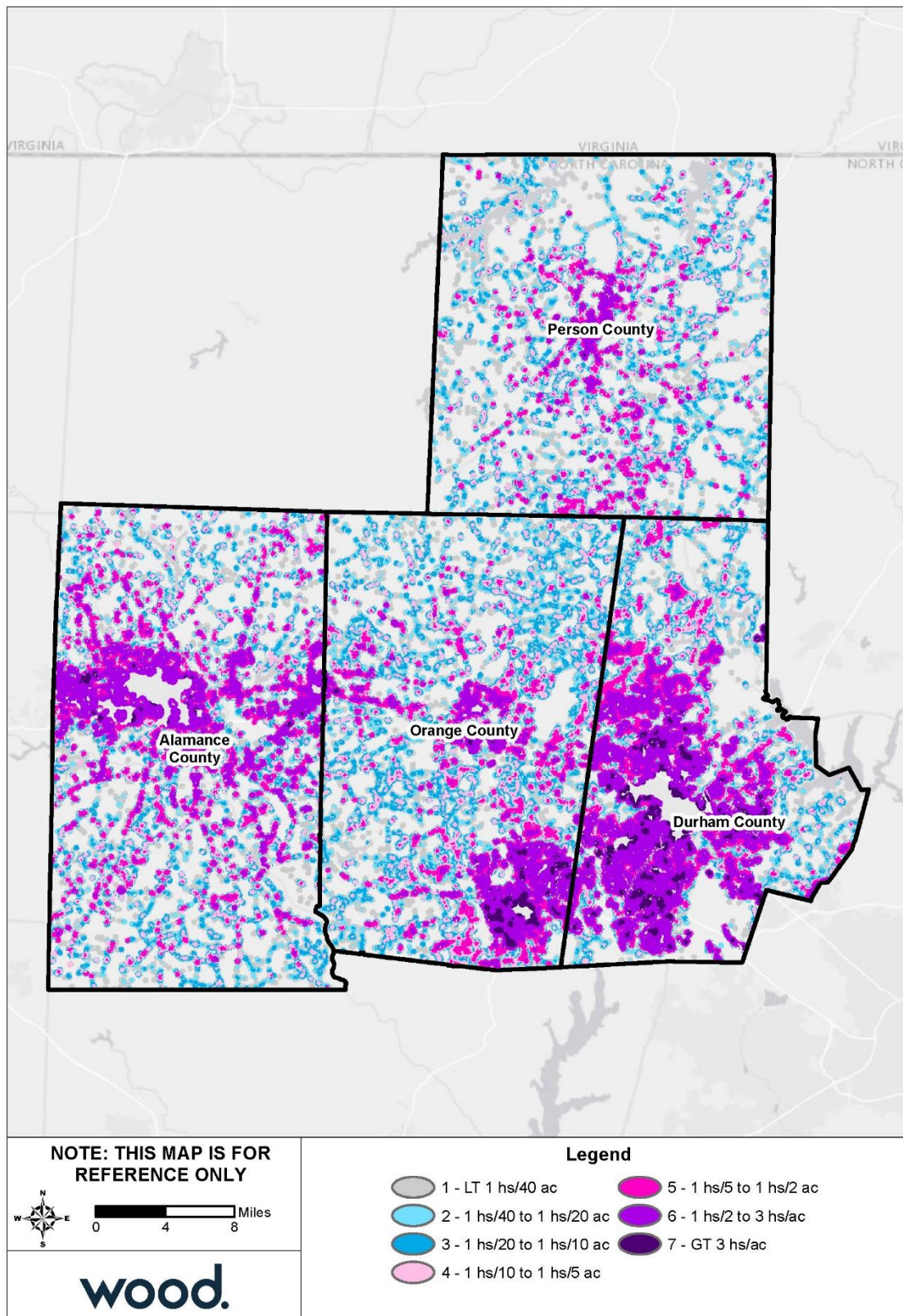
**Table 4.95 – Wildland Urban Interface, Population and Acres**

	Housing Density	WUI Population	Percent of WUI Population	WUI Acres	Percent of WUI Acres
	LT 1hs/40ac	1,955	0.4 %	124,393	20.0 %
	1hs/40ac to 1hs/20ac	4,320	0.8 %	79,359	12.8 %
	1hs/20ac to 1hs/10ac	13,920	2.6 %	108,088	17.4 %
	1hs/10ac to 1hs/5ac	28,861	5.4 %	101,696	16.4 %
	1hs/5ac to 1hs/2ac	60,086	11.2 %	91,307	14.7 %
	1hs/2ac to 3hs/1ac	305,404	57.1 %	106,566	17.1 %
	GT 3hs/1ac	120,303	22.5 %	10,484	1.7 %
	<b>Total</b>	<b>534,849</b>	<b>100.0 %</b>	<b>621,893</b>	<b>100.0 %</b>

Source: Southern Wildfire Risk Assessment



Figure 4.37 – Wildland Urban Interface, Eno-Haw Region



Source: Southern Wildfire Risk Assessment

## SECTION 4: RISK ASSESSMENT

### Extent

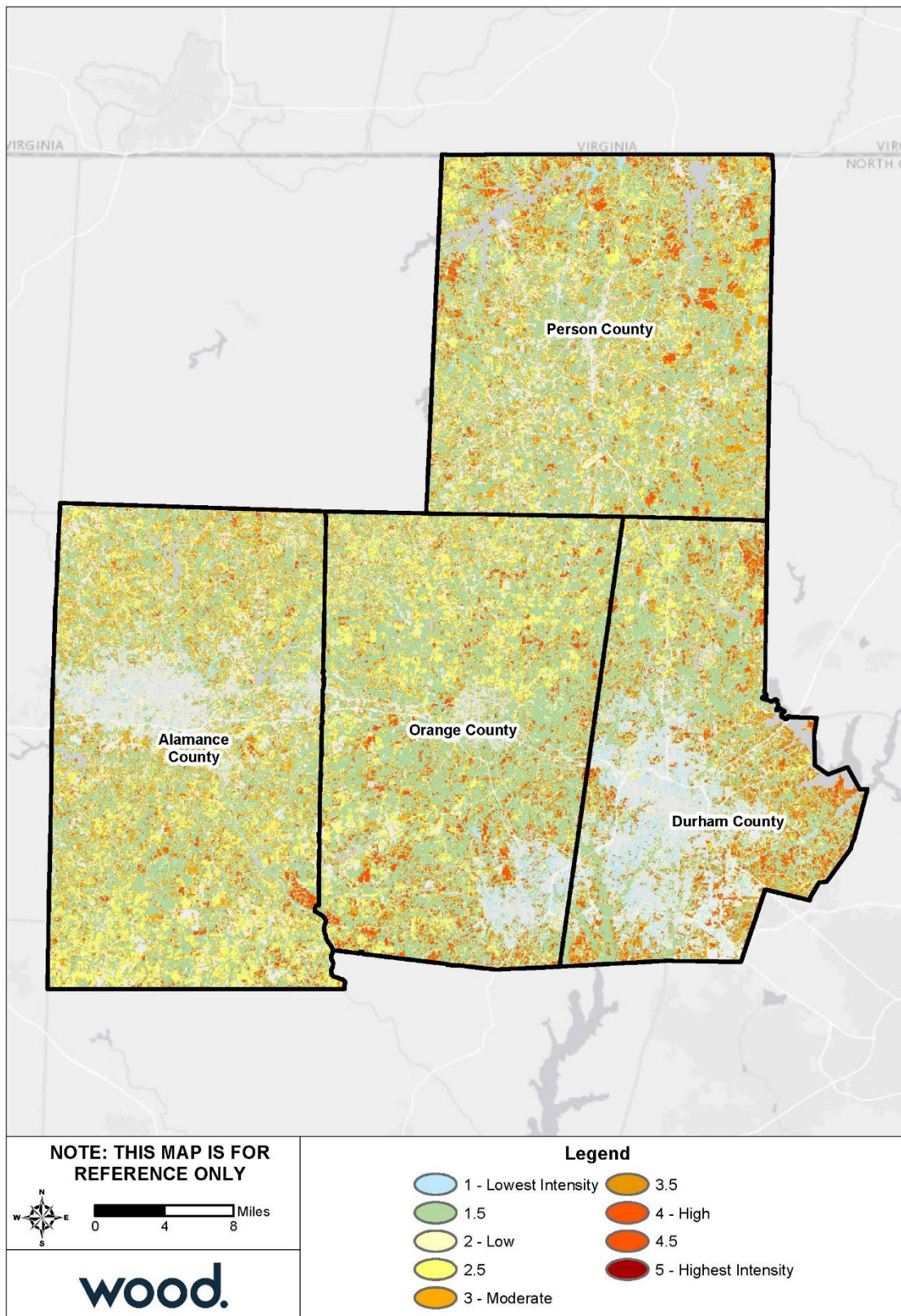
Wildfire extent can be defined by the fire's intensity and measured by the Characteristic Fire Intensity Scale, which identifies areas where significant fuel hazards which could produce dangerous fires exist. Fire Intensity ratings identify where significant fuel hazards and dangerous fire behavior potential exist based on fuels, topography, and a weighted average of four percentile weather categories. The Fire Intensity Scale consists of five classes, as defined by Southern Wildfire Risk Assessment. Figure 4.38 shows the potential fire intensity within the WUI across the Eno-Haw region.

**Table 4.96 – Fire Intensity Scale**

Class	Description
<b>1, Very Low</b>	Very small, discontinuous flames, usually less than 1 foot in length; very low rate of spread; no spotting. Fires are typically easy to suppress by firefighters with basic training and non-specialized equipment.
<b>2, Low</b>	Small flames, usually less than two feet long; small amount of very short range spotting possible. Fires are easy to suppress by trained firefighters with protective equipment and specialized tools.
<b>3, Moderate</b>	Flames up to 8 feet in length; short-range spotting is possible. Trained firefighters will find these fires difficult to suppress without support from aircraft or engines, but dozer and plows are generally effective. Increasing potential for harm or damage to life and property.
<b>4, High</b>	Large Flames, up to 30 feet in length; short-range spotting common; medium range spotting possible. Direct attack by trained firefighters, engines, and dozers is generally ineffective, indirect attack may be effective. Significant potential for harm or damage to life and property.
<b>5, Very High</b>	Very large flames up to 150 feet in length; profuse short-range spotting, frequent long-range spotting; strong fire-induced winds. Indirect attack marginally effective at the head of the fire. Great potential for harm or damage to life and property.

Source: Southern Wildfire Risk Assessment

Figure 4.38 – Characteristic Fire Intensity, Eno-Haw Region



Source: Southern Wildfire Risk Assessment

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A small portion, approximately 4.2 percent, of the Eno-Haw Region may experience up to a Class 4 Fire Intensity, which poses significant harm or damage to life and property. 16 percent of the Eno-Haw Region may experience Class 3 Fire Intensity, which has potential for harm to life and property but is easier to suppress with dozer and plows. The remainder of the region is either non-burnable (17.1%) or would face a Class 1 or Class 2 Fire Intensity, which are easily suppressed.

*Impact: 2 – Limited*

*Spatial Extent: 3 – Moderate*

### Historical Occurrences

The North Carolina Forest Service (NCFS) began keeping records of fire occurrence on private and state-owned lands in 1928. Since this time, there has been an average of approximately 4,000 fires burning more than 115,000 acres annually. Recently, within the last 10 years, the State has averaged closer to 3,200 fires per year and 15,000 acres burned annually.

Table 4.97 through Table 4.100 summarize past occurrences of wildfire in the Eno-Haw region by county since 1999 as provided by the NCFS in July 2019. This data only accounts for occurrences within unincorporated areas, which fall under the NCFS jurisdiction, as well as larger events in incorporated areas where local fire departments requested NCFS support for fire suppression. Actual number of fires and acreage burned are higher than what can be reported here.

**Table 4.97 – Records for Wildfire in Alamance County, 1999-2018**

Year	Number of Fires	Acreage Burned	Homes/Structures Protected	Value of Protected Homes/Structures
1999	19	29.8	N/A	N/A
2000	11	60.7	N/A	N/A
2001	47	72.6	N/A	N/A
2002	29	47.6	N/A	N/A
2003	5	7.2	N/A	N/A
2004	12	49.9	N/A	N/A
2005	14	53.7	N/A	N/A
2006	46	70.9	N/A	N/A
2007	20	163.6	N/A	N/A
2008	7	30.3	N/A	N/A
2009	5	11.4	13	\$102,000
2010	3	1.7	2	\$200,000
2011	10	47.8	41	\$4,865,000
2012	3	4.5	1	\$75,000
2013	2	1.1	4	\$350,000
2014	6	33.7	8	\$900,000
2015	10	13.56	4	\$550,000
2016	24	15.08	23	\$1,634,000
2017	35	21.41	34	\$2,370,500
2018	23	14.75	38	\$2,313,300
<b>Total</b>	<b>331</b>	<b>751.3</b>	<b>168</b>	<b>\$13,359,800</b>

Source: NC Forest Service

Table 4.98 – Records for Wildfire in Durham County, 1999-2018

Year	Number of Fires	Acreage Burned	Homes/Structures Protected	Value of Protected Homes/Structures
1999	48	121.7	N/A	N/A
2000	21	117.2	N/A	N/A
2001	38	65.6	N/A	N/A
2002	27	97	N/A	N/A
2003	16	19.7	N/A	N/A
2004	21	21.6	N/A	N/A
2005	36	35.7	N/A	N/A
2006	40	92.1	N/A	N/A
2007	58	82.6	N/A	N/A
2008	18	106.6	N/A	N/A
2009	18	25	23	\$1,995,000
2010	20	58.5	40	\$4,892,000
2011	12	62.8	34	\$6,364,000
2012	8	196	12	\$690,000
2013	11	37.3	42	\$1,695,000
2014	3	33	24	\$3,300,000
2015	15	24.27	59	\$20,640,000
2016	33	3.7	74	\$23,083,500
2017	63	35.99	126	\$29,843,000
2018	28	8.96	31	\$6,123,500
<b>Total</b>	<b>534</b>	<b>1,245.32</b>	<b>465</b>	<b>\$98,626,000</b>

Source: NC Forest Service

Table 4.99 – Records for Wildfire in Orange County, 1999-2018

Year	Number of Fires	Acreage Burned	Homes/Structures Protected	Value of Protected Homes/Structures
1999	68	63.8	N/A	N/A
2000	55	43.5	N/A	N/A
2001	113	117.9	N/A	N/A
2002	85	55.6	N/A	N/A
2003	37	28.2	N/A	N/A
2004	41	54	N/A	N/A
2005	40	39.2	N/A	N/A
2006	64	102.5	N/A	N/A
2007	23	323.2	N/A	N/A
2008	23	18.4	N/A	N/A
2009	17	46.5	7	\$1,153,000
2010	31	42.3	37	\$5,425,700
2011	35	47.5	55	\$13,137,000
2012	13	31.5	123	\$22,493,500
2013	16	43.6	63	\$10,965,000
2014	23	33.5	37	\$8,061,090
2015	36	46.98	59	\$12,340,000
2016	62	44.34	110	\$27,980,000
2017	75	80.86	139	\$27,105,000
2018	35	21.76	58	\$9,475,000
<b>Total</b>	<b>892</b>	<b>1,285.14</b>	<b>688</b>	<b>\$138,135,290</b>

Source: NC Forest Service

Table 4.100 – Records for Wildfire in Person County, 1999-2018

Year	Number of Fires	Acreage Burned	Homes/Structures Protected	Value of Protected Homes/Structures
1999	33	73.6	N/A	N/A
2000	33	33.7	N/A	N/A
2001	87	121.4	N/A	N/A
2002	62	155.7	N/A	N/A
2003	6	2.7	N/A	N/A
2004	31	221.4	N/A	N/A
2005	33	45.5	N/A	N/A
2006	50	135.7	N/A	N/A
2007	53	103.8	N/A	N/A
2008	28	52.2	N/A	N/A
2009	17	13.7	2	\$55,000
2010	15	62.9	19	\$285,000
2011	26	27.6	6	\$185,000
2012	9	10	6	\$290,000
2013	16	26.7	11	\$680,500
2014	15	21.6	22	\$1,227,000
2015	26	36.12	13	\$931,000
2016	47	134.55	11	\$438,000
2017	61	46.56	17	\$994,000
2018	39	146.94	7	\$21,000
<b>Total</b>	<b>687</b>	<b>1,472.37</b>	<b>114</b>	<b>\$5,106,500</b>

Source: NC Forest Service

The region experienced prolonged periods of severe drought in 2001, 2002, 2007, and 2008, as well as moderate drought in 2011, 2012, and 2018. These periods of drought may explain some of the annual variation in fires and acreage burned.

On average, the Eno-Haw Region experiences 122.2 fires and 237.7 acres burned annually from fires that require the North Carolina Forest Service to respond. Actual number of fires and acreage burned is likely higher because smaller fires within jurisdictional boundaries are managed by local fire departments.

#### Probability of Future Occurrence

The Southern Wildfire Risk Assessment provides a Burn Probability analysis which predicts the probability of an area burning based on landscape conditions, weather, historical ignition patterns, and historical fire prevention and suppression efforts. Burn Probability data is generated by simulating fires under different weather, fire intensity, and other conditions. Values in the Burn Probability (BP) data layer indicate, for each pixel, the number of times that cell was burned by a modeled fire, divided by the total number of annual weather scenarios simulated. The simulations are calibrated to historical fire size distributions. The Burn Probability for the Eno-Haw Region is presented in Table 4.101 and illustrated in Figure 4.39.

**Table 4.101 – Burn Probability, Eno-Haw Region**

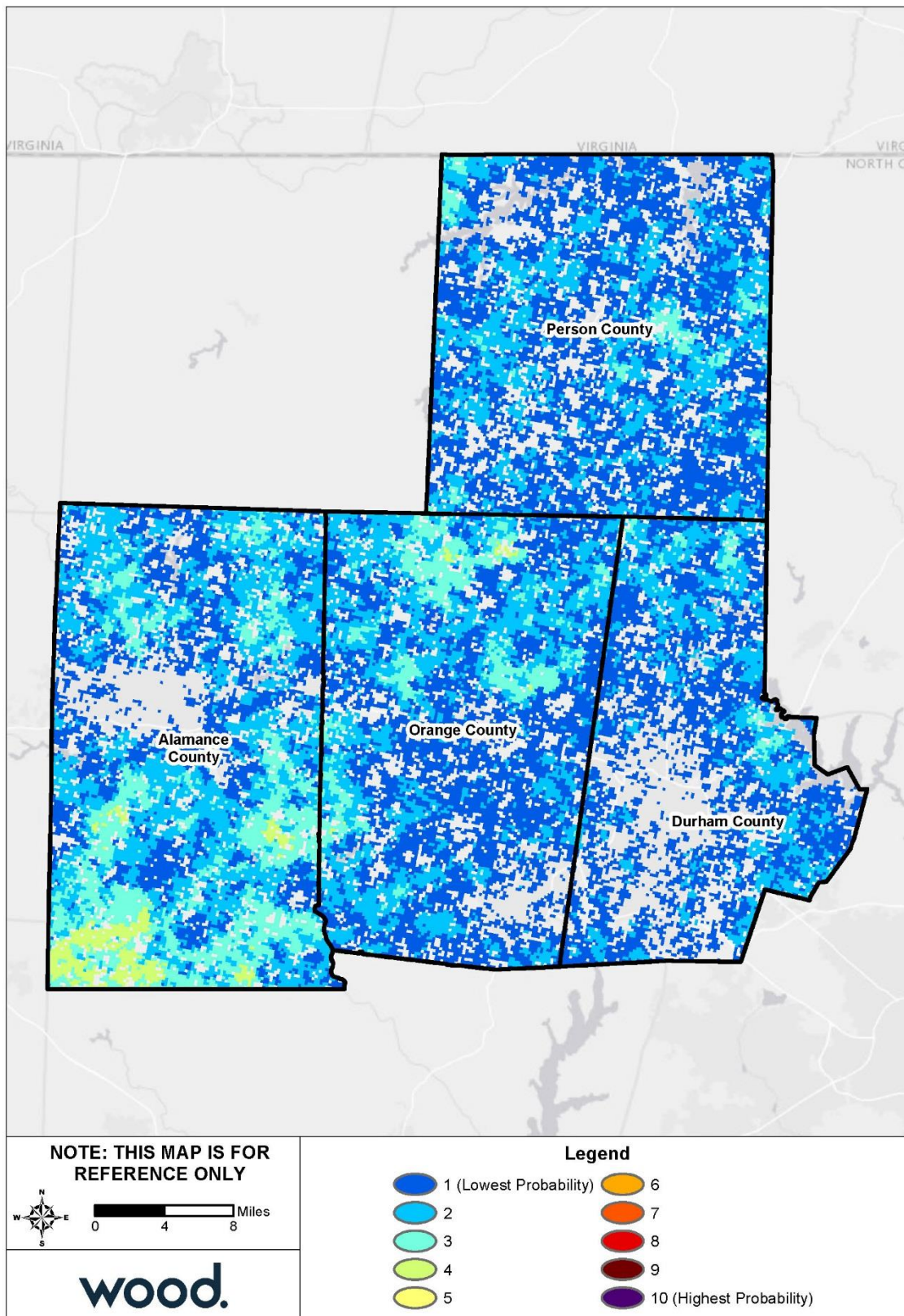
	Class	Acres	Percent
	1	373,069	51.0 %
	2	265,850	36.4 %
	3	81,153	11.1 %
	4	10,898	1.5 %
	5	0	0.0 %
	6	0	0.0 %
	7	0	0.0 %
	8	0	0.0 %
	9	0	0.0 %
	10	0	0.0 %
	<b>Total</b>	<b>730,970</b>	<b>100.0 %</b>

Source: Southern Wildfire Risk Assessment

All of the Eno-Haw Region has a relatively low burn probability, with the highest probabilities reaching a rating of 4 or less. The areas of moderate burn probability are located primarily in unincorporated Alamance County, particularly in the southwestern corner of the county. There is also limited area of moderate burn probability in northern unincorporated Orange County. The probability of wildfire across the region is considered possible, defined as between a 1% and 10% annual chance of occurrence. While all jurisdictions fall within this threshold, the communities containing moderate burn probability, noted above, have a comparatively higher probability of occurrence.

*Probability: 2 – Possible*

Figure 4.39 – Burn Probability, Eno-Haw Region



Source: Southern Wildfire Risk Assessment



## SECTION 4: RISK ASSESSMENT

### Climate Change

Wildfires are usually prevalent with a combination of high temperatures and dry conditions, combustible fuels and an ignition source. Climate change has been linked to longer, warmer and drier conditions in the southeast, exacerbating key potential conditions for a wildfire to spread. Per the Triangle Regional Resilience Assessment, increasing temperatures and longer periods of drought in the region will contribute to increased wildfires frequency, intensity, and size.

### Vulnerability Assessment

#### Methodologies and Assumptions

Population and property at risk to wildfire was estimated using data from the NCEM IRISK database, which was compiled in NCEM's Risk Management Tool.

Within IRISK, wildfire hazard areas were determined using the Wildland Fire Susceptibility Index (WFSI). The following parameters were applied:

- ▶ Areas with a WFSI value of 0.01 – 0.05 were considered to be at moderate risk.
- ▶ Areas with a WFSI value greater than 0.05 were considered to be at high risk.
- ▶ Areas with a WFSI value less than 0.01 were considered to not be at risk.

The WFSI integrates the probability of an acre igniting and the expected final fire size based on the rate of spread in four weather percentile categories into a single measure of wildland fire susceptibility. Due to some necessary assumptions, mainly fuel homogeneity, it is not the true probability. But since all areas of the state have this value determined consistently, it allows for comparison and ordination of areas of the state as to the likelihood of an acre burning.

### People

Wildfire can cause fatalities and human health hazards. Ensuring procedures are in place for rapid warning and evacuation are essential to reducing vulnerability. Table 4.102 details the population estimated to be at risk to wildfire according to the NCEM IRISK database.

**Table 4.102 – Estimated Population Impacted by Wildfire**

Jurisdiction	Total Population	Total Population at Risk		All Elderly Population	Elderly Population at Risk		All Children Population	Children at Risk	
		Number	Percent		Number	Percent		Number	Percent
Alamance County									
Unincorporated Alamance County	43,522	38,164	87.7%	6,358	5,575	87.7%	2,742	2,404	87.7%
City of Burlington	56,075	9,574	17.1%	8,192	1,396	17.0%	3,533	603	17.1%
City of Graham	16,584	5,520	33.3%	2,423	807	33.3%	1,045	348	33.3%
City of Mebane	14,590	11,262	77.2%	2,020	1,559	77.2%	893	689	77.2%
Town of Elon	10,006	4,301	43.0%	1,462	628	43.0%	630	271	43.0%
Town of Green Level	2,368	1,060	44.8%	346	155	44.8%	149	67	45.0%
Town of Haw River	3,773	2,759	73.1%	551	403	73.1%	238	174	73.1%
Town of Ossipee	544	227	41.7%	79	33	41.8%	34	14	41.2%
Town of Swepsonville	1,151	964	83.8%	168	141	83.9%	73	61	83.6%
Village of Alamance	1,462	1,108	75.8%	214	162	75.7%	92	70	76.1%

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Jurisdiction	Total Population	Total Population at Risk		All Elderly Population	Elderly Population at Risk		All Children Population	Children at Risk	
		Number	Percent		Number	Percent		Number	Percent
<b>Subtotal Alamance</b>	<b>150,075</b>	<b>74,939</b>	<b>49.9%</b>	<b>21,813</b>	<b>10,859</b>	<b>49.8%</b>	<b>9,429</b>	<b>4,701</b>	<b>49.9%</b>
<b>Durham County</b>									
Unincorporated Durham County	38,181	1,094	2.9%	3,725	107	2.9%	2,826	81	2.9%
City of Durham	225,814	667	0.3%	22,031	65	0.3%	16,715	49	0.3%
<b>Subtotal Durham</b>	<b>263,995</b>	<b>1,761</b>	<b>0.7%</b>	<b>25,756</b>	<b>172</b>	<b>0.7%</b>	<b>19,541</b>	<b>130</b>	<b>0.7%</b>
<b>Orange County</b>									
Unincorporated Orange County	45,470	3,401	7.5%	4,381	328	7.5%	2,342	175	7.5%
Town of Carrboro	20,883	4	0.0%	2,012	0	0.0%	1,076	0	0.0%
Town of Chapel Hill	59,351	0	0.0%	5,722	0	0.0%	3,117	0	0.0%
Town of Hillsborough	8,467	374	4.4%	816	36	4.4%	436	19	4.4%
<b>Subtotal Orange</b>	<b>134,171</b>	<b>3,779</b>	<b>2.8%</b>	<b>12,931</b>	<b>364</b>	<b>2.8%</b>	<b>6,971</b>	<b>194</b>	<b>2.8%</b>
<b>Person County</b>									
Unincorporated Person County	26,396	4,073	15.4%	4,007	618	15.4%	1,584	244	15.4%
City of Roxboro	13,079	1,005	7.7%	1,986	153	7.7%	785	60	7.6%
<b>Subtotal Person</b>	<b>39,475</b>	<b>5,078</b>	<b>12.9%</b>	<b>5993</b>	<b>771</b>	<b>12.9%</b>	<b>2369</b>	<b>304</b>	<b>12.8%</b>
<b>Total</b>	<b>587,716</b>	<b>85,557</b>	<b>14.6%</b>	<b>66,493</b>	<b>12,166</b>	<b>18.3%</b>	<b>38,310</b>	<b>5,329</b>	<b>13.9%</b>

Source: NCEM Risk Management Tool

### Property

Wildfire can cause direct property losses, including damage to buildings, vehicles, landscaped areas, agricultural lands, and livestock. Construction practices and building codes can increase fire resistance and fire safety of structures. Techniques for reducing vulnerability to wildfire include using street design to ensure accessibility to fire trucks, incorporating fire resistant materials in building construction, and using landscaping practices to reduce flammability and the ability for fire to spread. Properties within the WUI and outside an eight- minute drive time from a fire station are highly vulnerable.

Table 4.104 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings across all jurisdictions, by sector. The sectors facing the greatest risk to wildfire in the Region are commercial facilities, critical manufacturing, and government facilities.

Table 4.103 details the buildings at risk to wildfire in the Eno-Haw Region.

## SECTION 4: RISK ASSESSMENT

**Table 4.103 – Estimated Buildings Impacted by Wildfire**

Jurisdiction	All Buildings	Residential Buildings at Risk			Commercial Buildings at Risk			Public Buildings at Risk			Total Buildings at Risk		
	Num	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages	Num	% of Total	Estimated Damages
<b>Alamance County</b>													
Unincorporated Alamance County	29,650	22,720	76.6%	\$2,189,482,865	3,206	10.8%	\$592,495,065	255	0.9%	\$184,154,306	26,181	88.3%	\$2,966,132,236
City of Burlington	24,403	3,656	15%	\$401,745,660	391	1.6%	\$526,148,769	63	0.3%	\$92,455,203	4,110	16.8%	\$1,020,349,632
City of Graham	7,269	2,186	30.1%	\$273,255,114	137	1.9%	\$138,863,882	33	0.5%	\$63,536,803	2,356	32.4%	\$475,655,799
City of Mebane	5,835	4,091	70.1%	\$580,442,829	275	4.7%	\$455,518,397	42	0.7%	\$68,570,137	4,408	75.5%	\$1,104,531,363
Town of Elon	2,760	1,047	37.9%	\$170,893,947	65	2.4%	\$68,564,795	117	4.2%	\$135,141,122	1,229	44.5%	\$374,599,865
Town of Green Level	1,177	473	40.2%	\$33,891,997	47	4%	\$12,176,135	6	0.5%	\$2,150,024	526	44.7%	\$48,218,156
Town of Haw River	2,352	1,564	66.5%	\$134,526,958	92	3.9%	\$55,157,383	29	1.2%	\$18,985,559	1,685	71.6%	\$208,669,900
Town of Ossipee	330	125	37.9%	\$10,933,983	15	4.5%	\$7,404,940	5	1.5%	\$3,301,904	145	43.9%	\$21,640,827
Town of Swepsonville	573	455	79.4%	\$56,169,359	21	3.7%	\$37,867,378	3	0.5%	\$4,890,848	479	83.6%	\$98,927,585
Village of Alamance	798	541	67.8%	\$65,102,560	47	5.9%	\$19,385,064	13	1.6%	\$9,156,697	601	75.3%	\$93,644,321
<b>Subtotal Alamance</b>	<b>75,147</b>	<b>36,858</b>	<b>49%</b>	<b>\$3,916,445,272</b>	<b>4,296</b>	<b>5.7%</b>	<b>\$1,913,581,808</b>	<b>566</b>	<b>0.8%</b>	<b>\$582,342,603</b>	<b>41,720</b>	<b>55.5%</b>	<b>\$6,412,369,684</b>
<b>Durham County</b>													
Unincorporated Durham County	21,038	515	2.4%	\$67,944,537	177	0.8%	\$141,967,552	6	0%	\$4,012,437	698	3.3%	\$213,924,525
City of Durham	75,588	193	0.3%	\$39,333,190	18	0%	\$100,332,565	8	0%	\$52,251,529	219	0.3%	\$191,917,284
<b>Subtotal Durham</b>	<b>96,626</b>	<b>708</b>	<b>0.73%</b>	<b>107,277,727</b>	<b>195</b>	<b>0.20%</b>	<b>242,300,117</b>	<b>14</b>	<b>0.01%</b>	<b>56,263,966</b>	<b>917</b>	<b>0.95%</b>	<b>405,841,809</b>
<b>Orange County</b>													
Unincorporated Orange County	24,533	1,617	6.6%	\$265,704,238	567	2.3%	\$111,940,237	33	0.1%	\$67,853,955	2,217	9%	\$445,498,430
Town of Carrboro	5,782	1	0%	\$226,330	0	0%	\$0	0	0%	\$0	1	0%	\$226,330
Town of Chapel Hill	15,108	0	0%	\$0	0	0%	\$0	0	0%	\$0	0	0%	\$0
Town of Hillsborough	3,883	148	3.8%	\$24,261,113	32	0.8%	\$47,243,754	13	0.3%	\$73,591,389	193	5%	\$145,096,256
<b>Subtotal Orange</b>	<b>49,306</b>	<b>1,766</b>	<b>5.2%</b>	<b>\$290,191,681</b>	<b>599</b>	<b>1.8%</b>	<b>\$159,183,991</b>	<b>46</b>	<b>0.1%</b>	<b>\$141,445,344</b>	<b>2,411</b>	<b>7.1%</b>	<b>\$590,821,016</b>
<b>Person County</b>													
Unincorporated Person County	17,714	2,299	13%	\$301,898,644	523	3%	\$37,110,347	15	0.1%	\$20,159,406	2,837	16%	\$359,168,397
City of Roxboro	6,617	443	6.7%	\$62,595,545	84	1.3%	\$59,718,889	7	0.1%	\$14,987,106	534	8.1%	\$137,301,540
<b>Subtotal Person</b>	<b>24,331</b>	<b>2,742</b>	<b>11.3%</b>	<b>\$364,494,189</b>	<b>607</b>	<b>2.5%</b>	<b>\$96,829,236</b>	<b>22</b>	<b>0.1%</b>	<b>\$35,146,512</b>	<b>3,371</b>	<b>13.9%</b>	<b>\$496,469,937</b>
<b>Total</b>	<b>245,410</b>	<b>42,074</b>	<b>17.1%</b>	<b>\$4,678,408,869</b>	<b>5,697</b>	<b>2.3%</b>	<b>\$2,411,895,152</b>	<b>648</b>	<b>0.3%</b>	<b>\$815,198,425</b>	<b>48,419</b>	<b>19.7%</b>	<b>\$7,905,502,446</b>

Source: NCEM Risk Management Tool

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**Table 4.104 – Critical Infrastructure and Key Resources Buildings at Risk to Wildfire by Sector**

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	22	\$12,240,521
Commercial Facilities	1,405	\$1,141,325,876
Communications	2	\$707,732
Critical Manufacturing	564	\$840,428,481
Defense Industrial Base	3	\$31,172,887
Emergency Services	14	\$7,704,597
Energy	13	\$210,084,334
Food and Agriculture	3,559	\$203,121,864
Government Facilities	291	\$505,499,028
Healthcare and Public Health	90	\$144,570,968
Nuclear Reactors, Materials and Waste	1	\$50,000
Transportation Systems	386	\$292,939,196
Water	50	\$341,060,599
<b>All Categories</b>	<b>6,400</b>	<b>\$3,730,906,083</b>

Source: NCEM Risk Management Tool

### Environment

Wildfires have the potential to destroy forest and forage resources and damage natural habitats. Wildfire can also damage agricultural crops on private land. Wildfire is part of a natural process, however, and the environment will return to its original state in time.

### Consequence Analysis

Table 4.105 summarizes the potential detrimental consequences of wildfire.

**Table 4.105 – Consequence Analysis - Wildfire**

Category	Consequences
Public	In addition to the potential for fatalities, wildfire and the resulting diminished air quality pose health risks. Exposure to wildfire smoke can cause serious health problems within a community, including asthma attacks and pneumonia, and can worsen chronic heart and lung diseases. Vulnerable populations include children, the elderly, people with respiratory problems or with heart disease. Even healthy citizens may experience minor symptoms, such as sore throats and itchy eyes.
Responders	Public and firefighter safety is the first priority in all wildland fire management activities. Wildfires are a real threat to the health and safety of the emergency services. Most fire-fighters in rural areas are 'retained'. This means that they are part-time and can be called away from their normal work to attend to fires.
Continuity of Operations (including Continued Delivery of Services)	Wildfire events can result in a loss of power which may impact operations. Downed trees, power lines and damaged road conditions may prevent access to critical facilities and/or emergency equipment.
Property, Facilities and Infrastructure	Wildfires frequently damage community infrastructure, including roadways, communication networks and facilities, power lines, and water distribution systems. Restoring basic services is critical and a top priority. Efforts to restore roadways include the costs of maintenance and damage assessment teams, field data collection, and replacement or repair costs. Direct impacts to municipal water supply may occur through contamination of ash and debris during the fire, destruction of aboveground

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Category	Consequences
	distribution lines, and soil erosion or debris deposits into waterways after the fire. Utilities and communications repairs are also necessary for equipment damaged by a fire. This includes power lines, transformers, cell phone towers, and phone lines.
Environment	Wildfires cause damage to the natural environment, killing vegetation and animals. The risk of floods and debris flows increases after wildfires due to the exposure of bare ground and the loss of vegetation. In addition, the secondary effects of wildfires, including erosion, landslides, introduction of invasive species, and changes in water quality, are often more disastrous than the fire itself.
Economic Condition of the Jurisdiction	Wildfires can have significant short-term and long-term effects on the local economy. Wildfires, and extreme fire danger, may reduce recreation and tourism in and near the fires. If aesthetics are impaired, local property values can decline. Extensive fire damage to trees can significantly alter the timber supply, both through a short-term surplus from timber salvage and a longer-term decline while the trees regrow. Water supplies can be degraded by post-fire erosion and stream sedimentation.
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; event response efforts; and recovery efforts,

### Hazard Summary by Jurisdiction

The following table summarizes wildfire hazard risk by jurisdiction. Wildfire warning time and duration do not vary by jurisdiction. Spatial extent ratings were based on the proportion of area within the WUI; all jurisdictions have at least 50% of their area in the WUI and were assigned a rating of 3. Impact ratings were based on fire intensity data from SWRA. No jurisdictions have significant clusters of moderate to high fire intensity; therefore, all jurisdictions were assigned a rating of 2. Probability ratings were determined based on burn probability data from SWRA. Jurisdictions with clusters of moderate burn probability were assigned a rating of 3; all other jurisdictions were assigned a probability of 2.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	Score	Priority
Alamance County	3	2	3	4	3	2.8	H
Burlington	2	2	3	4	3	2.5	H
Graham	2	2	3	4	3	2.5	H
Mebane	2	2	3	4	3	2.5	H
Elon	2	2	3	4	3	2.5	H
Green Level	2	2	3	4	3	2.5	H
Haw River	2	2	3	4	3	2.5	H
Ossipee	2	2	3	4	3	2.5	H
Sweepsonville	2	2	3	4	3	2.5	H
Alamance	2	2	3	4	3	2.5	H
Durham County	2	2	3	4	3	2.5	H
Durham	2	2	3	4	3	2.5	H
Orange County	3	2	3	4	3	2.8	H
Carrboro	2	2	3	4	3	2.5	H
Chapel Hill	2	2	3	4	3	2.5	H
Hillsborough	2	2	3	4	3	2.5	H
Person County	2	2	3	4	3	2.5	H
Roxboro	2	2	3	4	3	2.5	H



## 4.5.12 Civil Unrest

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Civil Unrest	Possible	Limited	Small	Less than 6 hrs	Less than 1 week	2.3

## Hazard Background

Civil disorder is a term that generally refers to groups of people purposely choosing not to observe a law, regulation, or rule, usually in order to bring attention to a cause, concern, or agenda. Civil disorder can take the form of small gatherings or large groups blocking or impeding access to a building or disrupting normal activities by generating noise and intimidating people. They can range from a peaceful sit-in to a full-scale riot in which a mob burns or otherwise destroys property and terrorizes individuals. Even in its more passive forms, a group that blocks roadways, sidewalks, or buildings interferes with public order. In the 1990s abortion clinics, for example, were targets for these disruptive-type activities.

Throughout this country's history, incidents that disrupted the public peace have figured prominently. The constitutional guarantees allow for ample expression of protest and dissent, and in many cases collide with the preamble's requirement of the government "to ensure domestic tranquility." Typical examples of such conflicting ideology include the protest movements for civil rights in the late 1960s and the Vietnam War protest demonstrations in the early 1970s. The balance between an individual's and group's legitimate expression of dissent and the right of the populace to live in domestic tranquility requires the diligent efforts of everyone to avoid such confrontations in the future.

In modern society, laws have evolved that govern the interaction of its members to peacefully resolve conflict. In the United States, a crowd itself is constitutionally protected under "the right of the people to peacefully assemble." However, assemblies that are not peaceable are not protected, and this is generally the dividing line between crowds and mobs. The laws that deal with disruptive conduct are generally grouped into offenses that disturb the public peace. They range from misdemeanors, such as blocking sidewalks or challenging another to fight, to felonies, such as looting and rioting.

It is important to note that civil unrest is not synonymous with peaceful assembly or peaceful protest; Americans are guaranteed a right to assemble peacefully under the First Amendment to the Constitution.

## Types of Crowds

A crowd may be defined as a casual, temporary collection of people without a strong, cohesive relationship. Crowds can be classified into four general categories:

**Casual Crowd** — A casual crowd is merely a group of people who happen to be in the same place at the same time. Examples of this type include shoppers and sightseers. The likelihood of violent conduct is all but nonexistent.

**Cohesive Crowd** — A cohesive crowd consists of members who are involved in some type of unified behavior. Members of this group are involved in some type of common activity, such as worshipping, dancing, or watching a sporting event. Although they may have intense internal discipline (e.g., rooting for a team), they require substantial provocation to arouse to action.

**Expressive Crowd** — An expressive crowd is one held together by a common commitment or purpose. Although they may not be formally organized, they are assembled as an expression of common sentiment or frustration. Members wish to be seen as a formidable influence. One of the best examples of this type is a group assembled to protest something.

**Aggressive Crowd** — An aggressive crowd is made up of individuals who have assembled for a specific purpose. This crowd often has leaders who attempt to arouse the members or motivate them to action.

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Members are noisy and threatening and will taunt authorities. They tend to be impulsive and highly emotional and require only minimal stimulation to arouse them to violence. Examples of this type of crowd include demonstrations and strikers.

### Types of Mobs

A mob can be defined as a large disorderly crowd or throng. Mobs are usually emotional, loud, tumultuous, violent, and lawless. Like crowds, mobs have different levels of commitment and can be classified into four categories:

**Aggressive Mob**—An aggressive mob is one that attacks, riots, and terrorizes. The object of violence may be a person, property, or both. An aggressive mob is distinguished from an aggressive crowd only by lawless activity. Examples of aggressive mobs are the inmate mobs in prisons and jails, mobs that act out their frustrations after political defeat, or violent mobs at political protests or rallies.

**Escape Mob**—An escape mob is attempting to flee from something such as a fire, bomb, flood, or other catastrophe. Members of escape mobs have lost their capacity to reason and are generally impossible to control. They are characterized by unreasonable terror.

**Acquisitive Mob**—An acquisitive mob is one motivated by a desire to acquire something. Riots caused by other factors often turn into looting sprees. This mob exploits a lack of control by authorities in safeguarding property. Examples of acquisitive mobs would include the looting in South Central Los Angeles in 1992, or food riots in other countries.

**Expressive Mob**—An expressive mob is one that expresses fervor or revelry following some sporting event, religious activity, or celebration. Members experience a release of pent up emotions in highly charged situations. Examples of this type of mob include the June 1994 riots in Canada following the Stanley Cup professional hockey championship, European soccer riots, and those occurring after other sporting events in many countries, including the United States.

Although members of mobs have differing levels of commitment, as a group they are far more committed than members of a crowd. As such, a “mob mentality” sets in, which creates a cohesiveness and sense of purpose that is lacking in crowds. Thus, any strategy that causes individual members to contemplate their personal actions will tend to be more effective than treating an entire mob as a single entity.

*Warning Time: 4 – Less than six hours*

*Duration: 3 – Less than one week*

### Location

Civil disorder can arise from a number of causes for a variety of reasons. Circumstances may be spontaneous or may result from escalating tensions. Civil disorder can erupt anywhere, but the most likely locations are those areas with large population groupings or gatherings. Sites that are attractive for political or other rallies should be considered as probable locations for the epicenter of civil disorder events; arenas and stadiums are another type of venue where civil disorder can occur. Civil disorder can also occur in proximity to locations where a “trigger event” occurred.

### Extent

The ultimate extent of any civil disorder incident will depend on the magnitude of that event and its location. The more widespread an incident is, the greater the likelihood of excessive injury, loss of life and property damage; additional factors, such as the ability of law enforcement to contain the event, are also critical in minimizing damages.

*Impact: 2 – Limited*

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### *Spatial Extent: 2 – Small*

#### Historical Occurrences

Events in North Carolina's early history, as well as those from the late 1960s through this decade, indicate the State is not immune to riots, protests, and social upheaval. Some brief examples of civil unrest across the state are provided below.

The Greensboro Uprising in 1969 occurred on and around the campuses of James B. Dudley High School and North Carolina Agricultural and Technical State University (A&T) in Greensboro in May 1969. The uprising was sparked by perceived civil rights issues at the segregated high school, and then spread to the A&T campus. The uprising ended after the National Guard made a sweep of A&T dormitories, taking hundreds of students into protective custody.

The Wilmington Ten were arrested for a firebombing in February 1971 in Wilmington. Responders reported being shot at by snipers from the roof of a nearby church; the neighborhood erupted in rioting that lasted through the next day, leaving two people dead. The National Guard was activated and entered the church the next day to remove the suspects; the violence resulted in two deaths, six injuries, and more than a half million dollars in property damage. Nine young black men and a white female were arrested in connection with the crime and convicted, though their sentences were commuted; ultimately, they were granted full pardons in 2012.

The Greensboro Massacre took place in November 1979, when members of the Communist Workers' Party and others demonstrated against the Ku Klux Klan in Greensboro. Gunfire was exchanged between the demonstrators and members of the KKK and the American Nazi Party. The incident resulted in five fatalities and twelve injuries.

The Charlotte Riot of 2016 was a protest that lasted for three days, as a reaction to the shooting of a black man by a black police officer. One person was killed by a civilian, and multiple officers and civilians were injured in the unrest. The City of Charlotte eventually instituted a citywide curfew to quell the violence, and a State of Emergency was issued by the Governor, providing additional law enforcement and national guard support. The shooting was eventually ruled as justified.

Since 2010, civil unrest has again trended toward race relations as a cause. From controversial shootings of African American men by white police officers to the resulting Black Lives Matter movement, these trends may continue into the future as the country finds ways to improve race relations. North Carolina has experienced specific incidents of racial unrest and violence as part of this trend, and may continue to see these types of incidents in the future.

Specific incidents occurring in a single jurisdiction can cause civil unrest nationally; the Michael Brown shooting incident in Ferguson, MO is an example of this. On November 25, 2014, CNN reported that thousands of people in more than 170 U.S. cities rallied to protest the grand jury decision not to indict the officer involved. Protests also took place internationally, with demonstrations held in several major cities in Canada, and as far away as London.

Another recent trend is the destruction and/or defacement of statues dedicated to the Confederacy during the Civil War; the planning area itself has experienced incidents of this nature, including the destruction of the Confederate Soldiers Monument in Durham County in August 2017, and the destruction of the Silent Sam statue at the University of North Carolina at Chapel Hill in 2018. As the country continues to debate whether monuments to the Confederacy are still appropriate in 2019, these types of incidents may continue to occur.

### Probability of Future Occurrence

In their article on “Understanding Riots” published in the *Cato Journal* (Vol. 14, No 1), David D. Haddock and Daniel D. Polsby note that a large crowd itself is not an incipient riot merely because it assembles a great many people. Haddock and Polsby explain that “starting signals” must occur for civil disorder to erupt; these starting signals include certain kinds of high profile events. In fact, incidents can become signals simply because they have been signals in the past. In Detroit, for example, Devils Night (the night before Halloween) has in recent years become a springboard for multiple, independent, and almost simultaneous acts of arson. With any conventional triggering event, such as news of an assassination or unpopular jury verdict, crowds form spontaneously in various places as word of the incident spreads, without any one person having to recruit them. But since not every crowd threatens to evolve into a riot, the authors reason that a significant number of people must expect and desire that the crowd will become riotous. In addition, “someone has to serve as a catalyst—a sort of entrepreneur to get things going.” A typical action is the breaking of a window (a signal that can be heard by many who do not necessarily see it). Someone will throw the first stone, so to speak, when he calculates the risk of being apprehended has diminished to an acceptable level. This diminished risk is generally based on two variables—the size of the crowd relative to the police force and the probability that others will follow if someone leads. The authors conclude that once someone has taken a risk to get things started, the rioting will begin and spread until civil authorities muster enough force to make rioters believe they face a realistic prospect of arrest.

Nationwide, riots are apt to be a recurrent, if unpredictable, feature of social life. Without question, the planning area will continue to experience future episodes of marches, protests, demonstrations, and gatherings in various cities and communities that could lead to some type of disruptive civil disorder. However, based on the State’s general history of civil disturbance and the various human factors noted above, the probability that such incidents will develop into full-scale, widespread riots is considered low.

Should the planning area experience future incidents of disruptive civil disorder or rioting, the severity of a given event could range from low to high, depending on many factors. A spirited demonstration that gets out of hand may result in several arrests, minor damage to property (police vehicles with broken windows, etc.), some injuries, and manpower/overtime costs for police, fire, and other response services. To a greater extent, the threat of urban or intercity riots has the potential for millions of dollars in property damage, possible loss of life, and serious injuries, and extensive arrests. Sustaining police at the scene for extended periods, and possibly mobilizing state highway patrol and National Guard units, can add to the extensive manpower costs. Still, such riots tend to be confined to a single site or general area of a community rather than multiple locations or several areas of the State at the same time. Once a riot has occurred, police in other cities are generally on standby for possible riotous conditions and are better able to alleviate potential disturbances before they develop into full-scale riots.

### *Probability: 2 – Possible*

### Climate Change

As a human-caused hazard, any changes in climate would not have a direct impact on civil disorder. Far more relevant, though, could be the implications of future climate change as a cause for civil disorder. Climate change impact forecasts include increasingly extreme weather patterns that exacerbate issues of drought, flooding, severe weather and other weather hazards globally that could affect whole ecosystems. Incidents of civil disobedience could be a secondary result related to societal unrest as a result of other climate-impacted hazards.

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### Vulnerability Assessment

As discussed above, the impacts from civil disorder vary greatly depending on the nature, severity, and success of the attack.

When rioting does break out, it generally proves extremely difficult for first-responder law enforcement authorities to quell the mob promptly. The rules of constitutional law set stringent limits on how police officers can behave toward the people they try to arrest. Restraint also plays a crucial part in avoiding any action that “fans the flames.” Initial police presence is often undermined because forces may be staffed below the peak loads needed to bring things back under control. At a result, the riot may continue until enough state police or National Guard units arrive to bolster the arrest process and subsequently restore order. In many cases, damage to life and property may already be extensive.

### Methodologies and Assumptions

Vulnerability to incidents of civil unrest were assessed based on past occurrences nationally and internationally as well as publicly available information on these vulnerabilities.

#### People

Injuries and fatalities can occur during civil unrest.

#### Property

Should a large gathering of people turn violent, damage to property and infrastructure can result, as well as looting of property.

#### Environment

Environmental impacts could occur if the civil unrest occurs in an outdoor or environmentally sensitive area. These impacts would be tied to the parameters of the incident.

### Consequence Analysis

Table 4.106 summarizes the potential consequences of civil unrest.

**Table 4.106 – Consequence Analysis – Civil Unrest**

Category	Consequences
Public	Localized impact expected to be severe for unprotected personnel and moderate to light for protected personnel.
Responders	Localized impact expected to be severe for unprotected personnel and moderate to light for protected personnel.
Continuity of Operations (including Continued Delivery of Services)	Damage to facilities/personnel in the area of the incident may require temporary relocation of operations; localized disruption of lines of communication and destruction of facilities may postpone delivery of some services.
Property, Facilities and Infrastructure	Localized impact to facilities and infrastructure in the area of the incident. Some severe damage possible.
Environment	May cause extensive damage in isolated cases and some denial or delays in the use of some areas. Remediation needed.
Economic Condition of the Jurisdiction	Local economy and finances adversely affected, possibly for an extended period of time, depending on damage.



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Category	Consequences
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.

## 4.5.13 Critical Infrastructure Failure

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Critical Infrastructure Failure	Possible	Critical	Small	Less than 6 hrs	More than 1 week	2.7

## Hazard Background

Aging infrastructure is a concern across the United States, and transportation and utility systems in the Eno-Haw region are no exception. Per a FEMA Strategic Foresight Initiative report on Critical Infrastructure, infrastructure is becoming more prone to failure as average structure age increases, with age being the leading indicator of potential for failure in some cases. Average structure age has been steadily increasing as structures are being replaced at a slower rate. Circulation around the Eno-Haw region depends on several key bridges and roads for access and services. While there is redundancy in the transportation system in the more urban parts of the planning area, there is less redundancy in the more rural areas. As such, these key pieces of infrastructure are integral to the functioning of the communities in the planning area and would cause varying levels disruption should they become inaccessible. Damage to any of this infrastructure could result from the majority of the natural and human-caused hazards described in this plan. In addition to a secondary or cascading impact from another primary hazard, infrastructure can fail as a result of faulty equipment, lack of maintenance, degradation over time, or accidental damage such as a barge colliding with a bridge support.

Utility failure is another form critical infrastructure failure. Utility Failure refers to loss of electric power, water, sewage, natural gas, or other utilities. These failures might occur to either government or privately operated utility systems. They often occur because of, or in conjunction with, other disaster events such as high winds, hurricanes, tornadoes, winter storm events, flooding, or others. Critical utility failures might exacerbate the impacts and recovery times of such events. Failure might also be caused by accident separate of another hazard event and create hazardous conditions of their own.

Building and construction standards along with regular inspection and maintenance to transportation and utility infrastructure can provide a degree of certainty as to the capacity of infrastructure to withstand some damages. However, accidental damage is unpredictable. Moreover, any damages that take a road or bridge out of service will likely require significant repairs that could take weeks or months to complete.

*Warning Time: 4 – Less than six hours*

*Duration: 4 – More than one week*

## Location

Critical infrastructure failure is generally localized to the site of key transportation and utility infrastructure.

Bridges are generally designed to last 50 years, therefore one way to target the location of critical transportation infrastructure failure is to identify the location of bridges 45 years or older. The North Carolina Department of Transportation maintains a list of bridges in North Carolina. Bridges built in 1975 or prior are listed below in Table 4.107, there are 206 in the region.

Utilities in the region are provided by various public and private entities as detailed in Table 4.108, and utility failures may occur anywhere in the region where utilities are provided.

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**Table 4.107 – Bridges Built in 1975 or Prior**

County	Bridge Number	Route	Crossing	Year Built	Age (years)
Orange	32	US70	Eno River	1922	98
Alamance	92	NC49	Little Alamance Creek	1923	97
Person	28	US158	Deep Creek	1923	97
Alamance	72	NC87	Alamance Creek	1928	92
Alamance	14	NC87	Cane Creek	1929	91
Alamance	40	NC87	Branch Of Varnals Creek	1929	91
Durham	89	SR1902	Lick Creek	1930	90
Orange	16	NC751	Southern R.R.	1930	90
Person	11	US158	South Hyco Creek	1932	88
Durham	28	SR1774 (CLOSED)	Flat River	1935	85
Durham	98	NC55	Norfolk & Southern	1936	84
Alamance	81	US70	Back Creek	1938	82
Orange	86	SR1005	University Lake	1939	81
Durham	245	SR1321	Ellerbee Creek	1940	80
Orange	46	US70	Eno River	1941	79
Alamance	26	NC62	Gunn Creek	1949	71
Alamance	112	NC87	Reedy Fork Creek	1949	71
Alamance	119	NC87	Haw River	1949	71
Alamance	126	NC87	Mill Race	1949	71
Alamance	164	SR1113	Stinking Quarter Creek	1949	71
Orange	4	SR1004	West Fork Eno River	1949	71
Alamance	113	SR1003	Cane Creek	1950	70
Alamance	114	SR1003	South Fork Cane Creek	1950	70
Alamance	128	SR2369	Cane Creek	1950	70
Alamance	141	SR1005	Wells Creek	1950	70
Alamance	153	SR2371	Cane Creek	1950	70
Alamance	190	SR1005	Poppaw Creek	1950	70
Alamance	336	SR1569	Creek	1950	70
Orange	84	SR1005	Collins Creek	1950	70
Person	44	SR1111	South Flat River	1950	70
Alamance	22	SR1001	Mine Creek	1951	69
Durham	6	SR1617	Mountain Creek	1951	69
Durham	24	SR1004	Eno River	1951	69
Durham	25	SR1004	Little Creek	1951	69
Durham	44	PETTIGREW ST	NC55	1951	69
Durham	99	NC751	US15BUS, US501BUS	1951	69
Orange	24	SR1001	North Fork Little River	1951	69
Orange	37	NC86	New Hope Creek	1951	69
Orange	99	SR1723	New Hope Creek	1951	69
Person	15	SR1715	Rock Fork Branch	1951	69
Person	21	SR1715	North Flat River	1951	69
Alamance	170	SR1212	Prong Alamance Creek	1952	68
Durham	61	SR1464	Mountain Creek	1952	68
Orange	31	SR1010	Bolin Creek	1952	68
Orange	39	SR1010	Booker Creek	1952	68
Orange	41	SR1010 NBL	US15, US501 SBL	1952	68
Orange	45	US15, US501 SBL	NC54	1952	68

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County	Bridge Number	Route	Crossing	Year Built	Age (years)
Durham	220	SR1004	Creek Off Eno River	1953	67
Orange	7	US70E	SR1239 W	1953	67
Orange	51	SR1534	Buffalo Creek	1953	67
Alamance	3	SR1529	Dry Creek	1954	66
Alamance	238	SR2128	Haw Creek	1954	66
Durham	106	US70 E BYP	NC98	1954	66
Durham	115	US70 W BYP	NC98	1954	66
Orange	49	NC86	Southern Railway	1954	66
Orange	77	SR1113	New Hope Creek	1954	66
Orange	114	SR1548	South Fork Little River	1954	66
Alamance	258	SR1522	Staley Creek	1955	65
Durham	92	US70 BUS., NC98	Norfolk & Western R.R.	1955	65
Durham	117	SR1308	Mud Creek	1955	65
Durham	128	US70 BUS WBL	US70 Bypass EBL	1955	65
Durham	195	SR1675	I85	1955	65
Orange	90	SR1940	Pritchard MILL CREEK	1955	65
Orange	137	SR1550	Forrest Creek	1955	65
Person	27	SR1138	Creek	1955	65
Durham	20	SR1616	Dial Creek	1956	64
Durham	80	US15/US501NBL	SR1308	1956	64
Durham	109	US15/501 NBL	NC751	1956	64
Durham	114	US15/501B SB	Norfolk Southern Railway	1956	64
Durham	216	I85 & US15 NBL	SR1637 & Southern R.R.	1956	64
Orange	18	SR1421	Branch	1956	64
Orange	61	SR1002	Creek	1956	64
Orange	73	SR1115	Cane Creek	1956	64
Orange	104	SR1712	Stoney Creek	1956	64
Orange	189	SR1114	Cane Creek	1956	64
Alamance	15	SR1530	Haw River	1957	63
Alamance	51	SR1712	Haw River	1957	63
Durham	222	I85,US15 N	SR1637	1957	63
Orange	5	US15/US501	NC54	1957	63
Orange	20	SR1365	Branch Of Stagg Creek	1957	63
Orange	59	NC86	I85	1957	63
Orange	81	I85N, NC86	SR1006	1957	63
Orange	82	I85S, NC86	SR1006	1957	63
Orange	91	I85 NBL	Southern R.R.	1957	63
Orange	93	I85 SBL	Southern R.R.	1957	63
Orange	95	SR1709	I85	1957	63
Orange	96	SR1712	I85	1957	63
Orange	209	SR1366	Frank Creek	1957	63
Person	35	SR1120 (CLOSED)	South Flat River	1957	63
Person	98	SR1565	Tar River	1957	63
Alamance	35	NC62	Haw River	1958	62
Alamance	103	SR2182	Big Branch	1958	62
Alamance	148	I40,I85	Haw River	1958	62
Orange	11	SR1336	Eno River	1958	62
Orange	63	SR1567	Eno River	1958	62

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County	Bridge Number	Route	Crossing	Year Built	Age (years)
Orange	69	SR1134	Eno River	1958	62
Orange	83	I85N, NC86	SR1009	1958	62
Orange	87	I85S, NC86	SR1009	1958	62
Orange	98	I85 NBL	SR1713	1958	62
Orange	100	I85 SBL	SR1713	1958	62
Orange	103	I85 N	US70 E	1958	62
Orange	106	I85S, US70W	US70 EBL	1958	62
Orange	110	I85SBL, US70 EBL	US70 BUS WBL	1958	62
Orange	111	I85 SBL	US70 BUS WBL	1958	62
Alamance	52	SR1729	Stoney Creek	1959	61
Person	184	SR1532	Marlowe's Creek	1959	61
Alamance	24	SR1581	Stony Creek	1960	60
Alamance	36	SR1613	Tom's Creek	1960	60
Alamance	38	SR1611	Stoney Creek	1960	60
Alamance	41	SR1002	Stoney Creek	1960	60
Alamance	42	SR1002	Tom's Creek	1960	60
Alamance	173	SR1149	Back Creek	1960	60
Alamance	254	SR2104	Big Branch	1960	60
Durham	93	SR1945	Third Fork Creek	1960	60
Alamance	24	SR1581	Stony Creek	1960	60
Alamance	36	SR1613	Tom's Creek	1960	60
Alamance	38	SR1611	Stoney Creek	1960	60
Alamance	41	SR1002	Stoney Creek	1960	60
Alamance	42	SR1002	Tom's Creek	1960	60
Alamance	173	SR1149	Back Creek	1960	60
Alamance	254	SR2104	Big Branch	1960	60
Durham	93	SR1945	Third Fork Creek	1960	60
Alamance	301	SR2364	Wells Creek	1961	59
Durham	56	NC157	South Fork Little River	1961	59
Orange	27	SR1507	South Fork Little River	1961	59
Orange	192	SR1556	Strouds Creek	1961	59
Person	23	NC157	S. Flat River	1961	59
Person	50	SR1343	South Hyco Creek	1961	59
Person	51	SR1343 CLAYTON RD	Richland Creek	1961	59
Durham	85	SR1814	Little Lick Creek	1962	58
Alamance	59	SR1927	Quaker Creek Reservoir	1963	57
Alamance	95	SR2116	Big Alamance Creek	1963	57
Alamance	121	SR1136	Stinking Quarter Cr.	1963	57
Orange	6	US70 BUS	Eno River	1963	57
Orange	240	SR1009	Southern Railroad	1963	57
Person	16	NC57	Hyco Lake	1963	57
Person	20	NC57	Cobbs Creek	1963	57
Person	32	NC57	Hyco Lake	1963	57
Durham	49	SR1401	Eno River	1964	56
Orange	65	SR1002	Prong Eno River	1964	56
Person	197	SR1326	N & W Railroad	1964	56
Person	198	SR1336	Norfolk & West Railway	1964	56
Person	199	SR1194	Spillway	1964	56



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County	Bridge Number	Route	Crossing	Year Built	Age (years)
Alamance	109	SR2309	Alamance Creek	1965	55
Durham	200	I85 NBL, US15 NBL	SR1632	1965	55
Durham	201	I85 SBL&US15	SR1632	1965	55
Durham	218	I85, US15 SBL	SR1637 & Southern R.R.	1965	55
Durham	223	I85& US15 SB	SR1637	1965	55
Alamance	307	SR1936	Back Creek	1966	54
Durham	100	SR2028	I40	1966	54
Alamance	71	NC62	Stoney Creek	1967	53
Durham	35	US501	Eno River	1967	53
Durham	36	SR1671	Goose Creek	1967	53
Durham	55	US501N.B.	Little River(Lake)	1967	53
Durham	58	US501 S.B.	Little River(Lake)	1967	53
Durham	247	SR2028	Southern R/R	1967	53
Orange	102	SR1710	Stoney Creek	1967	53
Person	200	SR1325	Powell Creek	1967	53
Alamance	44	SR1768	Jordan's Creek	1968	52
Durham	71	US15/501 S	NC147	1968	52
Durham	147	SR1127	NC147	1968	52
Durham	154	SR1361	NC147	1968	52
Durham	156	SR1445	NC147	1968	52
Durham	160	NC147SBL	Blackwell Street	1968	52
Durham	163	NC147 NBL	Blackwell Street	1968	52
Durham	164	NC147 SBL	US15/501 NBL(BUS)	1968	52
Durham	166	NC147 NBL	US15, US501 NBL(BUS)	1968	52
Durham	169	SR1118	NC147	1968	52
Durham	173	NC147 SBL	Grant St.	1968	52
Durham	175	NC147 NBL	Grant St.	1968	52
Durham	202	SR2028 TW ALEXAND.	NC147	1968	52
Alamance	73	SR1928	Back Creek	1969	51
Durham	186	BRIGGS AVENUE	NC147	1969	51
Durham	194	SR1940	NC147	1969	51
Durham	226	I85NBL,US15N	Neuse River/Falls Lake	1969	51
Durham	227	I85 SBL,US15S	Neuse River/Falls Lake	1969	51
Durham	228	SR1959	I40	1969	51
Person	55	SR1337	Chub Lake	1969	51
Alamance	165	SR1131	Stinking Quarter Creek	1970	50
Alamance	178	SR1154	Little Alamance Creek	1970	50
Alamance	355	US70W	Storm Drain	1970	50
Durham	177	NC147 SBL	Bacon Street	1970	50
Durham	180	NC147 NBL	Bacon Street	1970	50
Durham	188	NC147 SBL	Southern Rr	1970	50
Durham	189	NC147NBL	Southern Railroad	1970	50
Durham	191	NC147 SBL	SR1171	1970	50
Durham	192	NC147 NBL	SR1171	1970	50
Person	33	SR1125	South Flat River	1970	50
Alamance	165	SR1131	Stinking Quarter Creek	1970	50
Alamance	178	SR1154	Little Alamance Creek	1970	50
Durham	83	US15/US501	SR1308	1971	49

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County	Bridge Number	Route	Crossing	Year Built	Age (years)
Durham	113	US15BYP,US501	NC751	1971	49
Alamance	68	SR1928	Southern R.R.	1972	48
Alamance	105	SR2174	Mary's Creek	1972	48
Alamance	136	SR2351	South Fork Cane Creek	1972	48
Alamance	34	NC54	Back Creek	1973	47
Alamance	70	NC54	Haw Creek	1973	47
Alamance	293	SR2123	Back Creek	1973	47
Durham	206	SR1121	NC147	1973	47
Durham	212	I40 EBL RAMP	NC147 NBL	1973	47
Durham	224	SR1999	I40	1973	47
Durham	260	SR1118	American Tobacco Trail	1973	47
Person	56	SR1322	Hyco Reservoir	1973	47
Person	202	SR1313	Hyco Canal	1973	47
Person	203	SR1316	Intake Canal (CP&L)	1973	47
Alamance	98	SR1003	Mary's Creek	1974	46
Durham	137	SR1322	NC147	1974	46
Durham	138	NC147 SBL	Campus Drive	1974	46
Durham	140	NC147 NBL	Campus Drive	1974	46
Durham	142	NC147 SBL	Buchanan Blvd	1974	46
Durham	144	NC147 N	Buchanan Blvd	1974	46
Orange	17	NC54	Cane Creek	1974	46
Orange	228	SR1009	New Hope Creek	1974	46
Durham	82	SR1815	Lick Creek	1975	45
Durham	84	SR1815	Chunky Pipe Creek	1975	45
Orange	199	SR1946	Neville Creek	1975	45

**Table 4.108 – Local Utility Providers**

Utility Type	Local Providers
Electricity	<ul style="list-style-type: none"> <li>• Duke Energy</li> <li>• Piedmont Electric Membership Corporation</li> </ul>
Natural Gas	<ul style="list-style-type: none"> <li>• Piedmont Natural Gas Company</li> <li>• Dominion Energy (Public Service Company of North Carolina)</li> </ul>
Water & Sewer	<ul style="list-style-type: none"> <li>• City of Burlington</li> <li>• City of Elon</li> <li>• City of Graham</li> <li>• Town of Haw River</li> <li>• Durham County Water Management</li> <li>• City of Durham</li> <li>• Town of Hillsborough</li> <li>• Orange Water and Sewer Authority</li> <li>• Orange-Alamance Water System</li> <li>• Efland Sewer System</li> <li>• Graham-Mebane Water System</li> <li>• City of Mebane</li> <li>• City of Roxboro</li> </ul>

### Extent

The significance of any transportation infrastructure failure will vary depending on the location and nature of the infrastructure itself. The loss of a local road may have only minor impacts limited to the immediate area. However, the loss of a major highway or key bridge could cause significant disruption across the Region. Depending on time of day and the onset of the failure, significant casualties are also possible: the 1967 Silver Bridge collapse between Point Pleasant, West Virginia and Gallipolis, Ohio and the 1980 Sunshine Skyway Bridge collapse outside St. Petersburg, Florida killed 46 and 35 people respectively.

Critical utility failures also vary depending on the location and circumstances surrounding the failure itself. Such failures might be localized or impact large swaths of the planning area and can range in duration – lasting anywhere from a few hours to multiple days or weeks. Impacts could be small losses of communication systems or larger losses of lifelines such as water and electricity, especially to critical facilities.

*Impact: 3 – Critical*

*Spatial Extent: 3 – Moderate*

### Historical Occurrences

A 2014 analysis of bridge failure rates by Dr. Wesley Cook of Utah State University found that an average of 128 bridges collapse every year in the U.S.; 53% of bridges that collapsed had been rated as structurally deficient prior to their collapse. Only 4% of bridge collapses resulted in loss of life.

A search of local newspapers and historical records did not return any instances of bridge failure in the four-county region.

Utility infrastructure failure, on the other hand, is more ubiquitous, particularly electricity outages. While small scale outages occur regularly, from high winds or downed branches, larger scale outages also occur, often in concert with large scale weather events like Hurricane Florence. The HMPC also noted two recent large scale water outages, although smaller events also occur:

- April 2016 – East Rosemary Street in Chapel Hill was shut down due to a water main break. The break caused 50 homes in the area to be without water for multiple hours as it was being repaired.
- November 2018 – A critical OWASA pipe broke in front of OWASA’s building, filling Jones Ferry Road. The break left more than 80,000 customers in the Chapel Hill-Carrboro area under a boil water advisory and with limited water for over 24 hours, asking users to limit water use to save water for necessary uses, like the UNC Hospital and UNC Chilled Water facilities. UNC Classes were cancelled, and Chapel Hill-Carrboro City schools were closed for two days. The broken pipe drained more than four water towers – neighboring Chatham, Hillsborough, and Durham piped in over 3.5 million gallons of water to supplement the system while the pipe was being fixed. The break occurred in a 77-year old pipe.
- March 2020 – OWASA had to repair to broken mains in Chapel Hill, one on South Road between Country Club Road and Raleigh Street and another on East Franklin Street between Estes Drive and Elliott Road.

The frequency of the above events highlights the fragility of aging infrastructure throughout not only the OWASA system, but across the planning area and the State of North Carolina.

### Probability of Future Occurrence

The likelihood of a major transportation infrastructure failure occurring in the Eno-Haw region is difficult to quantify. The continuing age and deterioration of America’s transportation infrastructure, coupled with

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increasing traffic and declining public investment in maintaining our infrastructure, indicate that road and bridge failures are likely to be more common in future decades than they have in the past. The American Society of Civil Engineers (ASCE) has estimated that \$2.2 trillion would be needed to bring the nation's infrastructure up to a condition that meets the needs of the current population. (Note that this total includes non-transportation infrastructure.) The potential for accidents and failures from infrastructure operating beyond its intended lifespan or with insufficient maintenance thus continues to increase.

According to the Federal Highway Administration (FHA), North Carolina ranks 27<sup>th</sup> among the 50 states in having the most roads in poor condition (6.6 percent) and 18<sup>th</sup> in terms of number of bridges rated as structurally deficient (9.9 percent). According to the U.S. Census Bureau's 2017 Annual Survey of State Government Finances, 8.8 percent of North Carolina's public spending is devoted to highways, ranking 11<sup>th</sup> among all states, and well above the national average of 5.6 percent.

Outages of critical utilities, however, are likely to occur more frequently. Power outages or water main breaks of some size happen regularly, with major incidents happening less frequently. The probability of some sort of critical infrastructure failure, then, is likely when considering large scale utility events and transportation network disruptions.

*Probability: 3 – Likely*

### Vulnerability Assessment

The impacts of transportation failures vary widely by the type of system, as well as the time of day and season of the failure.

### Methodologies and Assumptions

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Vulnerability to critical infrastructure failures was assessed based on past occurrences nationally and internationally as well as publicly available information on infrastructure vulnerability.

### People

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People can be injured or killed during transportation infrastructure failures. As noted above, the U.S. averages five fatality-causing bridge collapses per year, although data on the number of fatalities involved was not available. Numbers of non-fatal injuries was also not available.

Aside from direct injuries and fatalities, transportation failures can result in significant losses of time and money as individuals and commercial shipments are detoured or blocked. Disruption of transportation systems can limit the ability of emergency services and utility work crews to reach affected areas, and can put some members of the public at severe risk if they are unable to reach needed medical services, such as dialysis patients.

In extreme cases, a transportation failure could leave residents stranded without power, food, or other emergency supplies.

Utility failures can severely impact the health and safety of the public, particularly for children or elderly residents. An outage at any time poses risks to vulnerable populations who cannot be without water and electricity for medical treatments or refrigerated medications. Loss of water and electricity also poses a large risk to hospitals and health systems. During periods of extreme heat or cold, loss of electricity can pose a safety hazard. In the planning area, 36% of homes are heated by utility gas and 55% by electricity. The following table summarizes the number of Medicare recipients by county who are electricity-dependent. This is defined by the Department of Health and Human Services as Medicare recipients who rely on electricity dependent medical equipment.

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County by Zip Code	Electricity Dependent Medicare Recipients
Alamance County	1,775
Durham County	1,329
Orange County	663
Person County	486

Source: Department of Health and Human Services emPOWER

### Property

The primary property damage from transportation infrastructure failures is to the infrastructure itself, as well as to privately-owned automobiles.

Downed power lines might directly fall on houses or indirectly cause fires. Water or sewer pipe breaks or backups might cause flooding to property.

### Environment

Transportation infrastructure failures can result in oil spills or other hazardous materials releases that can severely impact the environment in the surrounding area.

### Consequence Analysis

Table 4.109 summarizes the potential consequences of a critical infrastructure failure.

**Table 4.109 – Consequence Analysis - Critical Infrastructure Failure**

Category	Consequences
Public	Potential injuries and fatalities.
Responders	Potential injuries and fatalities, as well as potentially significant delays to response times.
Continuity of Operations (including Continued Delivery of Services)	Loss of key utilities, roads, or bridges can affect delivery of services. Water, sewer, or electric outages can affect jurisdictions and entities abilities to operate at full capacity.
Property, Facilities and Infrastructure	In addition to the loss of transportation infrastructure itself, sustained road closure can impact supply chain deliveries to other critical facilities. Potential damage to property due to downed power lines
Environment	Potential for contamination of natural environment depending on the utility or infrastructure failure. May result in excess resource consumption.
Economic Condition of the Jurisdiction	May cause temporary shutdown of businesses. Delays in movement of people, goods, and services. Jurisdiction may incur costs of rebuilding or upgrading failed infrastructure.
Public Confidence in the Jurisdiction's Governance	Can cause loss of confidence in government's ability to maintain other critical infrastructure.



### 4.5.14 Cyber Threat

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Cyber Threat	Possible	Limited	Small	Less than 6 hrs	More than 1 week	2.4

#### Hazard Background

The State of North Carolina Hazard Mitigation Plan defines cyber attacks as “deliberate attacks on information technology systems in an attempt to gain illegal access to a computer, or purposely cause damage.” Cyber-attacks use malicious code to alter computer operations or data. The vulnerability of computer systems to attacks is a growing concern as people and institutions become more dependent upon networked technologies. The Federal Bureau of Investigation (FBI) reports that “cyber intrusions are becoming more commonplace, more dangerous, and more sophisticated,” with implications for private- and public-sector networks.

There are many types of cyber-attacks. Among the most common is a direct denial of service, or DDoS attack. This is when a server or website will be queried or pinged rapidly with information requests, overloading the system and causing it to crash.

Malware, or malicious software, can cause numerous problems once on a computer or network, from taking control of users’ machines to discreetly sending out confidential information. Ransomware is a specific type of malware that blocks access to digital files and demands a payment to release them. Hospitals, school districts, state and local governments, law enforcement agencies, businesses, and even individuals can be targeted by ransomware.

Cyber spying or espionage is the act of illicitly obtaining intellectual property, government secrets, or other confidential digital information, and often is associated with attacks carried out by professional agents working on behalf of a foreign government or corporation. According to cybersecurity firm Symantec, in 2016 “...the world of cyber espionage experienced a notable shift towards more overt activity, designed to destabilize and disrupt targeted organizations and countries.”

Major data breaches - when hackers gain access to large amounts of personal, sensitive, or confidential information - have become increasingly common. The Symantec report says more than seven billion identities have been exposed in data breaches over the last eight years. In addition to networked systems, data breaches can occur due to the mishandling of external drives, as has been the case with losses of some state employee data.

Cyber crime can refer to any of the above incidents when motivated primarily by financial gain or other criminal intent.

The most severe type of attack is cyber terrorism, which aims to disrupt or damage systems in order to cause fear, injury, and loss to advance a political agenda.

The North Carolina State Bureau of investigation’ Computer Crime Unit helps law enforcement across North Carolina solve sophisticated crimes involving digital evidence.

*Warning Time: 4 – Less than six hours*

*Duration: 4 – More than one week*

#### Location

Cyber disruption events can occur and/or impact virtually any location in the state where computing devices are used. Incidents may involve a single location or multiple geographic areas. A disruption can

## SECTION 4: RISK ASSESSMENT

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have far-reaching effects beyond the location of the targeted system; disruptions that occur far outside the region can still impact people, businesses, and institutions within the region.

### Extent

The extent or magnitude/severity of a cyber disruption event is variable depending on the nature of the event. A disruption affecting a small, isolated system could impact only a few functions/processes. Disruptions of large, integrated systems could impact many functions/processes, as well as many individuals that rely on those systems.

There is no universally accepted scale to quantify the severity of cyber-attacks. The strength of a DDoS attack is sometimes explained in terms of a data transmission rate. One of the largest DDoS disruptions ever, which brought down some of the internet's most popular sites on October 21, 2016, peaked at 1.2 terabytes per second.

Data breaches are often described in terms of the number of records or identities exposed.

*Impact: 2 – Limited*

*Spatial Extent: 2 – Small*

### Historical Occurrences

Symantec reports there were a total of 1,209 data breaches worldwide in 2016, 15 of which involved the theft of more than 10 million identities. While the number of breaches has remained relatively steady, the average number of identities stolen has increased to almost one million per incident. The report also found that one in every 131 emails contains malware, and the company's software blocked an average of 229,000 web attacks every day.

The Privacy Rights Clearinghouse, a nonprofit organization based in San Diego, maintains a timeline of 2,631 data breaches resulting from computer hacking incidents in the United States from 2005-2018. The database lists 6 data breaches in North Carolina, totaling over 2.6 million impacted records. One attack was recorded in Chapel Hill, and some of the rest almost certainly included information on individuals who live in the region. Similarly, some residents in the region were almost certainly affected by national and international data breaches. Media reports indicate an uptick in cyber attacks across the state.

Orange County was attacked with a ransomware virus in March 2019, causing slowdowns and service problems at key public offices such as the Register of Deeds, the sheriff's office and county libraries. The attack impacted a variety of county services, including disrupting the county's capability to process real estate closings, issue marriage licenses, process housing vouchers and verify tax bills. The county's Planning Department was unable to process fees or permits, and the county libraries' computers were out of service.

### Probability of Future Occurrence

Cyber attacks occur daily, but most have negligible impacts at the local or regional level. The possibility of a larger disruption affecting systems within the region is a constant threat, but it is difficult to quantify the exact probability due to such highly variable factors as the type of attack and intent of the attacker. Minor attacks against business and government systems have become a commonplace occurrence but are usually stopped with minimal impact. Similarly, data breaches impacting the information of residents of the Eno-Haw Region are almost certain to happen in coming years. Major attacks or breaches specifically targeting systems in the region are less likely but cannot be ruled out.

*Probability: 2 – Possible*

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### Vulnerability Assessment

As discussed above, the impacts from a cyber attack vary greatly depending on the nature, severity, and success of the attack.

### Methodologies and Assumptions

Vulnerability to cyber attacks was assessed based on past occurrences nationally and internationally as well as publicly available information on these vulnerabilities, as well as attacks occurring in the region.

### People

Cyber-attacks can have a significant cumulative economic impact. Symantec reports that in the last three years, businesses have lost \$3 billion due to spear-phishing email scams alone. A major cyber-attack has the potential to undermine public confidence and build doubt in their government's ability to protect them from harm. Injuries or fatalities from cyber attacks would generally only be possible from a major cyber terrorist attack against critical infrastructure.

### Property

Short of a major cyber terrorist attacks against critical infrastructure, property damage from cyber attacks is typically limited to computer systems.

### Environment

Short of a major cyber terrorist attacks against critical infrastructure, property damage from cyber attacks is typically limited to computer systems. A major cyber terrorism attack could potentially impact the environment by triggering a release of a hazardous materials, or by causing an accident involving hazardous materials by disrupting traffic-control devices.

### Consequence Analysis

Table 4.110 summarizes the potential consequences of a cyber threat.

**Table 4.110 – Consequence Analysis – Cyber Threat**

Category	Consequences
Public	Cyber attacks can impact personal data and accounts. Injuries or fatalities could potentially result from a major cyber terrorist attacks against critical infrastructure.
Responders	Cyber attacks can impact personal data and accounts. Injuries or fatalities could potentially result from a major cyber terrorist attacks against critical infrastructure.
Continuity of Operations (including Continued Delivery of Services)	Agencies that rely on electronic backup of critical files are vulnerable. The delivery of services can be impacted since governments rely, to a great extent, upon electronic delivery of services.
Property, Facilities and Infrastructure	Rare. Most attacks affect only data and computer systems. Sabotage of utilities and infrastructure from a major cyber terrorist attacks could potentially result in system failures that damage property on a scale equal with natural disasters. Facilities and infrastructure may become unusable as a result of a cyber-attack.
Environment	Rare. A major attack could theoretically result in a hazardous materials release.
Economic Condition of the Jurisdiction	Could greatly affect the economy. In an electronic-based commerce society, any disruption to daily activities can have disastrous impacts to the economy. It is difficult to measure the true extent of the impact.
Public Confidence in the Jurisdiction's Governance	The government's inability to protect critical systems or confidential personal data could impact public confidence. An attack could raise questions regarding the security of using electronic systems for government services.

### 4.5.15 Hazardous Materials Incident

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Hazardous Materials Incident	Likely	Minor	Negligible	Less than 6 hrs	Less than 24 hrs	2.0

#### Hazard Background

A hazardous substance is any substance that may cause harm to persons, property, or the environment when released to soil, water, or air. Chemicals are manufactured and used in increasing types and quantities. Each year over 1,000 new synthetic chemicals are introduced and as many as 500,000 products pose physical or health hazards and can be defined as “hazardous chemicals”. Hazardous substances are categorized as toxic, corrosive, flammable, irritant, or explosive. Hazardous material incidents generally affect a localized area.

#### Fixed Hazardous Materials Incident

A fixed hazardous materials incident is the accidental release of chemical substances or mixtures during production or handling at a fixed facility.

#### Transportation Hazardous Materials Incident

A transportation hazardous materials incident is the accidental release of chemical substances or mixtures during transport. Transportation Hazardous Materials Incidents in the Eno-Haw Region can occur during highway or air transport. Highway accidents involving hazardous materials pose a great potential for public exposures. Both nearby populations and motorists can be impacted and become exposed by accidents and releases. If airplanes carrying hazardous cargo crash, or otherwise leak contaminated cargo, populations and the environment in the impacted area can become exposed.

#### Pipeline Incident

A pipeline transportation incident occurs when a break in a pipeline creates the potential for an explosion or leak of a dangerous substance (oil, gas, etc.) possibly requiring evacuation. An underground pipeline incident can be caused by environmental disruption, accidental damage, or sabotage. Incidents can range from a small, slow leak to a large rupture where an explosion is possible. Inspection and maintenance of the pipeline system along with marked gas line locations and an early warning and response procedure can lessen the risk to those near the pipelines.

*Warning Time: 4 – Less than six hours*

*Duration: 2 – Less than 24 hours*

#### Location

The Toxics Release Inventory (TRI) Program run by the U.S. Environmental Protection Agency (EPA) maintains a database of industrial facilities across the country and the type and quantity of toxic chemicals they release. The program also tracks pollution prevention activities and which facilities are reducing toxic releases. The Toxic Release Inventory reports 36 sites with hazardous materials in the planning area, broken out as follows:

- ▶ Alamance – 13 facilities
- ▶ Durham – 11 facilities
- ▶ Orange – 5 facilities
- ▶ Person – 7 facilities

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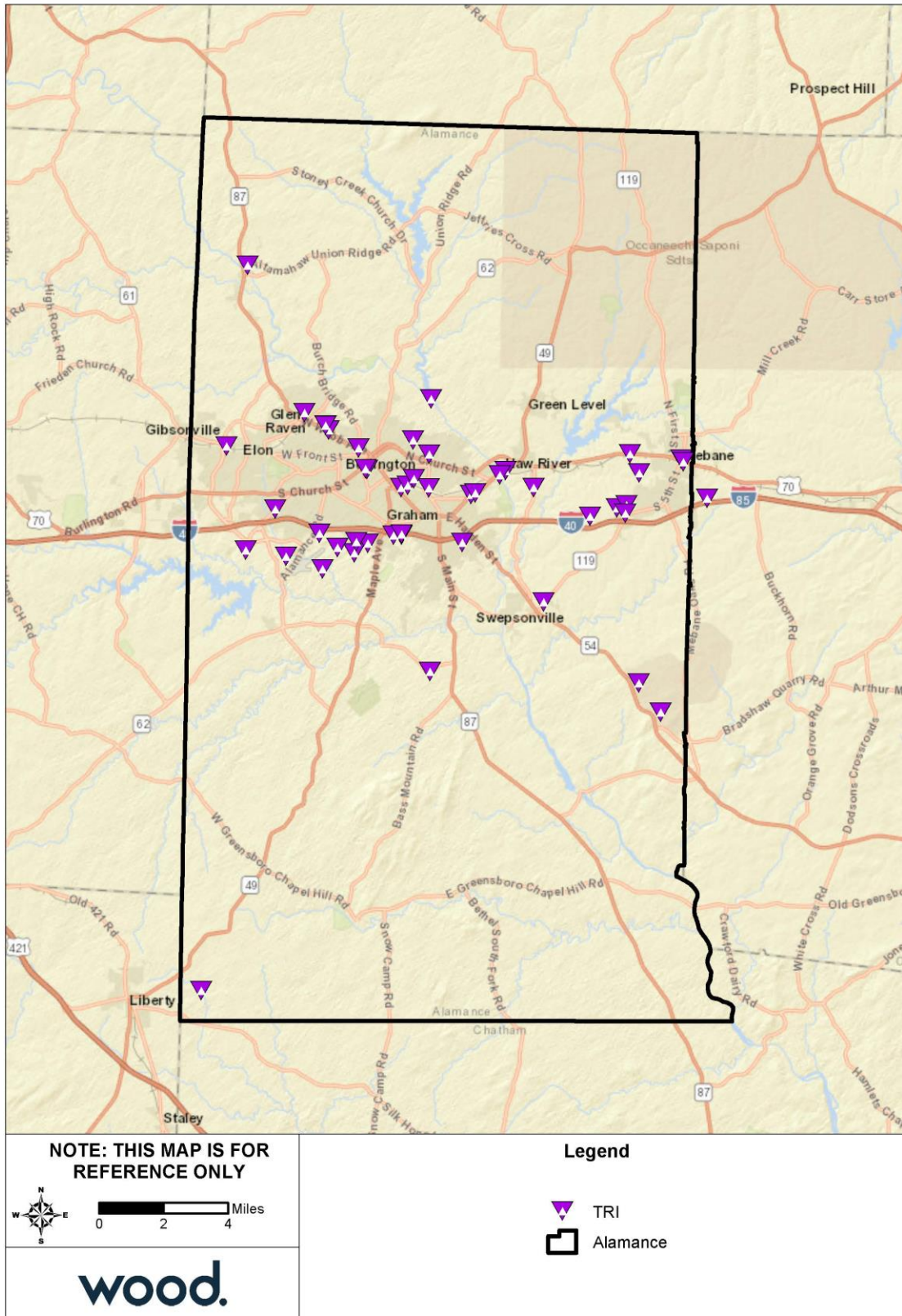
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These sites are shown in Figure 4.40 through Figure 4.43. Figure 4.44 shows Tier II sites located in Orange County. Tier II sites are those with certain chemicals above a given threshold, unique to each chemical. There are 67 sites in total across the County.

The U.S. Department of Transportation (USDOT) Pipeline and Hazardous Materials Safety Administration (PHMSA) maintains an inventory of the location of all gas transmission and hazardous liquid pipelines as well as liquid natural gas plants and hazardous liquid breakout tanks. The location of pipelines and pipeline infrastructure in the Eno-Haw Region are shown in Figure 4.45 through Figure 4.48.

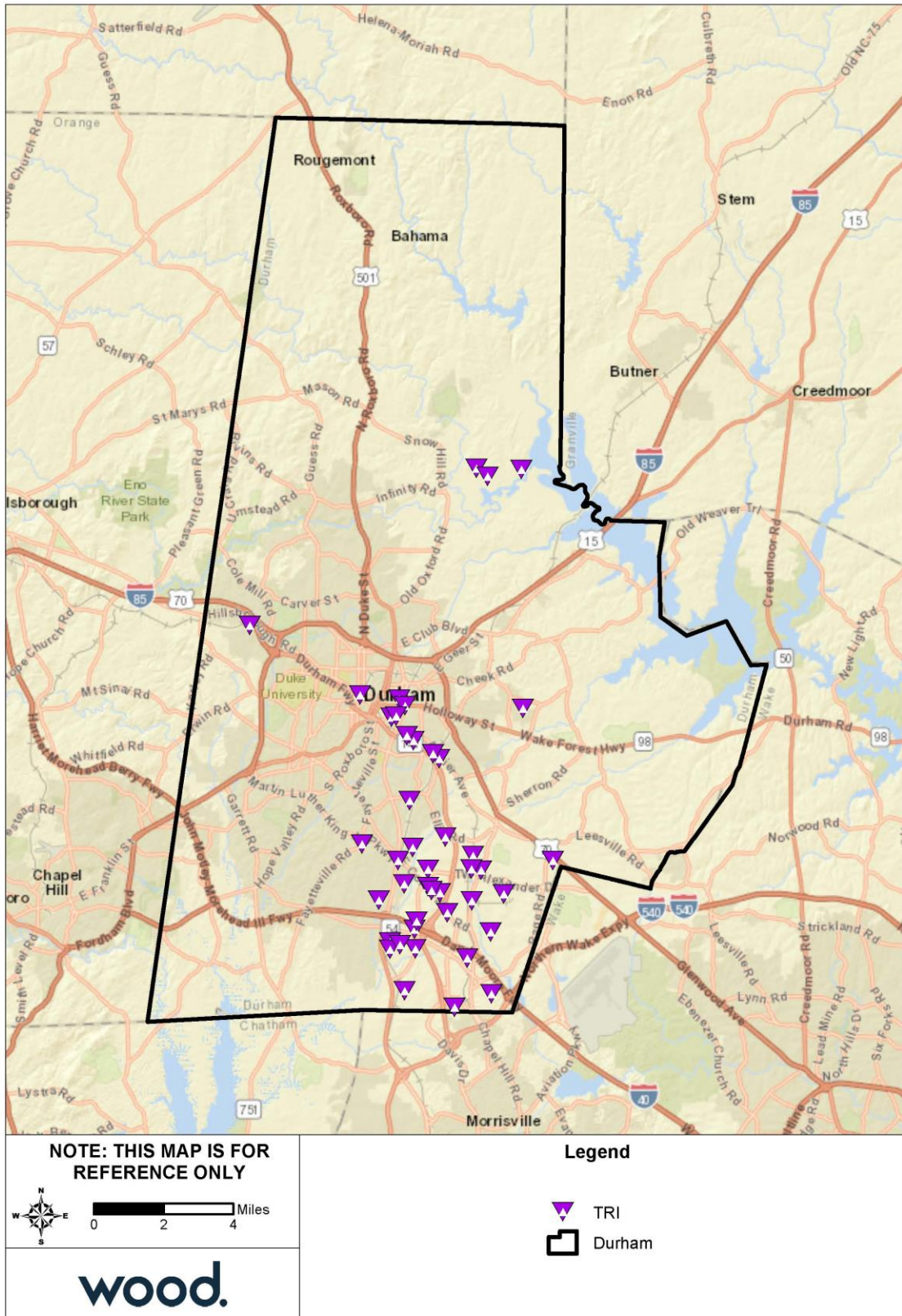


Figure 4.40 – Toxic Release Inventory Sites in Alamance County



Source: EPA Toxic Release Inventory

Figure 4.41 – Toxic Release Inventory Sites in Durham County



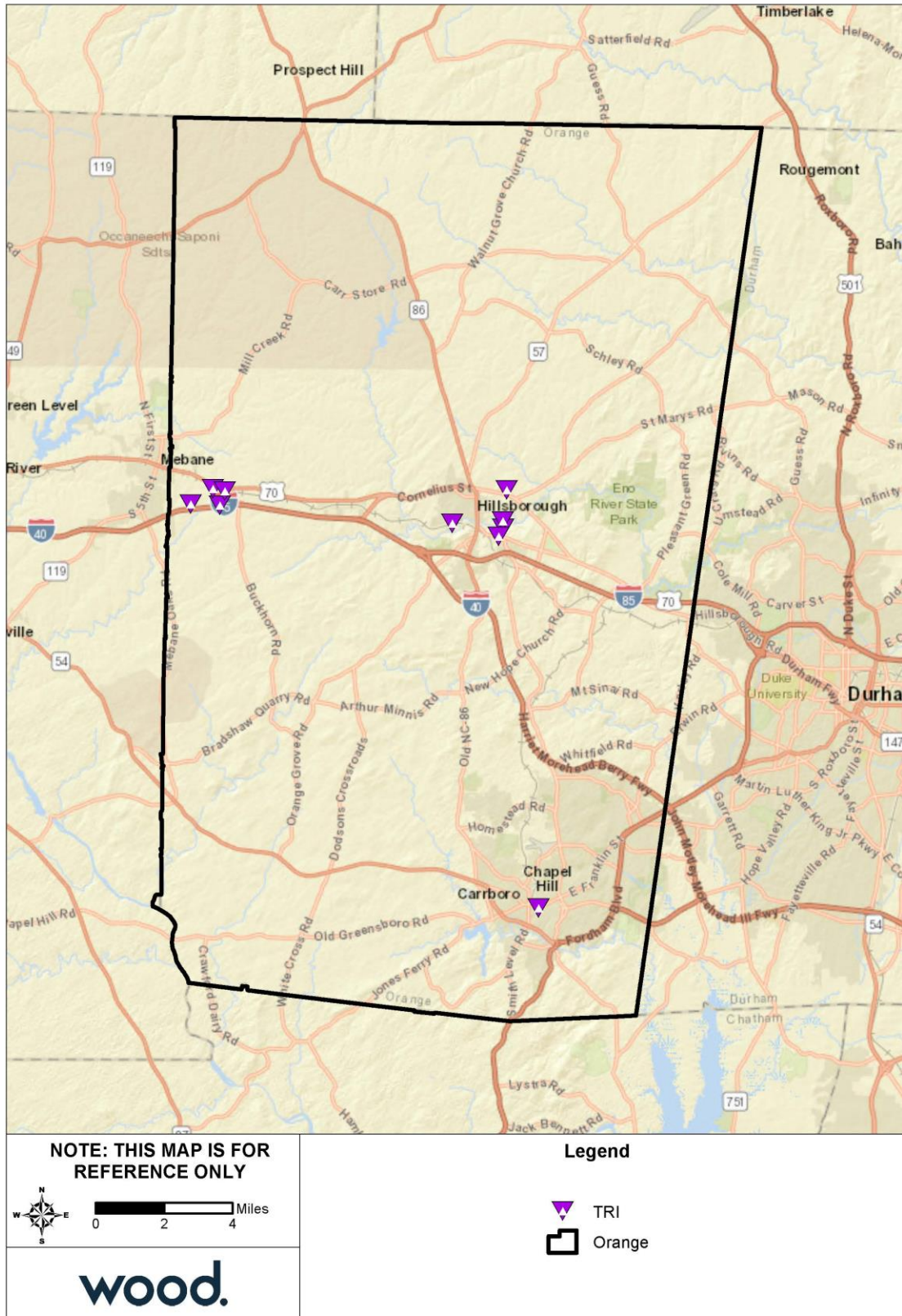
Source: EPA Toxic Release Inventory

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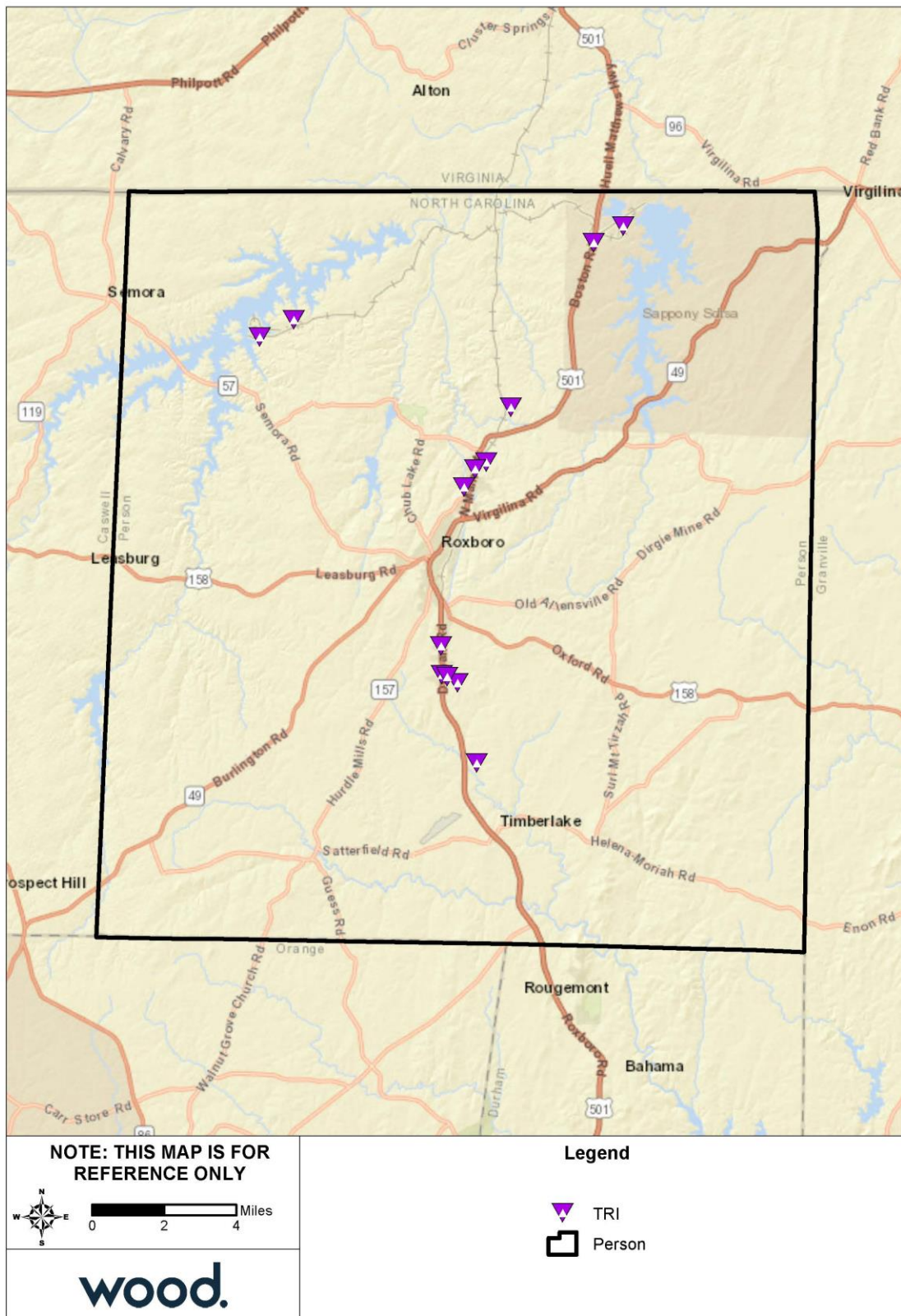


Figure 4.42 – Toxic Release Inventory Sites in Orange County



Source: EPA Toxic Release Inventory

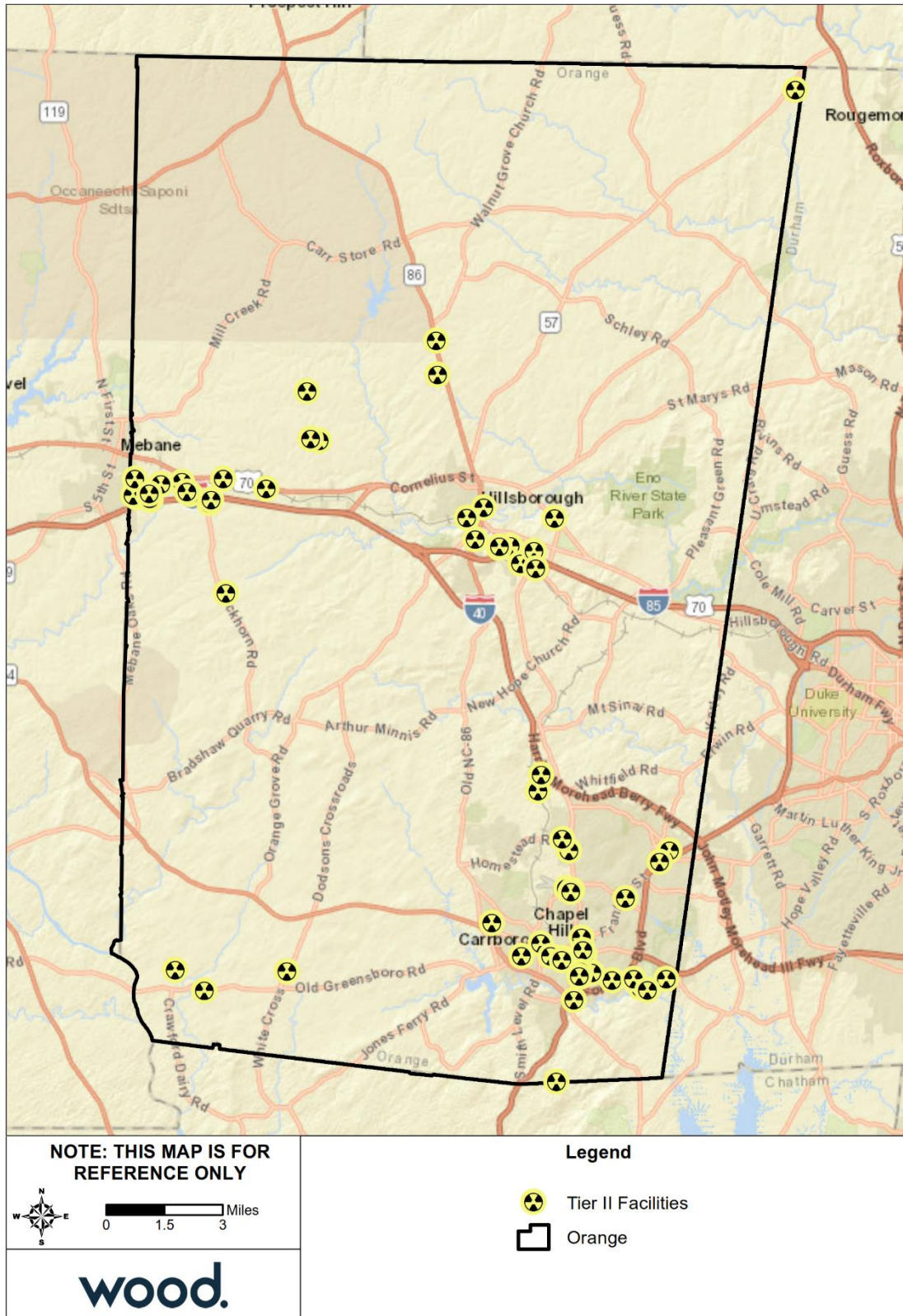
Figure 4.43 – Toxic Release Inventory Sites in Person County



Source: EPA Toxic Release Inventory



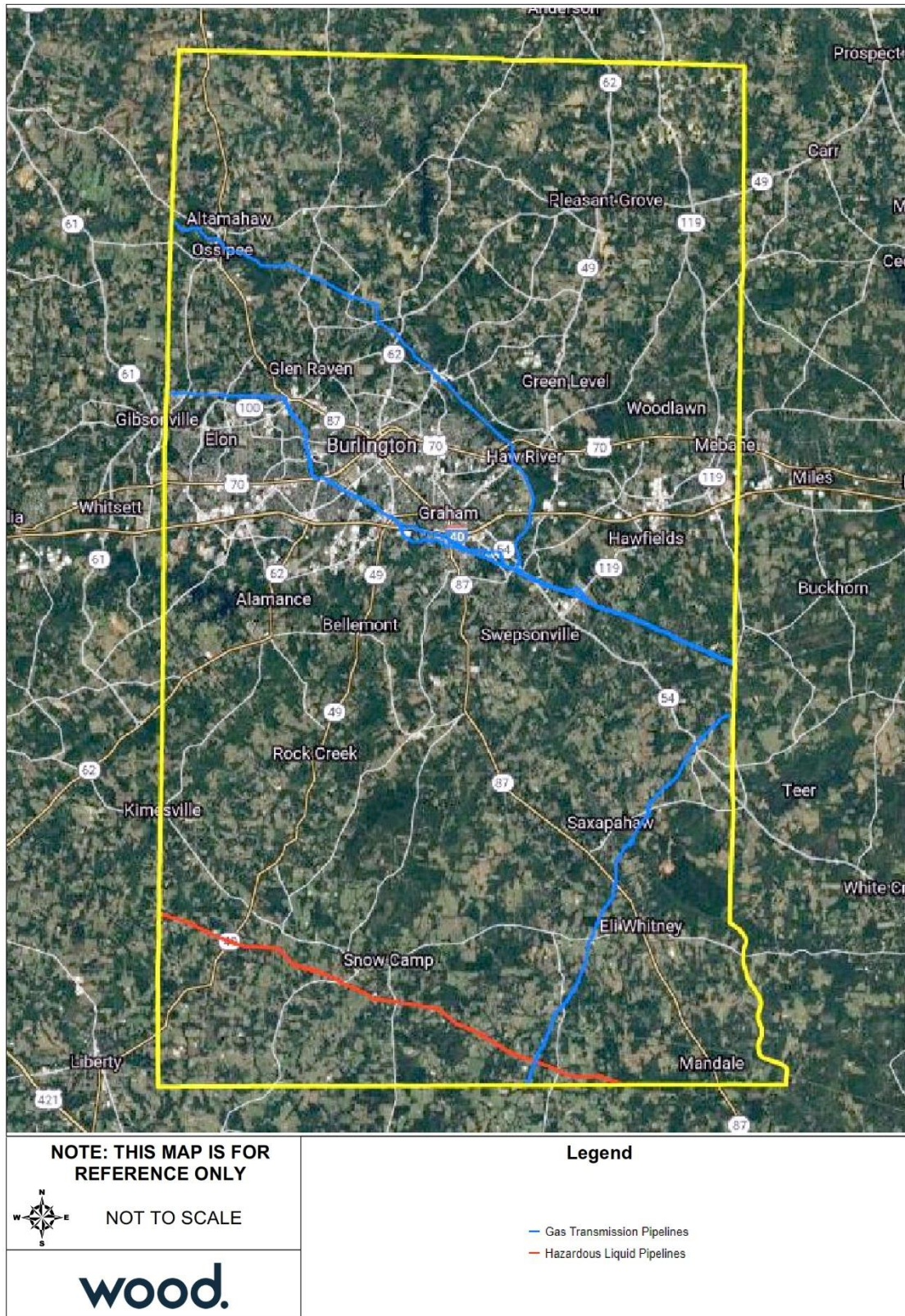
Figure 4.44 – Tier II Sites, Orange County



Source: EPA Toxic Release Inventory



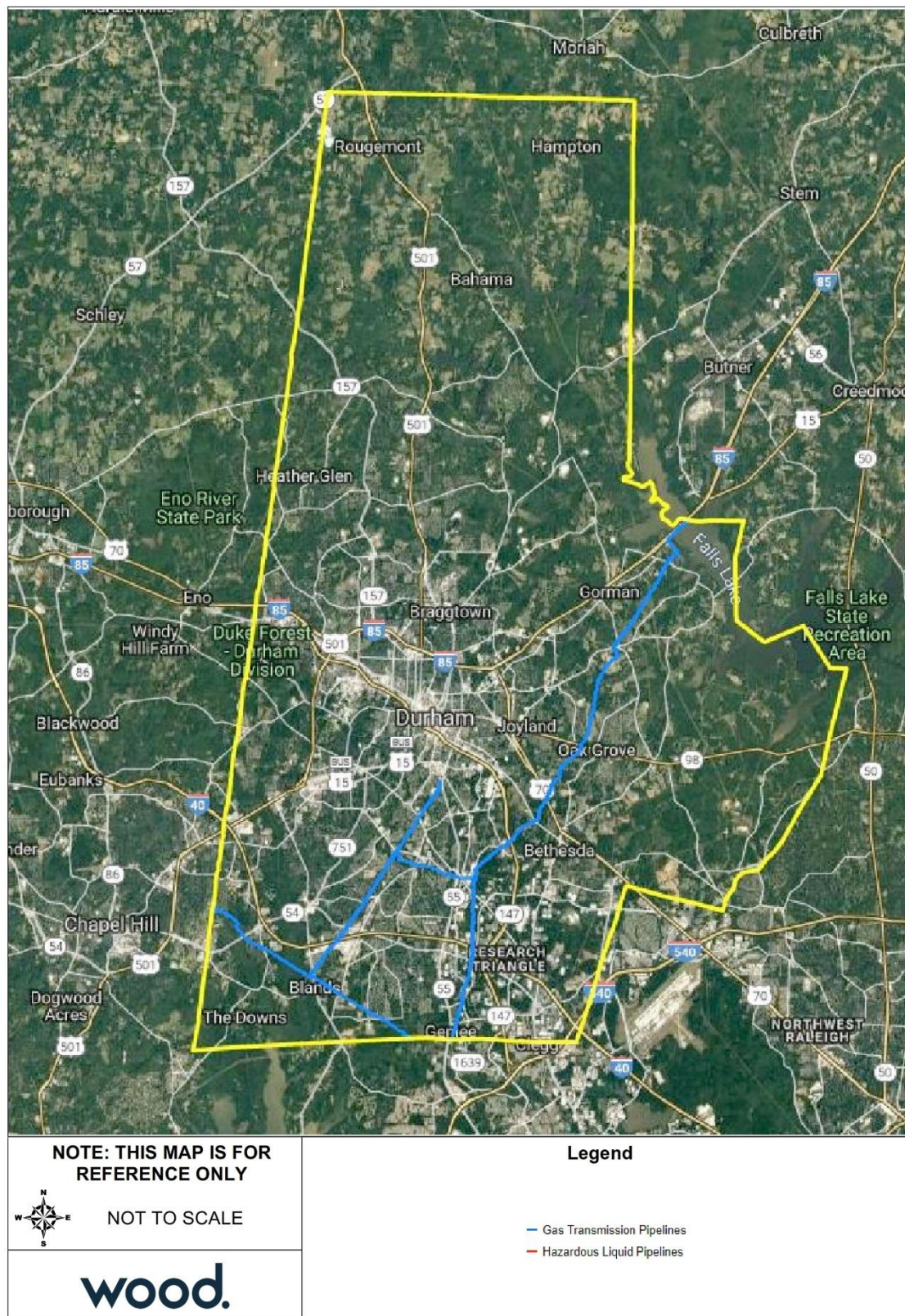
Figure 4.45 – Pipelines and Pipeline Infrastructure in Alamance County



Source: US Department of Transportation, Pipeline and Hazardous Materials Safety Administration, National Pipeline Mapping System



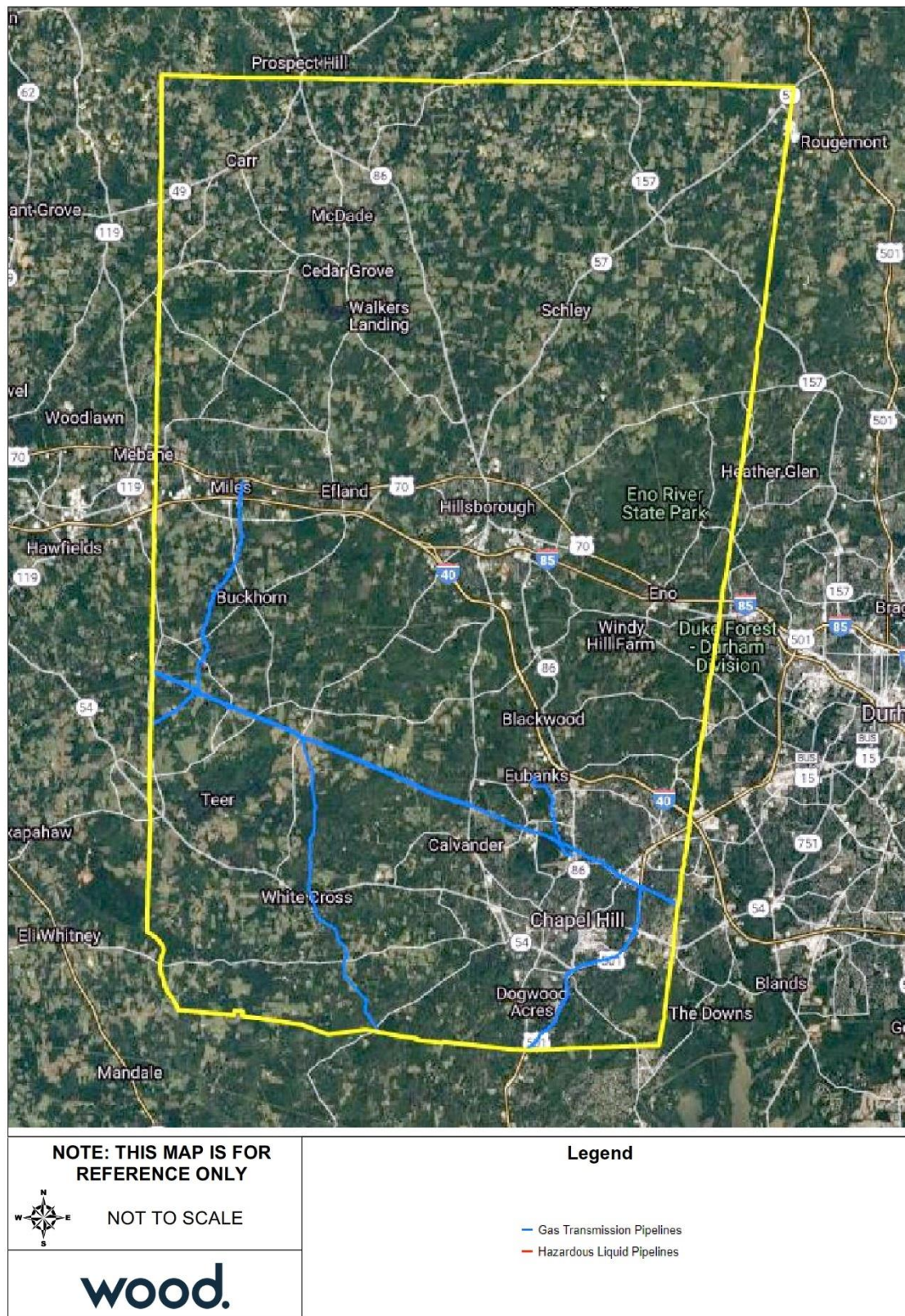
Figure 4.46 – Pipelines and Pipeline Infrastructure in Durham County



Source: US Department of Transportation, Pipeline and Hazardous Materials Safety Administration, National Pipeline Mapping System



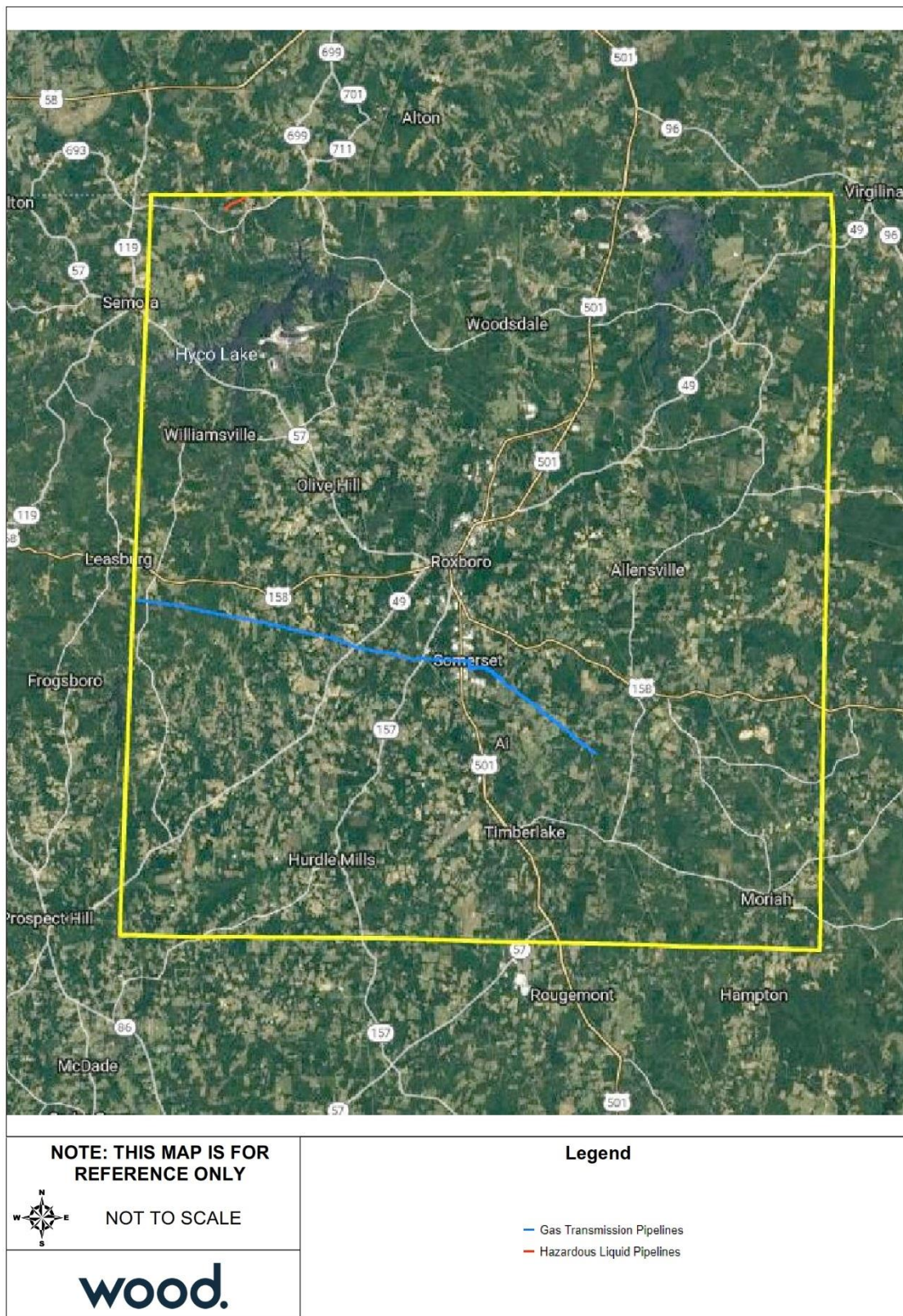
Figure 4.47 – Pipelines and Pipeline Infrastructure in Orange County



Source: US Department of Transportation, Pipeline and Hazardous Materials Safety Administration, National Pipeline Mapping System



Figure 4.48 – Pipelines and Pipeline Infrastructure in Person County



Source: US Department of Transportation, Pipeline and Hazardous Materials Safety Administration, National Pipeline Mapping System

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### Extent

The magnitude of a hazardous materials incident can be defined by the material type, the amount released, and the location of the release. The U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA), which records hazardous material incidents across the country, defines a “serious incident” as 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.

*Impact: 1 – Minor*

*Spatial Extent: 1 – Negligible*

### Historical Occurrences

The Eno-Haw Region experiences several hazardous materials incidents every year. The National Response Center (NRC), operated by the U.S. Coast Guard as part of the National Response System, maintains a database of reported oil, chemical, radiological, biological and etiological discharges into the environment, anywhere in the United States and its territories. NRC records list 510 hazardous materials incidents in the four counties of the Eno-Haw Region from 1990 through 2018. 48% of those incidents were in Durham County, with 24% in Alamance County and 14% each in Orange and Person Counties.

**Table 4.111 – Reported Hazardous Materials Incidents by County 1990-2018**

Year	Region	Alamance	Durham	Orange	Person
1990	9	4	4	1	0
1991	12	3	5	4	0
1992	20	8	8	2	2
1993	11	1	5	1	4
1994	19	8	3	3	5
1995	8	2	2	2	2
1996	25	4	10	3	8
1997	16	4	6	3	3
1998	18	3	13	0	2
1999	17	7	5	1	4
2000	34	12	13	5	4
2001	20	3	13	3	1
2002	34	3	22	5	4
2003	28	2	11	12	3
2004	13	5	5	0	3
2005	10	3	4	2	1
2006	18	2	12	2	2
2007	15	3	7	1	4

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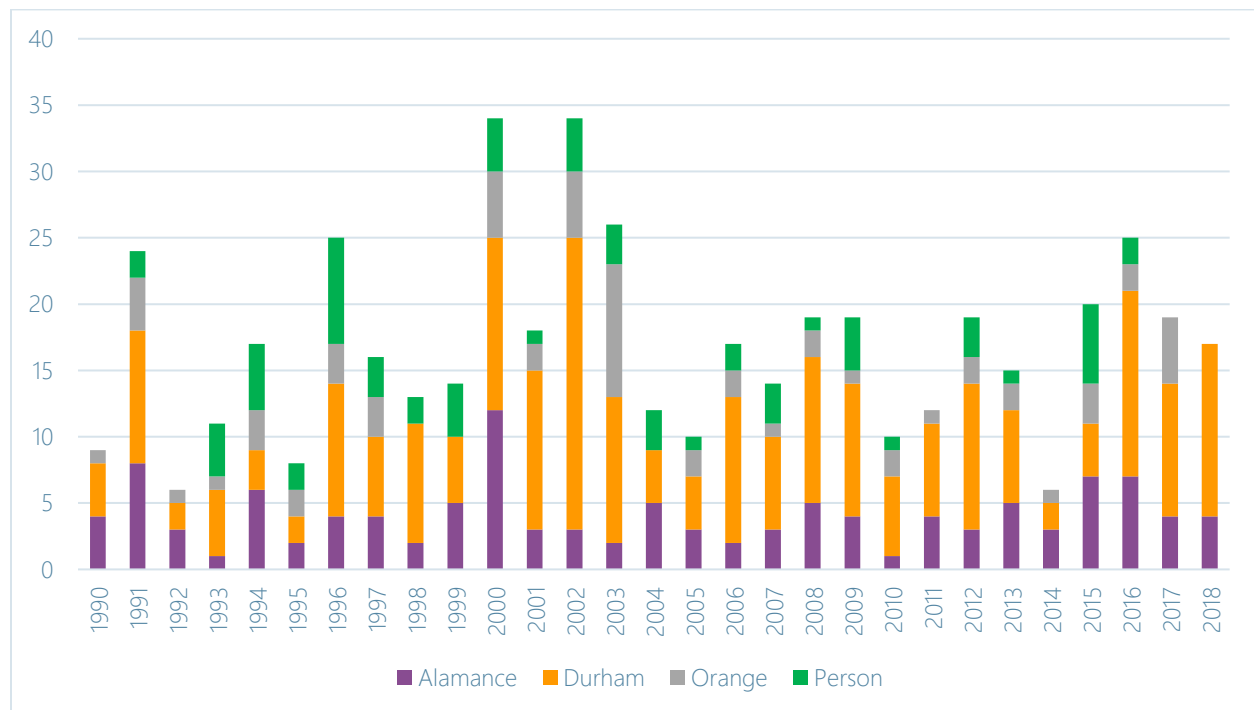
Year	Region	Alamance	Durham	Orange	Person
2008	19	5	11	2	1
2009	21	5	10	2	4
2010	11	2	6	2	1
2011	13	4	7	2	0
2012	22	4	13	2	3
2013	15	5	7	2	1
2014	14	4	9	1	0
2015	20	7	4	3	6
2016	15	4	7	2	2
2017	15	3	10	2	0
2018	18	4	14	6	0
<b>Total</b>	<b>510</b>	<b>124</b>	<b>246</b>	<b>70</b>	<b>70</b>
<b>Avg/Year</b>	<b>18</b>	<b>4</b>	<b>8</b>	<b>2</b>	<b>2</b>

Source: USCG National Response Center <http://nrc.uscg.mil/>

Note that these numbers only capture incidents reported to the NRC, and likely excludes a number of minor spills.

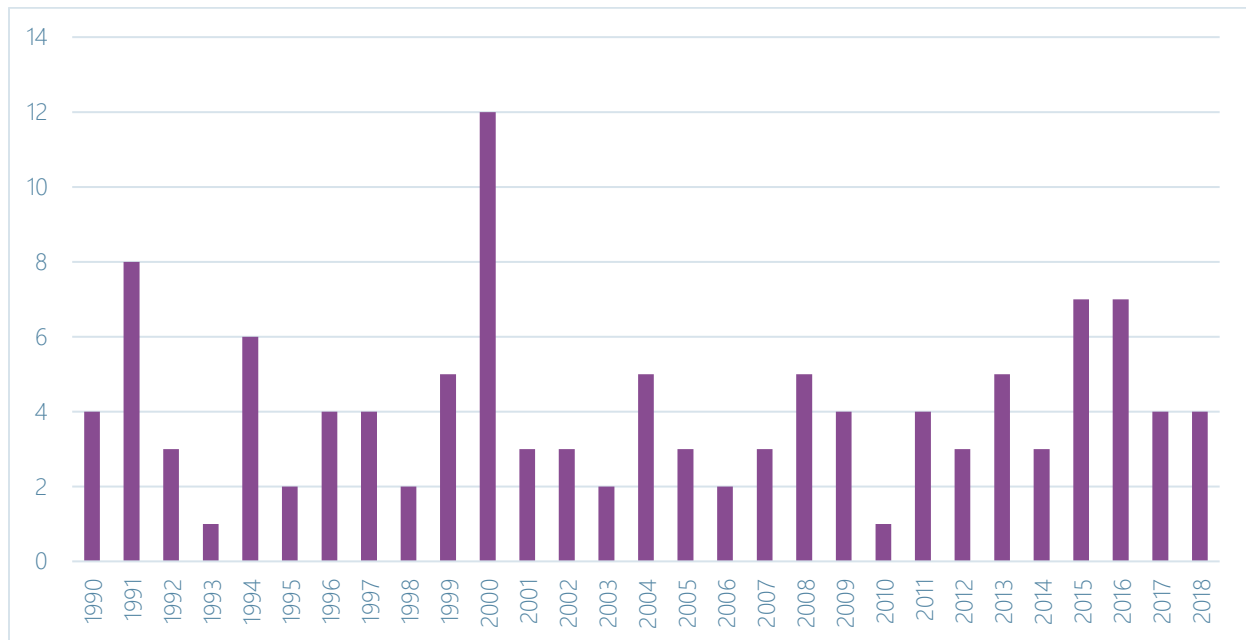
As the following figures show, the number of reported hazardous materials incidents varies greatly from year to year. During the 1990s the Region averaged approximately 16 hazardous materials a year. During the 2000s, that number increased to an average of 21 incidents a year, driven largely by an increase in Durham County. However, the 2010s so far have seen the number of reported hazardous materials decline back to an average of 16 per year.

**Figure 4.49 – Reported Hazardous Materials Incidents by Year 1990-2018**



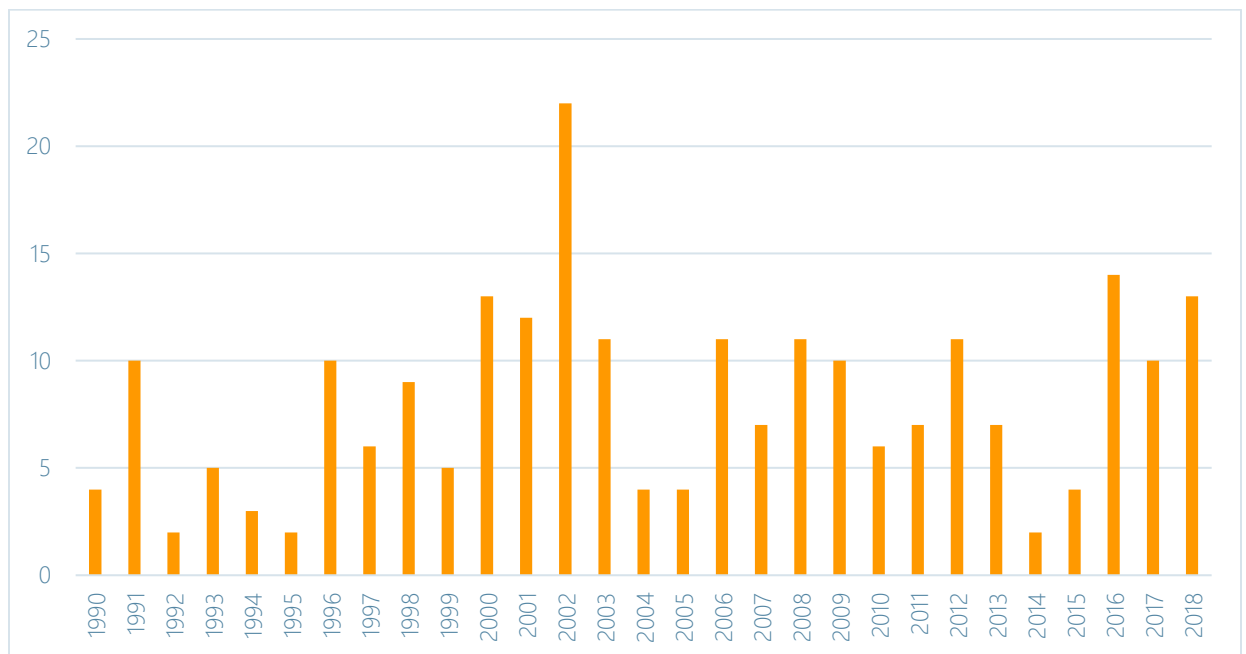
Source: USCG National Response Center <http://nrc.uscg.mil/>

**Figure 4.50 – Reported Hazardous Materials Incidents in Alamance County 1990-2018**



Source: USCG National Response Center <http://nrc.uscg.mil/>

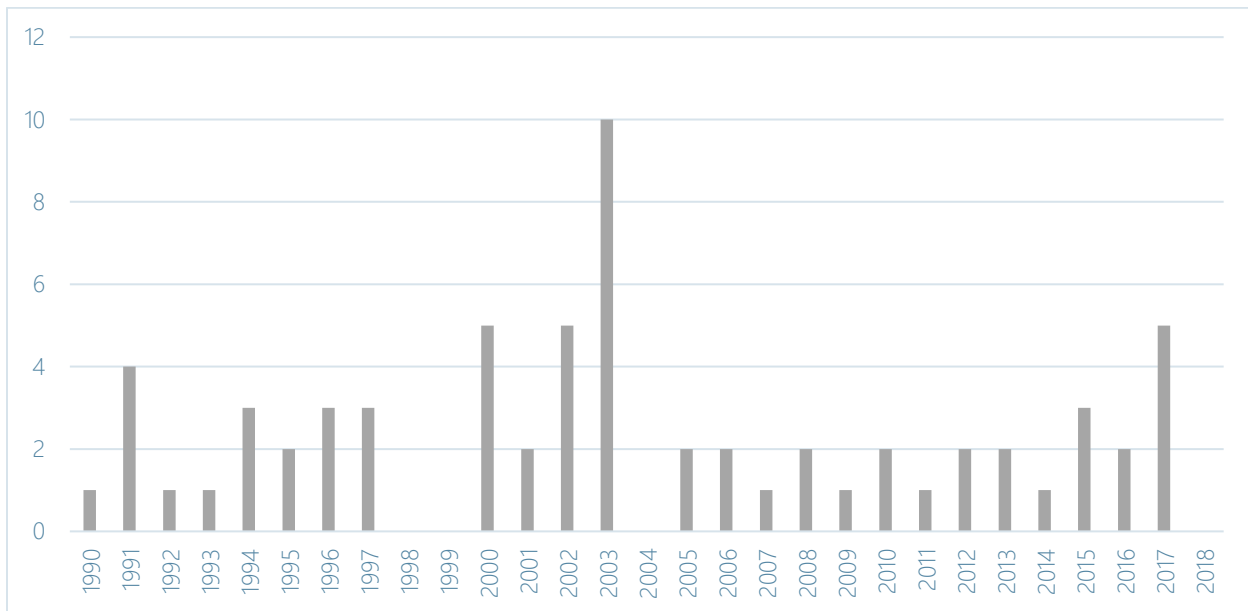
**Figure 4.51 – Reported Hazardous Materials Incidents in Durham County 1990-2018**



Source: USCG National Response Center <http://nrc.uscg.mil/>

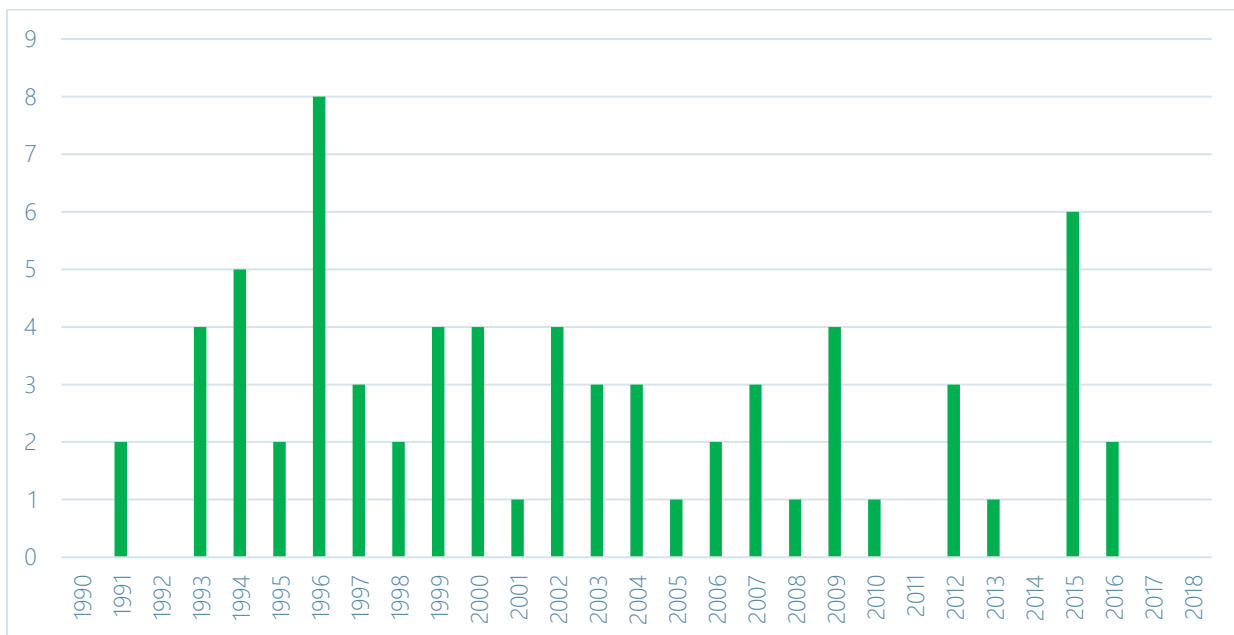


**Figure 4.52 – Reported Hazardous Materials Incidents in Orange County 1990-2018**



Source: USCG National Response Center <http://nrc.uscg.mil/>

**Figure 4.53 – Reported Hazardous Materials Incidents in Person County 1990-2018**



Source: USCG National Response Center <http://nrc.uscg.mil/>

The vast majority of these hazardous materials incidents were relatively minor with only minimal, localized impacts. Of the 510 incidents reported to the NRC from 1990 through 2018, only 41 (8%) resulted in any injuries, fatalities, or property damage; an additional 5 incidents (1%) led to evacuations but did not cause any injuries, fatalities, or property damage. The NRC records record 9 fatalities, 33 injuries (20 of which required hospitalization), 225 people evacuated, and \$690,000 in property damage resulting from those incidents. However, it should be noted that not all of these injuries, fatalities, or damages

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came from exposure to hazardous materials; many were likely the result of whatever physical accident or event caused the release.

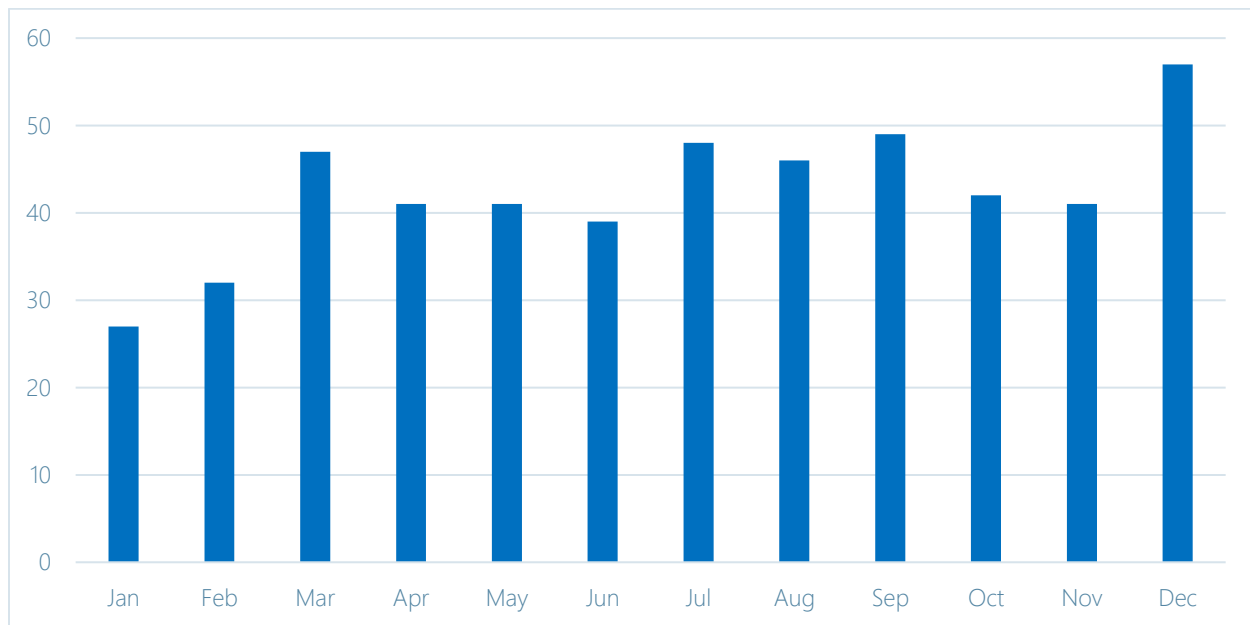
**Table 4.112 – Damaging Hazardous Materials Incidents 1990-2018**

	# of Incidents	# of Individuals	Damages
Fatalities	6	9	
Injuries	28	33	
Hospitalizations	20	20	
Evacuations	14	225	
Damage	6		\$690,000

Source: USCG National Response Center <http://nrc.uscg.mil/>

Hazardous materials incidents can happen in any month. NRC records show that they are most common in December, are least common in January and February, and are relatively consistent March through November. Most incidents occur during daylight hours, particularly during morning and noon rush hour.

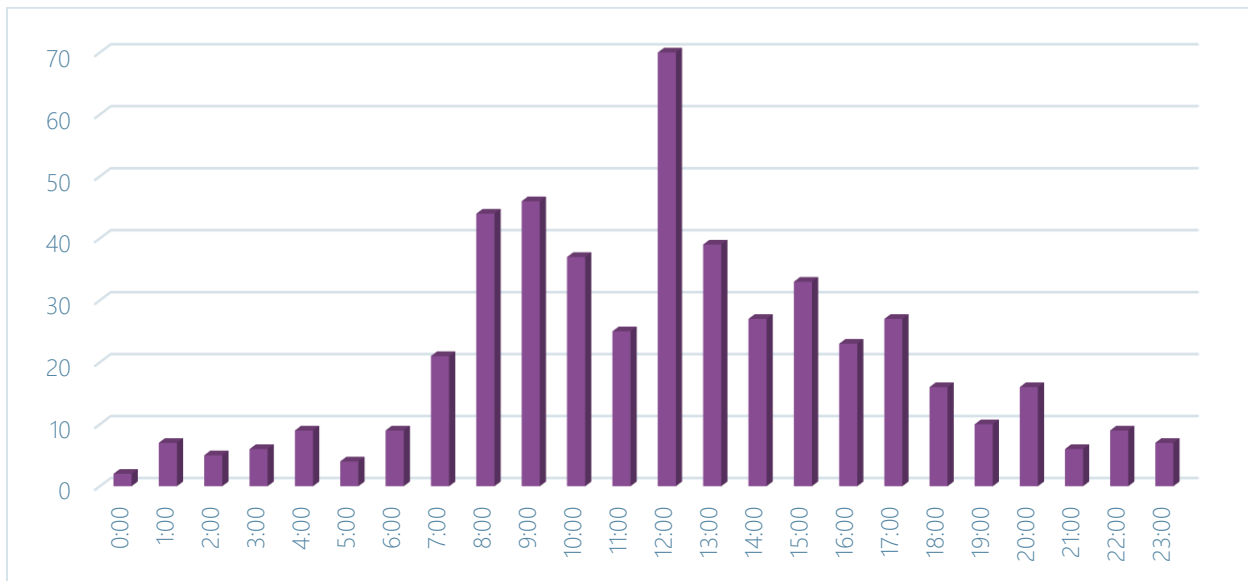
**Figure 4.54 – Reported Hazardous Materials Incidents by Month 1990-2018**



Source: USCG National Response Center <http://nrc.uscg.mil/>

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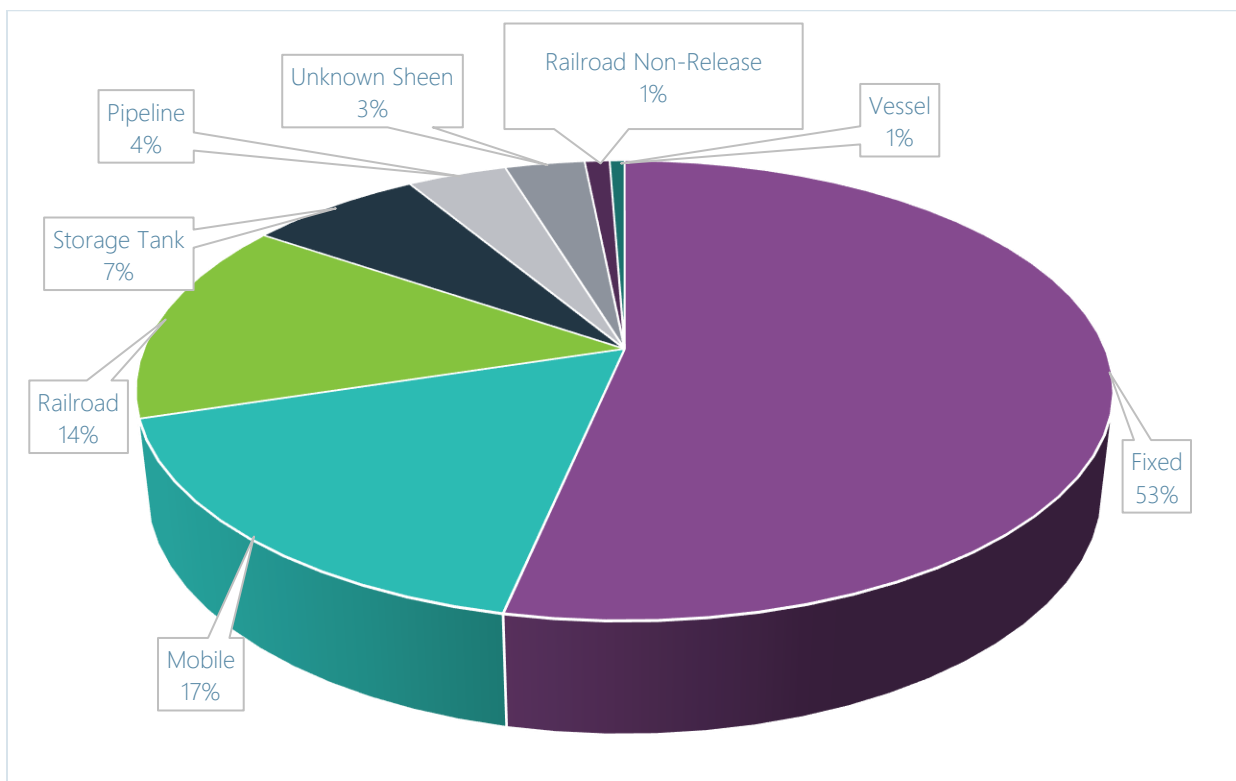
Figure 4.55 – Reported Hazardous Materials Incidents by Time Of Day 1990-2018



Source: USCG National Response Center <http://nrc.uscg.mil/>

As shown below, 60% of reported incidents take place at fixed facilities and storage tanks, while 33% take place during transportation (truck, railroad or water vessel), and 4% from pipelines.

Figure 4.56 – Reported Hazardous Materials Incidents by Type 1990-2018



Source: USCG National Response Center <http://nrc.uscg.mil/>

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### Probability of Future Occurrence

Based on historical occurrences recorded by the NRC, there have been 510 hazardous materials incidents reported in the Region from 1990 through 2018, an average of 18 a year. Thus, there is effectively a 100% chance that the Region will experience an incident in any given month.

However, as noted above 92% of those incidents have only minor, localized impacts. Only 46 incidents resulted in injuries, fatalities, property damage, or evacuations. That equates to an average of 1.6 damaging incidents occurring in the Region every year. The probability of a hazardous materials incident is the highest in Durham County, and lowest in Orange and Person Counties.

*Probability: 3 – Likely*

### Vulnerability Assessment

#### People

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People near facilities storing or transporting hazardous materials are at higher risk of exposure to a release incident. Additionally, any individuals working with or transporting hazardous materials are also at heightened risk. Depending on the materials, they may pose certain health hazards. If hazardous materials contaminate soils or water supply, people may be at risk of exposure through food or water.

#### Property

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The property impacts of a fixed hazardous facility, such as a chemical processing facility is typically localized to the property where the incident occurs. The impact of a small spill (i.e. liquid spill) may also be limited to the extent of the spill and remediated if needed. While cleanup costs from major spills can be significant, they do not typically cause significant long-term impacts to property.

Impacts of hazardous material incidents on critical facilities are most often limited to the area or facility where they occurred, such as at a transit station, airport, fire station, hospital, or railroad. However, they can cause long-term traffic delays and road closures resulting in major delays in the movement of goods and services. These impacts can spread beyond the planning area to affect neighboring counties, or vice-versa. While cleanup costs from major spills can be significant, they do not typically cause significant long-term impacts to critical facilities.

#### Environment

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Hazardous material incidents may affect a small area at a regulated facility or cover a large area outside such a facility. Widespread effects occur when hazards contaminate the groundwater and eventually the municipal water supply, or they migrate to a major waterway or aquifer. Impacts on wildlife and natural resources can also be significant.

#### Consequence Analysis

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Table 4.116 summarizes the potential detrimental consequences of hazardous materials incident.

**Table 4.113 – Consequence Analysis – Hazardous Materials Incident**

Category	Consequences
Public	Contact with hazardous materials could cause serious illness or death. Those living and working closest to hazardous materials sites face the greatest risk of exposure. Exposure may also occur through contamination of food or water supplies.
Responders	Responders face similar risks as the general public but a heightened potential for exposure to hazardous materials.

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Category	Consequences
Continuity of Operations (including Continued Delivery of Services)	A hazardous materials incident may cause temporary road closures or other localized impacts but is unlikely to affect continuity of operations.
Property, Facilities and Infrastructure	Some hazardous materials are flammable, explosive, and/or corrosive, which could result in structural damages to property. Impacts would be highly localized.
Environment	Consequences depend on the type of material released. Possible ecological impacts include loss of wildlife, loss of habitat, and degradation of air and/or water quality.
Economic Condition of the Jurisdiction	Clean up, remediation, and/or litigation costs may apply. Long-term economic damage is unlikely.
Public Confidence in the Jurisdiction's Governance	A hazardous materials incident may affect public confidence if the environmental or health impacts are enduring.

## 4.5.16 Infectious Disease

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Infectious Disease	Possible	Critical	Large	More than 24 hrs	More than 1 week	2.8

## Hazard Background

Public health emergencies can take many forms—disease epidemics, large-scale incidents of food or water contamination, or extended periods without adequate water and sewer services. There can also be harmful exposure to chemical, radiological, or biological agents, and largescale infestations of disease-carrying insects or rodents. The first part of this section focuses on emerging public health concerns and potential pandemics, while the second part addresses natural and human-caused air and water pollution.

Public health emergencies can occur as primary events by themselves, or they may be secondary to another disaster or emergency, such as tornado, flood, or hazardous material incident. For more information on those particular incidents, see Sections 4.5.10 (Tornado), 4.5.5 (Flood), and 4.5.15 (Hazardous Materials). The common characteristic of most public health emergencies is that they adversely impact, or have the potential to adversely impact, a large number of people. Public health emergencies can be worldwide or localized in scope and magnitude.

The primary communicable, or infectious, disease addressed within this plan is influenza:

**Influenza** - Whether natural or manmade, health officials say the threat of a dangerous new strain of influenza (flu) virus in pandemic proportions is a very real possibility in the years ahead. Unlike most illnesses, the flu is especially dangerous because it is spread through the air. A classic definition of influenza is a respiratory infection with fever. Each year, flu infects humans and spreads around the globe. There are three types of influenza virus: Types A, B, and C. Type A is the most common, most severe, and the primary cause of flu epidemics. Type B cases occur sporadically and sometimes as regional or widespread epidemics. Type C cases are quite rare and hence sporadic, but localized outbreaks have occurred. Seasonal influenza usually is treatable, and the mortality rate remains low. Each year, scientists estimate which particular strain of flu is likely to spread, and they create a vaccine to combat it. A flu pandemic occurs when the virus suddenly changes or mutates and undergoes an —antigenic shift, permitting it to attach to a person’s respiratory system and leave the body’s immune system defenseless against the invader.

Additional diseases of public health concern include tuberculosis, Smallpox, St. Louis Encephalitis, Meningitis, Lyme disease, West Nile, SARS, Zika, and Ebola. These communicable diseases are introduced within this plan, but full vulnerability analyses are not included at this time.

**Tuberculosis** - Tuberculosis, or TB, is the leading cause of infectious disease worldwide. It is caused by a bacteria called *Mycobacterium tuberculosis* that most often affects the lungs. TB is an airborne disease spread by coughing or sneezing from one person to another. The World Health Organization (WHO) estimates that one-third of the world's population, approximately two billion people, has latent TB, which means people have been infected by TB bacteria but are not yet ill with the disease and cannot transmit the disease. In 2015, 10.4 million people fell ill with TB and 1.8 million died from the disease (including 0.4 million among people with HIV). Over 95% of TB deaths occur in low- and middle- income countries.

**Smallpox** - Smallpox is a contagious, sometimes fatal, infectious disease. There is no specific treatment for smallpox disease, and the only prevention is vaccination. Smallpox is caused by the variola virus that emerged in human populations thousands of years ago. It is generally spread by face- to-face contact or by direct contact with infected bodily fluids or contaminated objects (such as bedding or clothing). A person with smallpox is sometimes contagious with onset of fever, but the person becomes most



contagious with the onset of rash. The rash typically develops into sores that spread over all parts of the body. The infected person remains contagious until the last smallpox scab is gone. Smallpox outbreaks have occurred periodically for thousands of years, but the disease is now largely eradicated after a worldwide vaccination program was implemented. After the disease was eliminated, routine vaccination among the general public was stopped. The last case of smallpox in the United States was in 1949.

**St. Louis Encephalitis** - In the United States, the leading type of epidemic flaviviral Encephalitis is St. Louis encephalitis (SLE), which is transmitted by mosquitoes that become infected by feeding on birds infected with the virus. SLE is the most common mosquito-transmitted pathogen in the United States. There is no evidence to suggest that the virus can be spread from person to person.

**Meningitis**- Meningitis is an infection of fluid that surrounds a person's spinal cord and brain. High fever, headache, and stiff neck are common symptoms of meningitis, which can develop between several hours to one to two days after exposure. Meningitis can be caused by either a viral or bacterial infection; however, a correct diagnosis is critically important, because treatments for the two varieties differ. Meningitis is transmitted through direct contact with respiratory secretions from an infected carrier. Primary risk groups include infants and young children, household contact with patients, and refugees. In the United States, periodic outbreaks continue to occur, particularly among adolescents and young adults. About 2,600 people in the United States get the disease each year. Generally, 10 to 14 percent of cases are fatal, and 11 to 19 percent of those who recover suffer from permanent hearing loss, mental retardation, loss of limbs, or other serious effects. Two vaccines are available in the United States.

**Lyme Disease** - Lyme disease was named after the town of Lyme, Connecticut, where an unusually large frequency of arthritis-like symptoms was observed in children in 1977. It was later found that the problem was caused by bacteria transmitted to humans by infected deer ticks, causing an average of more than 16,000 reported infections in the United States each year (however, the disease is greatly under-reported). Lyme disease bacteria are not transmitted from person to person. Following a tick bite, 80 percent of patients develop a red —bull's-eye|| rash accompanied by tiredness, fever, headache, stiff neck, muscle aches, and joint pain. If untreated, some patients may develop arthritis, neurological abnormalities, and cardiac problems, weeks to months later. Environmental issues addressed in this profile focus on air and water pollution, because contamination of those media can have widespread impacts on public health and devastating consequences. Particular issues of primary concern associated with sources of air and water pollution change over time depending on recent industrial activity, economic development, enforcement of environmental regulations, new scientific information on adverse health effects of particular contaminants or concentrations, and other factors. Lyme disease is rarely fatal. During early stages of the disease, oral antibiotic treatment is generally effective, while intravenous treatment may be required in more severe cases.

**West Nile Virus** - West Nile virus is a flavivirus spread by infected mosquitoes and is commonly found in Africa, West Asia, and the Middle East. It was first documented in the United States in 1999. Although it is not known where the U.S. virus originated, it most closely resembles strains found in the Middle East. It is closely related to St. Louis encephalitis and can infect humans, birds, mosquitoes, horses, and other mammals.

Most people who become infected with West Nile virus will have either no symptoms or only mild effects. However, on rare occasions, the infection can result in severe and sometimes fatal illness. There is no evidence to suggest that the virus can be spread from person to person.

An abundance of dead birds in an area may indicate that West Nile virus is circulating between the birds and mosquitoes in that area. Although birds are particularly susceptible to the virus, most infected birds

survive. The continued expansion of West Nile virus in the United States indicates that it is permanently established in the Western Hemisphere.

**Severe Acute Respiratory Syndrome** - Severe acute respiratory syndrome (SARS) is a respiratory illness that has recently been reported in Asia, North America, and Europe. Although the cause of SARS is currently unknown, scientists have detected in SARS patients a previously unrecognized coronavirus that appears to be a likely source of the illness. In general, humans infected with SARS exhibit fevers greater than 100.4 F, headaches, an overall feeling of discomfort, and body aches. Some people also experience mild respiratory symptoms. After two to seven days, SARS patients may develop a dry cough and have trouble breathing. The primary way that SARS appears to spread is by close person-to-person contact; particularly by an infected person coughing or sneezing contaminated droplets onto another person, with a transfer of those droplets to the victim's eyes, nose, or mouth.

**Zika Virus** - Discovered in the Zika forest of Uganda in 1947, the Zika virus is a member of the flavivirus family. It is transmitted to humans through the bite of an infected *Aedes* species mosquito (*Ae. aegypti* and *Ae. albopictus*). Zika virus can also be transmitted from an infected pregnant woman to her baby during pregnancy and can result in serious birth defects, including microcephaly. Less commonly, the virus can be spread through intercourse or blood transfusion. However, most people infected with the Zika virus do not become sick.

**Ebola** - previously known as Ebola hemorrhagic fever, is a rare and deadly disease caused by infection with one of the Ebola virus species. It was first discovered in 1976 near the Ebola River in what is now the Democratic Republic of the Congo. Since then, outbreaks have appeared sporadically in Africa.

Additional environmental concerns addressed in this hazard profile focus on air and water pollution, because contamination of those media can have widespread impacts on public health and devastating consequences. Particular issues of primary concern associated with sources of air and water pollution change over time depending on recent industrial activity, economic development, enforcement of environmental regulations, new scientific information on adverse health effects of particular contaminants or concentrations, and other factors.

*Warning Time: 1 – More than 24 hours*

*Duration: 4 – More than one week*

### Location

Infectious disease outbreaks can occur anywhere in the planning area, especially where there are groups of people in close quarters.

### Extent

When on an epidemic scale, diseases can lead to high infection rates in the population causing isolation, quarantine, and potential mass fatalities. An especially severe influenza pandemic or other major disease outbreak could lead to high levels of illness, death, social disruption, and economic loss. Impacts could range from school and business closings to the interruption of basic services such as public transportation, health care, and the delivery of food and essential medicines.

Table 4.114 describes the World Health Organization's six main phases to a pandemic flu as part of their planning guidance.

**Table 4.114 – World Health Organization's Pandemic Flu Phases**

Phase	Description
1	No animal influenza virus circulating among animals have been reported to cause infection in humans.
2	An animal influenza virus circulating in domesticated or wild animals is known to have caused infection in humans and is therefore considered a specific potential pandemic threat.
3	An animal or human-animal influenza reassortant virus has caused sporadic cases or small clusters of disease in people, but has not resulted in human-to-human transmission sufficient to sustain community-level breakouts.
4	Human-to-human transmission of an animal or human-animal influenza reassortant virus able to sustain community-level breakouts has been verified.
5	The same identified virus has caused sustained community-level outbreaks in two or more countries in one WHO region.
6	In addition to the criteria defined in Phase 5, the same virus has caused sustained community-level outbreaks in at least one other country in another WHO region.
Post-Peak Period	Levels of pandemic influenza in most countries with adequate surveillance have dropped below peak levels.
Post-Pandemic Period	Levels of influenza activity have returned to levels seen for seasonal influenza in most countries with adequate surveillance.

Source: World Health Organization

*Impact: 3 – Critical*

*Spatial Extent: 4 – Large*

Historical Occurrences

#### Public Health Emergencies – Influenza Pandemics

Since the early 1900s, four lethal pandemics have swept the globe: Spanish Flu of 1918-1919; Asian Flu of 1957-1958; Hong Kong Flu of 1968-1969; and Swine Flu of 2009-2010. The Spanish Flu was the most severe pandemic in recent history. The number of deaths was estimated to be 50-100 million worldwide and 675,000 in the United States. Its primary victims were mostly young, healthy adults. The 1957 Asian Flu pandemic killed about 70,000 people in the United States, mostly the elderly and chronically ill. The 1968 Hong Kong Flu pandemic killed 34,000 Americans. The 2009 Swine Flu caused 12,469 deaths in the United States. These historic pandemics are further defined in the following paragraphs along with several “pandemic scares”.

#### *Spanish Flu (H1N1 virus) of 1918-1919*

In 1918, when World War I was in its fourth year, another threat began that rivaled the war itself as the greatest killer in human history. The Spanish Flu swept the world in three waves during a two-year period, beginning in March 1918 with a relatively mild assault.

The first reported case occurred at Camp Funston (Fort Riley), Kansas, where 60,000 soldiers trained to be deployed overseas. Within four months, the virus traversed the globe, as American soldiers brought the virus to Europe. The first wave sickened thousands of people and caused many deaths (46 died at Camp Funston), but it was considered mild compared to what was to come. The second and deadliest wave struck in the autumn of 1918 and killed millions. At Camp Funston alone, there were 14,000 cases and 861 deaths reported during the first three weeks of October 1918.

Outbreaks caused by a new variant exploded almost simultaneously in many locations including France, Sierra Leone, Boston, and New York City, where more than 20,000 people died that fall. The flu gained its

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name from Spain, which was one of the hardest hit countries. From there, the flu went through the Middle East and around the world, eventually returning to the United States along with the troops.

Of the 57,000 Americans who died in World War I, 43,000 died as a result of the Spanish Flu. At one point, more than 10 percent of the American workforce was bedridden. By a conservative estimate, a fifth of the human race suffered the fever and aches of influenza between 1918 and 1919 and 20 million people died. At the height of the flu outbreak during the winter of 1918-1919, at least 20% of North Carolinians were infected by the disease. Ultimately, 10,000 citizens of the state succumbed to this disease.

### *Asian Flu (H2N2 virus) of 1957-1958*

This influenza pandemic was first identified in February 1957 in the Far East. Unlike the Spanish Flu, the 1957 virus was quickly identified, and vaccine production began in May 1957. A number of small outbreaks occurred in the United States during the summer of 1957, with infection rates highest among school children, young adults, and pregnant women; however, the elderly had the highest rates of death. A second wave of infections occurred early the following year, which is typical of many pandemics.

### *Hong Kong Flu (H3N2 virus) of 1968-1969*

This influenza pandemic was first detected in early 1968 in Hong Kong. The first cases in the United States were detected in September 1968, although widespread illness did not occur until December. This became the mildest pandemic of the twentieth century, with those over the age of 65 the most likely to die. People infected earlier by the Asian Flu virus may have developed some immunity against the Hong Kong Flu virus. Also, this pandemic peaked during school holidays in December, limiting student-related infections.

### *Pandemic Flu Threats: Swine Flu of 1976, Russian Flu of 1977, and Avian Flu of 1997 and 1999*

Three notable flu scares occurred in the twentieth century. In 1976, a swine-type influenza virus appeared in a U.S. military barracks (Fort Dix, New Jersey). Scientists determined it was an antigenically drifted variant of the feared 1918 virus. Fortunately, a pandemic never materialized, although the news media made a significant argument about the need for a Swine Flu vaccine.

In May 1977, influenza viruses in northern China spread rapidly and caused epidemic disease in children and young adults. By January 1978, the virus, subsequently known as the Russian Flu, had spread around the world, including the United States. A vaccine was developed for the virus for the 1978–1979 flu season. Because illness occurred primarily in children, this was not considered a true pandemic.

In March 1997, scores of chickens in Hong Kong's rural New Territories began to die—6,800 on three farms alone. The Avian Flu virus was especially virulent, and made an unusual jump from chickens to humans. At least 18 people were infected, and six died in the outbreak. Chinese authorities acted quickly to exterminate over one million chickens and successfully prevented further spread of the disease. In 1999, a new avian flu virus appeared. The new virus caused illness in two children in Hong Kong. Neither of these avian flu viruses started pandemics.

### *Swine Flu (H1N1 virus) of 2009–2010*

This influenza pandemic emerged from Mexico in 2009. The first U.S. case of H1N1, or Swine Flu, was diagnosed on April 15, 2009. The U.S. government declared H1N1 a public health emergency on April 26. By June, approximately 18,000 cases of H1N1 had been reported in the United States. A total of 74 countries were affected by the pandemic.

The CDC estimates that 43 million to 89 million people were infected with H1N1 between April 2009 and April 2010. There were an estimated 8,870 to 18,300 H1N1 related deaths. On August 10, 2010, the World Health Organization (WHO) declared an end to the global H1N1 flu pandemic.

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### Public Health Emergencies – Other Pandemics

#### *St. Louis Encephalitis, 1964-2005*

Between 1964 and 2005, there were 4,651 confirmed cases of SLE in the United States. Seventy-five of these cases were in Missouri. According to the U.S. Geological Survey, there was one case of SLE in Missouri in 2006. It should be noted, however, that less than 1 percent of SLE infections are clinically apparent, so the vast majority of infections remain undiagnosed. Illnesses range from mild headaches and fever to convulsions, coma, and paralysis. The last major outbreak of SLE occurred in the Midwest from 1974 to 1977, when over 2,500 cases were reported in 35 states. The most recent outbreak of St. Louis encephalitis was in 1999 in New Orleans, Louisiana, with 20 reported cases. The disease is generally milder in children than in adults, with the elderly at highest risk for severe illness and death. Approximately 3 to 30 percent of cases are fatal; no vaccine against SLE exists. In 2011, one probably case was reported in Boone County, MO.

#### *Meningitis, 1996-1997, 2005*

During 1996 and 1997, 213,658 cases of meningitis were reported, with 21,830 deaths, in Africa. According to the Missouri Department of Health and Senior Services, there were 28 cases in Missouri in 2005.

#### *Lyme Disease, 2015*

In the United States, Lyme disease is mostly found in the northeastern, mid-Atlantic, and upper north-central regions, and in several counties in northwestern California. In 2015, 95-percent of confirmed Lyme Disease cases were reported from 14 states: Connecticut, Delaware, Maine, Maryland, Massachusetts, Minnesota, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, and Wisconsin. Lyme disease is the most commonly reported vector-borne illness in the United States. In 2015, it was the sixth most common nationally notifiable disease. However this disease does not occur nationwide and is concentrated heavily in the northeast and upper Midwest.

#### *Severe Acute Respiratory Syndrome, 2003*

During November 2002-July 2003, a total of 8,098 probable SARS cases were reported to the World Health Organization (WHO) from 29 countries. In the United States, only 8 cases had laboratory evidence of infection. There were no confirmed cases in Missouri. Since July 2003, when SARS transmission was declared contained, active global surveillance for SARS disease has detected no person-to-person transmission. CDC has therefore archived the case report summaries for the 2003 outbreak. Across North Carolina, there was one confirmed SARS case – a man in Orange County tested positive in June 2003.

#### *Zika Virus, 2015*

In May 2015, the Pan American Health Organization issued an alert noting the first confirmed case of a Zika virus infection in Brazil. Since that time, Brazil and other Central and South America countries and territories, as well as the Caribbean, Puerto Rico, and the U.S. Virgin Islands have experienced ongoing Zika virus transmission. In August 2016, the Centers for Disease Control and Prevention (CDC) issued guidance for people living in or traveling to a 1-square-mile area Miami, Florida, identified by the Florida Department of Health as having mosquito-borne spread of Zika. In October 2016, the transmission area was expanded to include a 4.5-square-mile area of Miami Beach and a 1-square mile area of Miami-Dade County. In addition, all of Miami-Dade County was identified as a cautionary area with an unspecified level of risk. As of the end of 2018, the CDC reported 74 cases of Zika across the United States.

#### *Ebola, 2014-2016*

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In March 2014, West Africa experienced the largest outbreak of Ebola in history. Wide spread transmission was found in Liberia, Sierra Leone, and Guinea with the number of cases totaling 28,616 and the number of deaths totaling 11,310. In the United States, four cases of Ebola were confirmed in 2014 including a medical aid worker returning to New York from Guinea, two healthcare workers at Texas Presbyterian Hospital who provided care for a diagnosed patient, and the diagnosed patient who traveled to Dallas, Texas from Liberia. All three healthcare workers recovered. The diagnosed patient passed away in October 2014.

In March 2016, the WHO terminated the public health emergency for the Ebola outbreak in West Africa.

### *Coronavirus Disease (COVID-19), 2020*

During the update of this plan, the Coronavirus disease 2019, also known as COVID-19, outbreak became a worldwide pandemic. COVID-19 was caused by severe acute respiratory syndrome coronavirus 2 (SARS-Cov-2). First identified in Wuhan, China in December 2019, the virus quickly spread throughout China and then globally. As of May 5, 2020 there were over 3.5 million cases worldwide resulting in over 250,000 deaths. In the United States, COVID-19 was first identified in late January in Washington State and rapidly spread throughout the Country, with large epicenters on both the east and west coasts.

In order to curb the spread of the virus, Governor Roy Cooper issued a statewide Stay at Home Order on March 27, 2020. According to the North Carolina Department of Health and Human services, as of May 5, 2020, there were over 12,000 confirmed cases and 450 deaths across 99 of the 100 counties in the State. In the Eno-Haw region as of May 5, 2020, there were a total of 1,152 cases, 126 in Alamance, 773 in Durham, 230 in Orange, and 23 in Person. Additionally, there were 44 deaths in total, 3 in Alamance, 23 in Durham, 18 in Orange, and 1 in Person. Case counts are rising in North Carolina and the Eno-Haw region at the time of this assessment.

### *Probability of Future Occurrence*

It is impossible to predict when the next pandemic will occur or its impact. The CDC continually monitors and assesses pandemic threats and prepares for an influenza pandemic. Novel influenza A viruses with pandemic potential include Asian lineage avian influenza A (H5N1) and (H7N9) viruses. These viruses have all been evaluated using the Influenza Risk Assessment Tool (IRAT) to assess their potential pandemic risk. Because the CDC cannot predict how severe a future pandemic will be, advance planning is needed at the national, state and local level; this planning is done through public health partnerships at the national, state and local level.

Today, a much larger percentage of the world's population is clustered in cities, making them ideal breeding grounds for epidemics. Additionally, the explosive growth in air travel means the virus could literally be spread around the globe within hours. Under such conditions, there may be very little warning time. Most experts believe we will have just one to six months between the time that a dangerous new influenza strain is identified and the time that outbreaks begin to occur in the United States. Outbreaks are expected to occur simultaneously throughout much of the nation, preventing shifts in human and material resources that normally occur with other natural disasters. These and many other aspects make influenza pandemic unlike any other public health emergency or community disaster.

### *Probability: 2 – Possible*



### 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.

Hot days can be unhealthy—even dangerous. High air temperatures can cause heat stroke and dehydration, and affect people’s cardiovascular and nervous systems. Midwestern cities like St. Louis are vulnerable to heat waves, because many houses and apartments lack air conditioning, and urban areas are typically warmer than their rural surroundings. In recent decades, severe heat waves have killed hundreds of people across the Midwest. Heat stress is expected to increase as climate change brings hotter summer temperatures and more humidity. Certain people are especially vulnerable, including children, the elderly, the sick, and the poor.

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. Floodprone 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.

### Vulnerability Assessment

#### Methodologies and Assumptions

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Vulnerability to infectious disease was assessed based on past occurrences nationally and internationally as well as publicly available information on these vulnerabilities, as well as attacks occurring in the region.

#### People

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Disease spread and mortality is affected by a variety of factors, including virulence, ease of spread, aggressiveness of the virus and its symptoms, resistance to known antibiotics and environmental factors.

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While every pathogen is different, diseases normally have the highest mortality rate among the very young, the elderly or those with compromised immune systems. As an example, the unusually deadly 1918 H1N1 influenza pandemic had a mortality rate of 20%. If an influenza pandemic does occur, it is likely that many age groups would be seriously affected. The greatest risks of hospitalization and death—as seen during the last two pandemics in 1957 and 1968 as well as during annual outbreaks of influenza—will be to infants, the elderly, and those with underlying health conditions. However, in the 1918 pandemic, most deaths occurred in young adults. Few people, if any, would have immunity to a new virus.

Approximately twenty percent of people exposed to West Nile Virus through a mosquito bite develop symptoms related to the virus; it is not transmissible from one person to another. Preventive steps can be taken to reduce exposure to mosquitos carrying the virus; these include insect repellent, covering exposed skin with clothing and avoiding the outdoors during twilight periods of dawn and dusk, or in the evening when the mosquitos are most active.

### Property

For the most part, property itself would not be impacted by a human disease epidemic or pandemic. However, as concerns about contamination increase, property may be quarantined or destroyed as a precaution against spreading illness. Furthermore, staffing shortages could affect the function of critical facilities.

### Environment

A widespread pandemic would not have an impact on the natural environment unless the disease was transmissible between humans and animals. However, affected areas could result in denial or delays in the use of some areas, and may require remediation.

### Consequence Analysis

Table 4.115 summarizes the potential consequences of infectious disease.

**Table 4.115 – Consequence Analysis – Infectious Disease**

Category	Consequences
Public	Adverse impact expected to be severe for unprotected personnel and moderate to light for protected personnel.
Responders	Adverse impact expected to be severe for unprotected personnel and uncertain for trained and protected personnel, depending on the nature of the incident.
Continuity of Operations (including Continued Delivery of Services)	Danger to personnel in the area of the incident may require relocation of operations and lines of succession execution. Disruption of lines of communication and destruction of facilities may extensively postpone delivery of services.
Property, Facilities and Infrastructure	Access to facilities and infrastructure in the area of the incident may be denied until decontamination completed.
Environment	Incident may cause denial or delays in the use of some areas. Remediation needed.
Economic Condition of the Jurisdiction	Local economy and finances adversely affected, possibly for an extended period of time.
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.

**4.5.17 Radiological Emergency**

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Radiological Emergency	Unlikely	Catastrophic	Small	Less than 6 hrs	More than 1 week	2.7

**Hazard Background**

A radiological incident is an occurrence resulting in the release of radiological material at a fixed facility (such as power plants, hospitals, laboratories, etc.) or in transit.

Radiological incidents related to transportation are described as an incident resulting in a release of radioactive material during transportation. Transportation of radioactive materials through North Carolina over the interstate highway system is considered a radiological hazard. The transportation of radioactive material by any means of transport is licensed and regulated by the federal government. As a rule, there are two categories of radioactive materials that are shipped over the interstate highways:

- Low level waste consists of primarily of materials that have been contaminated by low level radioactive substances but pose no serious threat except through long-term exposure. These materials are shipped in sealed drums within placarded trailers. The danger to the public is no more than a wide array of other hazardous materials.
- High level waste, usually in the form of spent fuel from nuclear power plants, is transported in specially constructed casks that are built to withstand a direct hit from a locomotive.

Radiological emergencies at nuclear power plants are divided into classifications. Table 4.116 shows these classifications, as well as descriptions of each.

**Table 4.116 – Radiological Emergency Classifications**

Emergency Classification	Description
Notification of Unusual Event (NOUE)	Events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring offsite response or monitoring are expected unless further degradation of safety systems occurs.
Alert	Events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life-threatening risk to site personnel or damage to site equipment because of hostile action. Any releases are expected to be limited to small fractions of the Environmental Protection Agency (EPA) Protective Action Guides (PAGs)
Site Area Emergency (SAE)	Events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or hostile action that results in intentional damage or malicious acts; 1) toward site personnel or equipment that could lead to the likely failure of or; 2) that prevent effective access to, equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA PAG exposure levels beyond the site boundary.
General Emergency	Events are in progress or have occurred which involve actual or imminent substantial core degradation or melting with potential for loss of containment integrity or hostile action that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA PAG exposure levels offsite for more than the immediate site area.

*Warning Time: 4 – Less than 6 hours*

*Duration: 4 – More than one week*

### Location

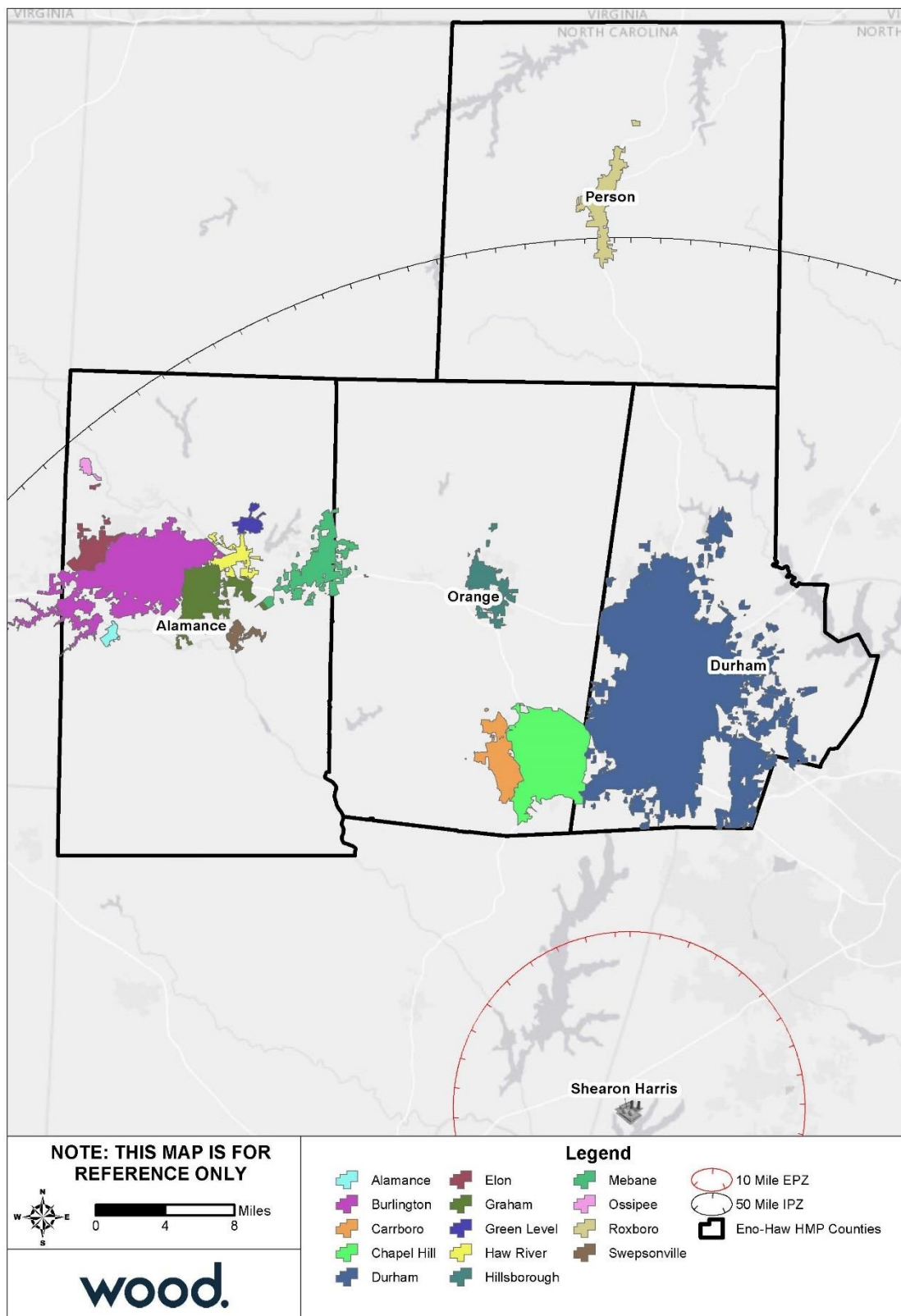
Harris Nuclear Plant, which is located in southwest Wake County south of the planning area, is a single-unit 928-megawatt power plant. The plant began commercial operation in 1987 and now employs approximately 800 people. Its reactor is a pressurized water reactor and the plant operates with a very high level of security. This is the location from which the most catastrophic nuclear accident might occur and will be the focal point of the nuclear analysis in this plan. However, it should also be noted that there is a 1-megawatt PULSTAR research reactor located on North Carolina State University's campus in downtown Raleigh. Although its impacts would potentially be less far-reaching than Harris Nuclear Plant's in the event of an accident, it should still be noted that the effects could be extremely detrimental.

The Nuclear Regulatory Commission defines two emergency planning zones around nuclear plants:

- ▶ **Emergency Planning Zone (EPZ)** – The EPZ is a 10-mile radius around nuclear facilities. It is also known as the Plume Exposure Pathway. Areas located within this zone are considered to be at highest risk of exposure to radioactive materials. Within this zone, the primary concern is exposure to and inhalation of radioactive contamination. Predetermined action plans within the EPZ are designed to avoid or reduce dose from such exposure. Residents within this zone would be expected to evacuate in the event of an emergency. Other actions such as sheltering, evacuation, and the use of potassium-iodide must be taken to avoid or reduce exposure in the event of a nuclear incident.
- ▶ **Ingestion Pathway Zone (IPZ)** – The IPZ is delineated by a 50-mile radius around nuclear facilities as defined by the federal government. Also known as the Ingestion Exposure Pathway, the IPZ has been designated to mitigate contamination in the human food chain resulting from a radiological accident at a nuclear power facility. Contamination to fresh produce, water supplies, and other food produce may occur when radionuclides are deposited on surfaces.

Figure 4.57 shows the location of Harris Nuclear Plant and the approximate 10-mile Emergency Planning Zone (EPZ) buffer and 50-mile Ingestion Pathway Zone (IPZ) around the plant. While none of the counties or communities in the planning area fall into the 10-mile EPZ, areas of Alamance and Person counties, and the entirety of Orange and Durham counties are included in the 50-mile IPZ.

Figure 4.57 – Harris Nuclear Plant Location in Relation to Planning Area



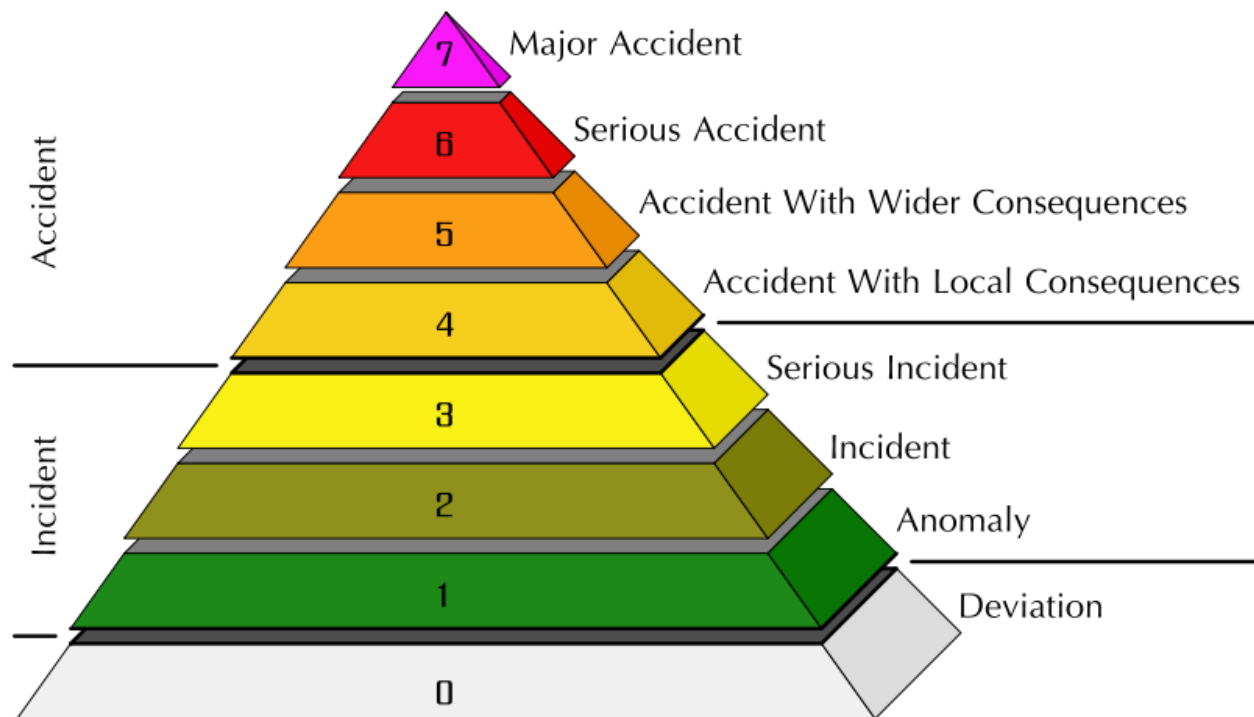


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The Nuclear Regulatory Commission defines two emergency planning zones around nuclear plants. Areas located within 10 miles of the station are considered to be within the zone of highest risk to a nuclear incident and this radius is the designated 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 county 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.

### Extent

The International Atomic Energy Association (IAEA) developed the International Nuclear and Radiological Event Scale to quantify the magnitude of radiological events. This scale is logarithmic, meaning each increasing level represents a 10-fold increase in severity compared to the previous level.



Source: International Atomic Energy Association

*Impact: 4 – Catastrophic*

*Spatial Extent: 2 – Small*

### Historical Occurrences

As reported in the 2018 State Hazard Mitigation Plan, Harris Nuclear Plant is one of only three plants in the country to have had no Nuclear Regulatory Commission findings as of September 2017. Therefore, there are no recent historical occurrences of any serious incidents at the Harris Plant. However, there have been events that warranted emergency declarations at both the Harris Nuclear Plant and the PULSTAR research reactor at North Carolina State University.

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### Probability of Future Occurrence

Radiological hazards are highly unpredictable. Nuclear reactors present the possibility of catastrophic damages, yet the industry is highly regulated and historical precedence suggests an incident is unlikely.

*Probability: 1 – Unlikely*

### Vulnerability Assessment

#### People

People within the 50-mile EPZ are at risk of exposure through ingestion of contaminated food and water. Low levels of radiation are not considered harmful, but a high exposure to radiation can cause serious illness or death.

#### Property

A radiological incident could cause severe damage to the power station itself but would not cause direct property damage outside the station, especially with the distance between the reactor and the planning area. However, property values could drop substantially if a radiological incident resulted in contamination of nearby areas.

#### Environment

A radiological incident could result in the spread of radioactive material into the environment, which could contaminate water and food sources and harm animal and plant life. These impacts are lessened the further an area is to the plant site.

### Consequence Analysis

Table 4.117 summarizes the potential detrimental consequences of radiological incident.

**Table 4.117 – Consequence Analysis – Radiological Incident**

Category	Consequences
Public	High levels of radiation could cause serious illness or death. Those living and working closest to the nuclear plant would face the greatest risk of exposure.
Responders	Responders face potential for heightened exposure to radiation, which could cause severe chronic illness and death.
Continuity of Operations (including Continued Delivery of Services)	An incident at the nuclear plant could interrupt power generation and cause power shortages. Regular operations would likely be affected by the response effort an event would require.
Property, Facilities and Infrastructure	The plant itself could be damaged by a radiological incident. Nearby property and facilities could be affected by contamination.
Environment	Water supplies, food crops, and livestock within 50 miles of the nuclear plant could be contaminated by radioactive material in the event of a major incident.
Economic Condition of the Jurisdiction	The local economy could be affected if a radiological incident caused contamination of nearby areas. Property values and economic activity could decline as a result.
Public Confidence in the Jurisdiction's Governance	A radiological incident would likely cause severe loss of public confidence given that the hazard is human-caused and highly regulated. Public confidence can also be affected by false alarms.

## 4.5.18 Terrorism / Mass Casualty

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Terrorism/Mass Casualty	Possible	Catastrophic	Negligible	Less than 6 hrs	More than 1 week	2.8

## Hazard Background

There is no universal globally agreed-upon definition of terrorism. In a broad sense, terrorism is the use of violence and threats to intimidate or coerce, especially against civilians, in the pursuit of political aims. Terrorism is defined in the United States by the Code of Federal Regulations as “the unlawful use of force or violence against persons or property to intimidate or coerce a government, civilian population, or any segment thereof, in furtherance of political or social objectives.”

These hazards can occur anywhere and demonstrate unlawful force, violence, and/or threat against persons or property causing intentional harm for purposes of intimidation, coercion or ransom in violation of the criminal laws of the United States. These actions may cause massive destruction and/or extensive casualties. The threat of terrorism, both international and domestic, is ever present, and an attack can occur when least expected. For this analysis, this hazard primarily focuses on an active shooter event.

The Southern Poverty Law Center reports 32 active hate groups in North Carolina. Table 4.118 shows active hate groups in North Carolina, according to the Southern Poverty Law Center (SPLC). The SPLC defines a hate group as any group with “beliefs or practices that attack or malign an entire class of people – particularly when the characteristics being maligned are immutable.” It is important to note that inclusion on the SPLC list is not meant to imply that a group advocates or engages in violence or other criminal activity. This list is a living document, and the groups listed here are those present at the time of this plan update.

Table 4.118 – Hate Groups Active in North Carolina

Group	Type	Location
Nation of Islam	Black Nationalist, Nation of Islam	Greensboro
ACTBAC NC	Neo-confederate	Snow Camp
Israelite Church of God in Jesus Christ	Black Nationalist	Greensboro
American Guard	General Hate	Statewide
Traditionalist Worker Party	Neo-Nazi; Traditionalist Worker Party	Statewide
Vinlanders Social Club	Racist Skinhead; Vinlanders Social Club	Statewide
Vanguard America	Neo-Nazi	Statewide
Israelite School of Universal Practical Knowledge	Black Nationalist	Statewide
Crew 38	Racist Skinhead	Statewide
Soldiers of Odin	Anti-Muslim	Statewide
Blood and Honour Social Club	Racist Skinhead; Blood and Honour	Statewide
The Daily Stormer	Neo-Nazi	Statewide
Confederate Hammerskins	Racist Skinhead	Statewide
Blood and Honour U.S.A.	Racist Skinhead; Blood and Honour	Statewide
East Coast Nights of the True Invisible Empire	Ku Klux Klan	Statewide
Israel United in Christ	Black Nationalist	Concord
Nation of Islam	Black Nationalist; Nation of Islam	Durham
Nation of Islam	Black Nationalist; Nation of Islam	Charlotte
Great Millstone	Black Nationalist	Charlotte

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Group	Type	Location
Loyal White Knights of the Ku Klux Klan	Ku Klux Klan	Pelham
Americans for Legal Immigration (ALIPAC)	Anti-Immigrant	Raleigh
Identity Dixie	Neo-Confederate	Statewide
Loyal White Knights of the Ku Klux Klan	Ku Klux Klan	Pelham
ACT for America	Anti-Muslim; Act for America	Fayetteville
Nation of Islam	Black Nationalist; Nation of Islam	Raleigh
Cumberland Conservatives	Anti-Muslim	North Carolina
North Carolinians for Immigration Reform and Enforcement	Anti-Immigrant	Wade
Confederate White Knights of the Ku Klux Klan	Ku Klux Klan	Vale
North Carolina Pastors Network	Anti-Muslim	Morgantown
Identity Evropa	White Nationalist; Identity Evropa	Boone
Revolutionary Black Panther Party	Black Nationalist	Wilmington
Nation of Islam	Black Nationalist; Nation of Islam	Wilmington

Source: Southern Poverty Law Center, <https://www.splcenter.org/hate-map>

The Nation of Islam is located in Durham in Durham County, and it is likely that groups found statewide have a footprint in the region.

*Warning Time: 4 – Less than 6 hours*

*Duration: 4 – More than one week*

Generally, no warning is given for mass shootings. Duration is dependent on the parameters of the incident; while the incidents themselves are usually relatively short, residual impacts on the community can be long-lasting. This score takes into account a prolonged scenario with continuous impacts.

### Location

An active shooter incident could occur at any location across the region, but are more likely to target highly populated areas, critical infrastructure, or symbolic locations. Churches, schools and malls have all been the site of recent attacks nationwide.

### Extent

The extent of a shooting incident is tied to many factors, including the incident site, weapon(s), location, time of day, and other circumstances; for this reason, it is difficult to put assess a single definition or conclusion of the extent of “terrorism.” As a general rule, shooting incidents are targeted to where they can do the most damage and have the maximum impact possible, though this impact is tempered by the weapon used in the attack itself.

*Impact: 4 – Catastrophic*

*Spatial Extent: 1 – Negligible*

### Historical Occurrences

According the non-profit Gun Violence Archive, 337 mass shootings across America in 2018 (defined as four or more people shot or killed in a single incident, not counting the shooter); ten were recorded in North Carolina, resulting in 13 fatalities and 39 injuries. Examples of mass shooting incidents include:

Old Salisbury Road Shooting, Winston-Salem, NC, July 1988. A gunman shot nine passersby from the centerline of Old Salisbury Road; four people were killed.

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Carthage Nursing Home Shooting, Carthage, NC, March 2009. A gunman opened fire at Pinelake Health and Rehabilitation nursing home. The shooter killed eight people and wounded a ninth.

University of North Carolina Shooting, Charlotte, NC, April 2019. A shooting on the last day of classes for the spring semester sent six people to the hospital, resulting in two fatalities.

The following additional incidents were also of concern to the planning committee, as they could have escalated to mass casualty events:

**August 2019** – The KKK held a rally in Hillsborough and later returned to spread propaganda and recruitment flyers throughout the Town. The rally and materials promoted racism, anti-gay statements, and other hate speech that has fueled other mass casualty events across the country in recent years.

**March 2006** – An alumnus drove a sport-utility vehicle through the Pit, a central gathering location on the UNC Chapel-Hill campus, with the intention of killing students, faculty, and staff. No one was killed in the attack, but nine people were injured.

### Probability of Future Occurrence

While difficult to estimate when a deliberate act like a shooting may occur, it can be inferred that the probability of an attack in any one area in the Region is very low at any given time. However, given the record of two incidents in the past 20 years that could have escalated to mass casualty events, the HMPC considers the probability of future incidents to be possible.

When identified, credible threats may increase the probability of an incident; these threats are generally tracked by law enforcement.

*Probability: 2 – Possible*

### Vulnerability Assessment

#### People

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People can and do suffer direct impacts from a shooting incident, with the potential for both injuries and fatalities. The number of injuries and fatalities are variable, dependent on many factors surrounding the attack including the location, the number of type of weapons used, the shooter's skill with weapons, the amount of people at the location and law enforcement response time.

#### Property

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The potential for damage to property is highly dependent on the type of attack. Buildings and infrastructure may be damaged. Impacts are highly localized to the target of the attack.

#### Environment

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Most shooting attacks do not cause widespread damage to the environment.

### Consequence Analysis

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Table 4.119 summarizes the potential detrimental consequences of a mass shooter threat.

**Table 4.119 – Consequence Analysis – Terrorism / Mass Shooter**

Category	Consequences
Public	Injuries and fatalities are probable; these impacts would be highly localized to the attack. Widespread stress and psychological suffering may occur.
Responders	Responders face increased risks during an effort to stop an attack or rescue others while an attack is underway.



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Category	Consequences
Continuity of Operations (including Continued Delivery of Services)	Critical infrastructure may be targeted by an attack; therefore, continuity of operations may be affected.
Property, Facilities and Infrastructure	Impacts depend of the type of attack. Building damage could occur during attack.
Environment	Incident specific; widespread environmental damage not likely.
Economic Condition of the Jurisdiction	The local economy could be disrupted, depending on the location and scale of an attack.
Public Confidence in the Jurisdiction's Governance	Loss of public confidence likely should an attack be carried out; additional loss of confidence and trust may result if response and recovery are not swift and effective

## 4.6 CONCLUSIONS ON HAZARD RISK

### Priority Risk Index

As discussed in Section 4.3 Risk Assessment Methodology and Assumptions, the Priority Risk Index was used to rate each hazard on a set of risk criteria and determine an overall standardized score for each hazard. The conclusions drawn from this process are summarized below.

Table 4.120 summarizes the degree of risk assigned to each identified hazard using the PRI method.

**Table 4.120 – Summary of PRI Results**

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Dam Failure	Possible	Critical	Negligible	Less than 6 hrs	Less than 1 week	2.4
Drought	Likely	Minor	Large	More than 24 hrs	More than 1 week	2.5
Earthquake	Unlikely	Minor	Large	Less than 6 hrs	Less than 6 hrs	1.9
Extreme Heat	Highly Likely	Critical	Large	More than 24 hrs	Less than 1 week	3.3
Flood	Likely	Limited	Small	6 to 12 hrs	Less than 1 week	2.5
Hurricane & Tropical Storm	Likely	Critical	Large	More than 24 hrs	Less than 24 hrs	2.9
Landslide	Unlikely	Minor	Negligible	6 to 12 hours	Less than 6 hrs	1.2
Severe Weather: Hail <sup>1</sup>	Highly Likely	Minor	Small	Less than 6 hrs	Less than 6 hours	2.4
Severe Weather: Lightning <sup>1</sup>	Highly Likely	Minor	Negligible	Less than 6 hrs	Less than 6 hours	2.2
Severe Weather: Thunderstorm Winds <sup>1</sup>	Highly Likely	Limited	Large	Less than 6 hrs	Less than 6 hours	3.1
Severe Winter Storm	Highly Likely	Critical	Large	More than 24 hrs	More than 1 week	3.3
Tornado	Likely	Critical	Small	Less than 6 hrs	Less than 6 hours	2.7
Wildfire	Possible	Limited	Moderate	Less than 6 hrs	Less than 1 week	2.5
Civil Unrest	Possible	Limited	Small	Less than 6 hrs	Less than 1 week	2.3
Critical Infrastructure Failure	Possible	Critical	Small	Less than 6 hrs	More than 1 week	2.7
Cyber Threat	Possible	Limited	Small	Less than 6 hrs	More than 1 week	2.4
Hazardous Materials Incident	Likely	Minor	Negligible	Less than 6 hrs	Less than 24 hrs	2.0
Infectious Disease	Possible	Critical	Large	More than 24 hrs	More than 1 week	2.8
Radiological Emergency	Unlikely	Catastrophic	Small	Less than 6 hrs	More than 1 week	2.7
Terrorism/Mass Casualty	Possible	Catastrophic	Negligible	Less than 6 hrs	More than 1 week	2.8

<sup>1</sup>Note: Severe Weather hazards average to a score of 2.6 and are therefore considered together as a high risk hazard.

The results from the PRI have been classified into three categories based on the assigned risk value which are summarized in Table 4.121:

- ▶ **High Risk** – Widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread.
- ▶ **Medium Risk** – Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster.
- ▶ **Low Risk** – Minimal potential impact. The occurrence and potential cost of damage to life and property is negligible or nonexistent. This is not a priority hazard for mitigation projects.

Table 4.121 – Summary of Hazard Risk Classification

<p><b>High Risk</b> (<math>&gt; 2.4</math>)</p>	<p>Extreme Heat Severe Winter Storm Hurricane &amp; Tropical Storm Critical Infrastructure Failure Infectious Disease Terrorism / Mass Casualty Tornado Radiological Emergency Severe Weather Drought Flood Wildfire</p>
<p><b>Moderate Risk</b> (<math>2.0 - 2.4</math>)</p>	<p>Dam Failure Cyber Threat Civil Unrest Hazardous Materials Incident</p>
<p><b>Low Risk</b> (<math>&lt; 2.0</math>)</p>	<p>Earthquake Landslide</p>

Note: Low risk hazards are not prioritized for mitigation.

## 5 Capability Assessment

This section discusses the capability of the Eno-Haw region to implement hazard mitigation activities. It consists of the following four subsections:

- 5.1 Overview
- 5.2 Conducting the Capability Assessment
- 5.3 Capability Assessment Findings
- 5.4 Conclusions on Local Capability

### 5.1 OVERVIEW

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

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

The capability assessment completed for the Eno-Haw region serves as a critical planning step toward developing an effective mitigation strategy. Coupled with the risk assessment, the capability assessment helps identify and target effective goals, objectives, and mitigation actions that are realistically achievable under given local conditions.

### 5.2 CONDUCTING THE CAPABILITY ASSESSMENT

To facilitate the inventory and analysis of local government capabilities within the planning area, a detailed Local Capability Self-Assessment worksheet was distributed to members of the HMPC after the first planning committee meeting. The survey questionnaire requested information on a variety of "capability indicators" such as existing local plans, policies, programs, or ordinances that contribute to and/or hinder the region's ability to implement hazard mitigation actions. Other indicators included information related to the region's fiscal, administrative, and technical capabilities, such as access to local budgetary and personnel resources for mitigation purposes, and existing education and outreach programs that can be used to promote mitigation. Communities were also asked to comment on the current political climate with respect to hazard mitigation, an important consideration for any local planning or decision-making process.

At a minimum, the survey results provide an extensive and consolidated inventory of existing local plans, ordinances, programs, and resources in place or under development. With this information, inferences can be made about the overall effect on hazard loss reduction in each community. In completing the

survey, local officials were also asked to rate their jurisdiction’s specific capabilities. The survey instrument thereby not only helps accurately assess the degree of local capability, but it also serves as a good source of introspection for counties and local jurisdictions that want to improve their capabilities. Identified gaps, weaknesses, or conflicts can be recast as opportunities for specific actions to be proposed as part of the mitigation strategy.

The information provided in response to the survey questionnaire was incorporated into a database for further analysis. A general scoring methodology was then applied to quantify each jurisdiction’s overall capability. According to the scoring system, each capability indicator was assigned a point value based on its relevance to hazard mitigation. Additional points were added based on the jurisdiction’s self-assessment of their own planning and regulatory capability, administrative and technical capability, fiscal capability, education and outreach capability, and political capability.

Using this scoring methodology, a total score and an overall capability rating of “High,” “Moderate,” or “Limited” could be determined according to the total number of points received. These classifications are designed to provide nothing more than a general assessment of local government capability. In combination with the narrative responses provided by local officials, the results of this capability assessment provide critical information for developing an effective and meaningful mitigation strategy.

5.3 CAPABILITY ASSESSMENT FINDINGS

The findings of the capability assessment are summarized in this plan to provide insight into the relevant capacity of the Eno-Haw region to implement hazard mitigation activities. All information is based upon the input provided by local government officials through the Local Capability Self-Assessment.

5.3.1 Planning and Regulatory Capability

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

This assessment is designed to provide a general overview of the key planning and regulatory tools or programs in place or under development for the Eno-Haw region, along with their potential effect on loss reduction. This information will help identify opportunities to address gaps, weaknesses, or conflicts with other initiatives and integrate the implementation of this plan with existing planning mechanisms where appropriate.

Table 5.1 provides a summary of the relevant local plans, ordinances, and programs already in place or under development for the Eno-Haw region. A checkmark (v) indicates that the given item is currently in place and being implemented. An asterisk (\*) indicates that the given item is currently being developed for future implementation. A plus sign (+) indicates that a jurisdiction is covered for that item under a county-implemented version. Each of these local plans, ordinances, and programs should be considered available mechanisms for incorporating the requirements of the Hazard Mitigation Plan.



## SECTION 5: CAPABILITY ASSESSMENT

Table 5.1 – Relevant Plans, Ordinances, and Programs

Jurisdiction	Hazard Mitigation Plan	Comprehensive Land Use Plan	Floodplain Management Plan	Open Space Management Plan	Stormwater Management Plan	Emergency Operations Plan	SARA Title III Plan	Radiological Emergency Plan	Continuity of Operations Plan	Evacuation Plan	Disaster Recovery Plan	Capital Improvements Plan	Economic Development Plan	Historic Preservation Plan	Transportation Plan	Flood Damage Prevention Ordinance	Zoning Ordinance	Subdivision Ordinance	Site Plan Review Requirements	Unified Development Ordinance	Post-Disaster Redevelopment Ordinance	Building Code	Fire Code	Community Wildfire Protection Plan	National Flood Insurance Program	Community Rating System
Alamance County	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	
City of Burlington	✓	✓	✓	✓	✓	✓	+	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	
City of Graham	✓	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+		+	+		+	
City of Mebane	+	✓			✓	+	+	+	+	+	+	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	
Town of Elon	✓	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+		+	+		+	
Town of Green Level	✓	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+		+	+		+	
Town of Haw River	✓	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+		+	+		+	
Town of Ossipee	✓	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+		+	+			
Town of Swepsonville	✓	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+		+	+		+	
Village of Alamance	✓	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+		+	+		+	
Durham County	✓	✓	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓
City of Durham	✓	✓	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓
Orange County	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Town of Carrboro	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	
Town of Chapel Hill	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	
Town of Hillsborough	✓	✓	✓	✓	✓	✓	✓		✓			✓	✓	✓	+	✓	✓	✓	✓	✓		✓	✓		✓	
Person County	✓	✓				✓			✓	✓	✓	✓			✓	✓	✓	✓	✓			✓	✓		✓	
City of Roxboro	✓	*	✓		✓	✓			✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	

Source: Local Capability Assessment Survey

Based upon the responses summarized in the above table, jurisdictions in the Eno-Haw Region could improve regulatory capability by developing post-disaster redevelopment ordinances. Additionally, the Region could work cooperatively to develop a Community Wildfire Protection Plan (CWPP); however, the basics CWPP are now included in this plan update.

A more detailed discussion on the region's planning and regulatory capability follows, along with the incorporation of additional information based on the narrative comments provided by local officials in response to the survey questionnaire.

### 5.3.1.1 Emergency Management

Hazard mitigation is widely recognized as one of the four primary phases of emergency management, as is shown in Figure 5.1. In reality, mitigation is interconnected with all other phases and is an essential component of effective preparedness, response, and recovery. Opportunities to reduce potential losses through mitigation practices are most often implemented before a disaster event, such as through the elevation of flood-prone structures or by regular enforcement of policies that regulate development. However, mitigation opportunities can also be identified during immediate preparedness or response activities, such as installing storm shutters in advance of a hurricane. Furthermore, incorporating mitigation during the long-term recovery and redevelopment process following a disaster event is what enables a community to become more resilient.

Figure 5.1 – The Four Phases of Emergency Management



Planning for each phase is a critical part of a comprehensive emergency management program and a key to the successful implementation of hazard mitigation actions. As such, the Local Capability Self-Assessment asked several questions across a range of emergency management plans to assess the region's willingness to plan and their level of technical planning proficiency.

#### Hazard Mitigation Plan

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

- ▶ Alamance, Durham, and Orange Counties and their participating jurisdictions were previously covered by the Eno-Haw Regional Hazard Mitigation Plan. Person County and the City of Roxboro were previously covered by the Person-Roxboro Hazard Mitigation Plan.

### Disaster Recovery Plan

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

- ▶ 14 of the 18 participating jurisdictions have a disaster recovery plan either in place or under development. (6 jurisdictions have one in place; 8 covered under a county plan)

### Emergency Operations Plan

An emergency operations plan outlines responsibilities and how resources will be deployed during and following an emergency or disaster.

- ▶ All participating jurisdictions have an emergency operations plan either in place or are covered under a county plan.

### Continuity of Operations Plan

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

- ▶ 15 of the 18 participating jurisdictions have a continuity of operations plan either in place or are covered under a county plan.

#### 5.3.1.2 General Planning

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

### Comprehensive/General Plan

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

- ▶ All participating jurisdictions have a comprehensive land use plan in place or are covered by county planning efforts. Some communities are currently in the process of updating their comprehensive plans.

### Capital Improvements Plan

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

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- ▶ All participating jurisdictions have a capital improvements plan in place or are covered by county capital improvements planning.

### Historic Preservation Plan

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

- ▶ All but one of the participating jurisdictions have a historic preservation plan in place or are covered by a county plan.

### Zoning Ordinance

Zoning represents the primary means by which land use is controlled by local governments. As part of a community's police power, zoning is used to protect the public health, safety, and welfare of those in a given jurisdiction that maintains zoning authority. A zoning ordinance is the mechanism through which zoning is typically implemented. Since zoning regulations enable municipal governments to limit the type and density of development, a zoning ordinance can serve as a powerful tool when applied in identified hazard areas.

- ▶ All participating jurisdictions have a zoning ordinance in place.

### Subdivision Ordinance

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

- ▶ All participating jurisdictions have a subdivision ordinance in place.

### Building Codes, Permitting, and Inspections

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

- ▶ All participating jurisdictions have building codes in place.

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

In conducting the assessment, ISO collects information related to personnel qualification and continuing education, as well as number of inspections performed per day. This type of information combined with local building codes is used to determine a grade for that jurisdiction. The grades range from 1 to 10, with a BCEGS grade of 1 representing exemplary commitment to building code enforcement, and a grade of 10 indicating less than minimum recognized protection.

### 5.3.1.3 Floodplain Management

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

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

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

Table 5.2 provides NFIP policy and claim information for each participating jurisdiction in the Eno-Haw region.

All but one jurisdiction in the region participate in the NFIP and will continue to comply with all required provisions of the program. Floodplain management is managed through zoning ordinances, building code restrictions, and the county and municipal building inspection programs. The jurisdictions will coordinate with NCEM and FEMA to develop maps and regulations related to Special Flood Hazard Areas within their jurisdictional boundaries and, through a consistent monitoring process, will design and improve their floodplain management program in a way that reduces the risk of flooding to people and property.

#### Community Rating System

An additional indicator of floodplain management capability is active participation in the Community Rating System (CRS). The CRS is an incentive-based program that encourages communities to undertake defined flood mitigation activities that go beyond the minimum requirements of the NFIP. Each of the CRS mitigation activities is assigned a point value. As a community earns points and reaches identified thresholds, they can apply for an improved CRS class. Class ratings, which range from 10 to 1 and increase on 500-point increments, are tied to flood insurance premium reductions. Every class improvement earns an additional 5 percent discount for NFIP policyholders, with a starting discount of 5 percent for Class 9 communities and a maximum possible discount of 45 percent for Class 1 communities.

Community participation in the CRS is voluntary. Any community that is in full compliance with the rules and regulations of the NFIP may apply to FEMA for a CRS classification better than class 10. The CRS application process has been greatly simplified over the past several years, based on community



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comments intended to make the CRS more user friendly, and extensive technical assistance available for communities who request it.

- ▶ Durham County, the City of Durham, and Orange County participate in the Community Rating System. Each community's CRS Class is shown in Table 5.2.

### Floodplain Management Plan

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

- ▶ 16 of the 18 participating jurisdictions have a floodplain management plan in place or are covered by a county plan.

### Open Space Management Plan

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

- ▶ 15 of the 18 participating jurisdictions have an open space management plan in place or are covered by a county plan.

### Stormwater Management Plan

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

- ▶ 17 of the 18 participating jurisdictions have a stormwater management plan in place or are covered by a county plan.

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Table 5.2 – NFIP Policy and Claim Information

Jurisdiction	Date of Initial FIRM or FHBM	CRS Class	Current Effective Map Date	NFIP Policies in Force	Insurance in Force	Written Premium in Force	Closed Losses	Total Payments
Alamance County	01/03/75	-	09/06/06	49	\$15,023,600	\$104,809	29	\$824,801
City of Burlington	06/21/74	-	09/06/06	149	\$31,186,800	\$150,597	31	\$378,054
City of Graham	07/11/75	-	09/06/06	43	\$8,991,900	\$27,646	8	\$63,752
City of Mebane	11/05/80	-	09/06/06	40	\$9,747,000	\$19,948	2	\$4,622
Town of Elon	06/05/89	-	09/06/06	22	\$5,373,800	\$11,328	2	\$12,790
Town of Green Level	12/22/98	-	09/06/06	0	0	0	0	0
Town of Haw River	07/18/75	-	09/06/06	6	\$899,200	\$3,008	1	\$60,000
Town of Ossipee	09/06/06	-	09/06/06	0	0	0	0	0
Town of Swepsonville	01/03/75	-	09/06/06	3	\$557,900	\$1,600	0	0
Village of Alamance	01/03/75	-	09/06/06	0	0	0	0	0
Durham County	01/25/74	8	05/02/06	208	\$54,359,900	\$129,208	44	\$583,957
City of Durham	01/25/74	7	05/02/06	1,124	\$274,660,200	\$980,475	153	\$2,555,190
Orange County	06/16/78	6	02/02/07	86	\$25,734,300	\$41,096	9	\$185,944
Town of Carrboro	02/22/74	-	09/26/17	90	\$24,270,700	\$50,509	8	\$94,288
Town of Chapel Hill	06/21/74	-	02/02/07	672	\$130,511,700	\$596,394	191	\$10,242,770
Town of Hillsborough	05/19/78	-	02/02/07	15	\$4,796,500	\$14,615	3	\$9,032
Person County	02/10/78	-	06/04/07	17	\$3,874,400	\$7,199	0	\$0
City of Roxboro	01/13/78	-	06/04/07	10	\$3,412,700	\$14,974	2	\$24,521
<b>TOTAL PLAN</b>	-	-	-	<b>2,534</b>	<b>\$593,400,600</b>	<b>\$2,153,406</b>	<b>483</b>	<b>\$15,039,721</b>

Source: FEMA NFIP Policy Statistics via NCEM Risk Management Tool; revised by HMPC

### 5.3.2 Administrative and Technical Capability

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

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

Table 5.3 provides a summary of the Local Capability Self-Assessment results for the region with regard to relevant staff and personnel resources. A checkmark indicates the presence of a staff member(s) in that jurisdiction with the specified knowledge or skill.

Note that while all but one jurisdiction are participants in the NFIP, several jurisdictions in Alamance County do not have a local floodplain manager. In these cases, due to the limited capacity of these small jurisdictions, Alamance County is the designated floodplain administrator for the jurisdiction.

Table 5.3 – Relevant Staff/Personnel Resources

Jurisdiction	Planners with knowledge of land development and land management practices	Engineers or professionals trained in construction practices related to buildings and/or infrastructure	Planners or engineers with an understanding of natural and/or human-caused hazards	Building Official	Emergency manager	Floodplain manager	Land surveyors	Scientist familiar with the hazards of the community	Staff with education or expertise to assess the community vulnerability to hazards	Personnel skilled in Geographic Information Systems (GIS) and/or HAZUS	Resource development staff or grant writers	Maintenance programs to reduce risk	Warning systems/services	Mutual Aid Agreements
Alamance County	√	√	√	√	√	√	√		√	√	√	√	√	√
City of Burlington	√	√	√	√	√	√	√	√	√	√	√	√	√	√
City of Graham	√	√	√	√	√	√			√	√	√	√	√	√
City of Mebane	√	√	√	√	√	√			√	√	√	√	√	√
Town of Elon	√	√	√	√	√	√			√			√		√
Town of Green Level		√		√		√								√
Town of Haw River	√	√		√								√		√
Town of Ossipee														√
Town of Swepsonville														√
Village of Alamance	√													√
Durham County	√	√	√	√	√	√			√	√	√	√	√	√
City of Durham	√	√	√	√	√	√			√	√	√	√	√	√
Orange County	√	√	√	√	√	√			√	√		√	√	√
Town of Carrboro	√	√	√	√		√			√	√	√	√	√	√
Town of Chapel Hill	√	√	√	√	√	√			√	√		√	√	√
Town of Hillsborough	√	√	√	√	√	√			√	√		√	√	√
Person County	√		√	√	√	√			√	√	√		√	√
City of Roxboro	√	√	√	√	√	√	√		√	√	√	√	√	√

Source: Local Capability Assessment Survey

### 5.3.3 Fiscal Capability

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

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

Table 5.4 provides a summary of the results for the region with regard to relevant fiscal resources. A checkmark indicates that the given fiscal resource is locally available for hazard mitigation purposes (including match funds for state and federal mitigation grant funds).

**Table 5.4 – Relevant Fiscal Resources**

Jurisdiction	Capital Improvement Programming	Community Development Block Grants (CDBG)	Special Purpose Taxes	Gas/Electric Utility Fees	Water/Sewer Fees	Stormwater Utility Fees	Development Impact Fees	General Obligation Bonds	Revenue Bonds	Special Tax Bonds	Other
Alamance County	√			√	√	√	√		√		
City of Burlington	√	√	√	√	√	√					
City of Graham				√	√						
City of Mebane	√	√			√		√				
Town of Elon				√	√						
Town of Green Level				√	√						
Town of Haw River				√	√						
Town of Ossipee				√	√						
Town of Swepsonville				√	√						
Village of Alamance				√	√						
Durham County	√	√			√		√	√	√		√
City of Durham	√	√			√		√	√	√		√
Orange County	√	√	√	√	√	√		√	√	√	
Town of Carrboro	√	√	√	√	√	√		√	√	√	
Town of Chapel Hill	√	√	√	√	√	√		√	√	√	
Town of Hillsborough	√				√	√		√	√	√	√
Person County	√	√			√	√		√	√		
City of Roxboro	√	√			√	√	√	√			

Source: Local Capability Assessment Survey



### 5.3.4 Education and Outreach Capability

This type of local capability refers to education and outreach programs and methods already in place that could be used to implement mitigation activities and communicate hazard-related information. Examples include natural disaster or safety related school programs; participation in community programs such as Firewise or StormReady; and activities conducted as part of hazard awareness campaigns such as a Tornado Awareness Month.

Table 5.5 provides a summary of the results for the region with regard to relevant education and outreach resources. A checkmark indicates that the given resource is locally available for hazard mitigation purposes.

**Table 5.5 – Education and Outreach Resources**

Jurisdiction	Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Natural disaster or safety related school programs	StormReady certification	Firewise Communities certification	Public-private partnership initiatives addressing disaster-related issues	Other
Alamance County		√	√	√	√	√	
City of Burlington	√	√	√	√		√	
City of Graham			√				
City of Mebane		√	√				
Town of Elon			√				
Town of Green Level			√				
Town of Haw River			√				
Town of Ossipee			√				
Town of Swepsonville			√				
Village of Alamance			√				
Durham County	√	√	√	√			
City of Durham	√	√	√	√			
Orange County	√	√	√	√		√	
Town of Carrboro	√	√	√				
Town of Chapel Hill	√	√	√			√	
Town of Hillsborough	√	√					
Person County		√		√	√		
City of Roxboro		√	√			√	

Source: Local Capability Assessment Survey

### 5.3.5 Mitigation Capability

This type of local capability refers to the mitigation strategies and actions that are developed by the communities in this plan.

Table 5.6 provides a summary of the results for the planning area with regard to relevant mitigation resources. A checkmark (✓) indicates that the given resource is locally available for hazard mitigation purposes.

**Table 5.6 – Mitigation Resources**

Jurisdiction	Do you apply for mitigation grant funding?	Do you perform reconstruction projects?	Do you perform building elevations?	Do you perform acquisitions?
Alamance County	✓			
City of Burlington	✓			
City of Graham				
City of Mebane				
Town of Elon				
Town of Green Level				
Town of Haw River				
Town of Ossipee				
Town of Swepsonville				
Village of Alamance				
Durham County	✓	✓	✓	✓
City of Durham	✓	✓	✓	✓
Orange County	✓	✓	✓	✓
Town of Carrboro	✓	✓	✓	✓
Town of Chapel Hill				
Town of Hillsborough	✓			
Person County	✓	✓		
City of Roxboro				

### 5.3.6 Political Capability

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

## SECTION 5: CAPABILITY ASSESSMENT

The Local Capability Self-Assessment was used to capture information on political capability of the region. Survey respondents were asked to rate political support as they perceive it and identify general examples of local political capability, such as guiding development away from identified hazard areas, restricting public investments or capital improvements within hazard areas, or enforcing local development standards that go beyond minimum state or federal requirements.

HMPC representatives from many participating jurisdictions responded that political leaders are at least potentially willing to implement mitigation measures. In Person County and Roxboro, respondents noted mixed support and that current leaders have not been faced with a hazard event requiring immediate implementation of mitigation. Therefore, leaders here may not be motivated to pursue mitigation. A few participating jurisdictions noted having local standards that exceed state requirements, which exemplifies local political will to implement mitigation. For example, the Town of Hillsborough has standards in its flood damage prevention ordinance and fire prevention ordinance that exceed state standards.

### 5.3.7 Local Self-Assessment Rating

In addition to the inventory and analysis of specific local capabilities, the Local Capability Self-Assessment asked counties and local jurisdictions within the Eno-Haw region to assign a rating of their perceived capability across each of the capability categories and overall as either “limited,” “moderate,” or “high.”

Table 5.7 summarizes the self-assessment ratings for each community in the Eno-Haw region.

**Table 5.7 – Self-Assessment of Capability**

Jurisdiction	Plans, Ordinances, Codes and Programs	Administrative and Technical Capability	Fiscal Capability	Education and Outreach Capability	Mitigation Capability	Political Capability	Overall Capability
Alamance County	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
City of Burlington	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
City of Graham	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
City of Mebane	High	High	High	Moderate	Limited	Moderate	Moderate
Town of Elon	Moderate	Moderate	Limited	Limited	Limited	Limited	Moderate
Town of Green Level	Moderate	Moderate	Limited	Limited	Limited	Limited	Moderate
Town of Haw River	Moderate	Moderate	Limited	Limited	Limited	Limited	Moderate
Town of Ossipee	Limited	Limited	Limited	Limited	Limited	Limited	Limited
Town of Swepsonville	Limited	Limited	Limited	Limited	Limited	Limited	Limited
Village of Alamance	Limited	Limited	Limited	Limited	Limited	Limited	Limited
Durham County	High	High	Moderate	Moderate	Moderate	Limited	Moderate
City of Durham	High	High	Moderate	Moderate	Moderate	Limited	Moderate
Orange County	High	High	Moderate	High	High	Moderate	Moderate
Town of Carrboro	High	High	Moderate	High	High	Moderate	Moderate
Town of Chapel Hill	High	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Town of Hillsborough	Moderate	Moderate	Moderate	Limited	Limited	Moderate	Moderate
Person County	Moderate	Moderate	Moderate	Limited	Moderate	Limited	Moderate
City of Roxboro	Moderate	High	Moderate	Moderate	Moderate	Limited	Moderate

Source: Local Capability Assessment Survey

### 5.4 CONCLUSIONS ON LOCAL CAPABILITY

In order to form meaningful conclusions on the assessment of local capability, a quantitative scoring methodology was designed and applied to results of the Local Capability Assessment Survey. This methodology attempts to assess the overall level of capability of the Eno-Haw region to implement hazard mitigation actions.

Table 5.8 shows the results of the capability assessment using the designed scoring methodology. The capability score is based solely on the information provided by local officials in response to the Local Capability Self-Assessment. According to the assessment, the average local capability score for all responding jurisdictions is 86, which falls into the Moderate capability ranking.

**Table 5.8 – Capability Assessment Results**

Jurisdiction	Overall Capability Score	Overall Capability Rating
Alamance County	105	High
City of Burlington	109	High
City of Graham	74	Moderate
City of Mebane	91	Moderate
Town of Elon	67	Low
Town of Green Level	62	Low
Town of Haw River	63	Low
Town of Ossipee	56	Low
Town of Swepsonville	56	Low
Village of Alamance	57	Low
Durham County	107	High
City of Durham	107	High
Orange County	114	High
Town of Carrboro	105	High
Town of Chapel Hill	103	High
Town of Hillsborough	93	Moderate
Person County	79	Moderate
City of Roxboro	92	Moderate

Source: Local Capability Assessment Survey, NCEM Risk Management Tool

As previously discussed, one of the reasons for conducting a capability assessment is to examine local capabilities to detect any existing gaps or weaknesses within ongoing government activities that could hinder proposed mitigation activities and possibly exacerbate community hazard vulnerability. These gaps or weaknesses have been identified, for each jurisdiction, in the tables found throughout this section. The participating jurisdictions used the capability assessment as part of the basis for the mitigation actions that are identified in Section 7; therefore, each jurisdiction addresses their ability to expand on and improve their existing capabilities through the identification of their mitigation actions.

## 6 Mitigation Strategy

**Requirement §201.6(c)(3): [The plan shall include] a mitigation strategy that provides the jurisdiction’s blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.**

This section describes the process for developing the mitigation strategy for the Eno-Haw Regional Hazard Mitigation Plan. It describes how the Region met the requirements for Planning Step 6 (Set Goals), Planning Step 7 (Review Possible Activities), and Planning Step 8 (Draft an Action Plan). This section includes the following sub-sections:

- ▶ 6.1 Goals and Objectives
- ▶ 6.2 Identification & Analysis of Mitigation Activities

### 6.1 GOALS AND OBJECTIVES

**Requirement §201.6(c)(3)(i): [The mitigation strategy section shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.**

Goal setting builds upon the findings of Section 4, which documents the hazards and associated risks that threaten the Eno-Haw Region, and Section 5, which evaluates each jurisdiction’s capacity of the to reduce the impact of hazards. The intent of Goal Setting is to identify areas where improvements to existing capabilities can be made so that exposure and vulnerability is reduced. Goals also guide the review of possible mitigation measures. This plan needs to make sure that recommended actions are consistent with what is appropriate for the Counties and their incorporated municipalities. Mitigation goals need to reflect community priorities and should be consistent with other local plans.

- ▶ **Goals** are general guidelines that explain what is to be achieved. They are usually broad-based policy type statements, long term and represent global visions. Goals help define the benefits that the plan is trying to achieve.
- ▶ **Objectives** are short term aims that, when combined, form a strategy or course of action to meet a goal. Unlike goals, objectives are specific and measurable.

#### 6.1.1 Coordination with Other Planning Efforts

The goals of this plan need to be consistent with and complement the goals of other local planning efforts. The primary planning documents that the goals of this plan should complement and be consistent with are the county and participating jurisdictions’ comprehensive plans. Comprehensive plans are important because they are developed and designed to guide future growth within their communities. Keeping the Hazard Mitigation Plan and Comprehensive Plans consistent ensures that land development is done with awareness and understanding of hazard risk and that mitigation projects complement rather than contradict community development objectives. Another local resource that was reviewed for coordination was the Triangle Regional Resilience Assessment. Durham City and County, Orange County, and the Town of Chapel Hill participated in the preparation of the Triangle Regional Resilience Assessment, which covers Orange, Durham, and Wake Counties, but the options and strategies for building resilience are applicable to the broader region and were reviewed by the HMPC when considering new mitigation alternatives.



### 6.1.2 Goal Setting

At the second planning meeting, held on October 8, 2019, the HMPC reviewed and discussed the goals from the 2015 Eno-Haw Plan and the 2015 Person County-City of Roxboro Plan. The following revised goals, which combine the sentiment of the goals from the previous plans, were provided to the HMPC for discussion and feedback:

#1	Change, enhance, or adopt plans, ordinances, policies, regulations, and other local tools and mechanisms to better facilitate risk reduction activities and improve overall resiliency.
#2	Protect the public health, safety and welfare by increasing training, education, and public awareness of hazards and by encouraging collective and individual responsibility for mitigating hazard risks.
#3	Improve technical, administrative, financial, and political capability to implement effective mitigation projects and respond to hazards.
#4	Implement structure and infrastructure projects to improve public safety, reduce risk to vulnerable populations, and protect buildings, transportation, and other critical and essential functions of the Eno-Haw Region.

The HMPC approved the revised goals and expanded upon them with the development of objectives. The HMPC reviewed a set of objectives proposed by the planning consultant and made several minor revisions. The approved of the goal revisions and proposed objectives, which are detailed below in Section 6.1.3.

### 6.1.3 Resulting Goals and Objectives

The HMPC agreed upon four general goals for this planning effort and included specific objectives in support of each goal. The final goals and objectives are as follows:

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#### **Goal 1 – Change, enhance, or adopt plans, ordinances, policies, regulations, and other local tools and mechanisms to better facilitate risk reduction activities and improve overall resiliency.**

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**Objective 1.1:** Strive to ensure that development occurs in such a way as to protect wetlands, floodplains, erosion control measures, and other natural features that serve to reduce hazard risk.

**Objective 1.2:** Pursue policies that incorporate hazard mitigation into new development and post-disaster redevelopment.

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#### **Goal 2 – Protect the public health, safety and welfare by increasing training, education, and public awareness of hazards and by encouraging collective and individual responsibility for mitigating hazard risks.**

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**Objective 2.1:** Implement a public awareness campaign to educate citizens of possible hazards and mitigation options.

**Objective 2.2:** Pursue strategies and technologies to improve warning and notification of hazard events and ensure that emergency services are adequate to protect public health and safety.

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#### **Goal 3 – Improve technical, administrative, financial, and political capability to implement effective mitigation projects and respond to hazards.**

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**Objective 3.1:** Improve operations for hazards and emergencies that cause disruptions to traffic, release times, power outages, sheltering, and communications.

**Objective 3.2:** Improve regular regional communication and foster the creation of more multi-jurisdictional regional planning efforts related to risk reduction and resiliency.

## SECTION 6: MITIGATION STRATEGY

**Goal 4 – Implement structure and infrastructure projects to improve public safety, reduce risk to vulnerable populations, and protect buildings, transportation, and other critical and essential functions of the Eno-Haw Region.**

**Objective 4.1:** Strive to keep infrastructure extensions out of known hazardous areas in order to actively discourage development in high risk areas.

**Objective 4.2:** Retrofit or otherwise protect critical facilities and infrastructure against damages.

### 6.2 IDENTIFICATION AND ANALYSIS OF MITIGATION ACTIVITIES

**Requirement §201.6(c)(3)(ii):** [The mitigation strategy section shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure. All plans approved by FEMA after October 1, 2008, must also address the jurisdiction's participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.

To identify and select mitigation projects that support the mitigation goals, each hazard identified in Section 4 Hazard Identification was evaluated. The following were determined based on the Priority Risk Index scores to be high and medium priority hazards:

- ▶ Extreme Heat
- ▶ Severe Winter Storm
- ▶ Hurricane & Tropical Storm
- ▶ Infectious Disease
- ▶ Tornado
- ▶ Radiological Emergency
- ▶ Severe Weather
- ▶ Drought
- ▶ Flood
- ▶ Wildfire
- ▶ Terrorism / Mass Casualty
- ▶ Dam Failure
- ▶ Cyber Threat
- ▶ Civil Unrest
- ▶ Hazardous Materials Incident

Note: actions were also identified for Landslide despite it being a low priority hazard. Additionally, this list contains technological/human-caused hazards, but only natural hazards on this list were necessarily prioritized for mitigation. Mitigation action development for technological/human-caused hazards was left to the discretion of each jurisdiction.

Once it was determined which hazards warranted the development of specific mitigation actions, the HMPC analyzed viable mitigation options that supported the identified goals and objectives. The HMPC was provided with the following list of mitigation categories which are utilized as part of the CRS planning process but are also applicable to multi-hazard mitigation.

- ▶ Prevention
- ▶ Property Protection
- ▶ Natural Resource Protection
- ▶ Emergency Services
- ▶ Structural Projects
- ▶ Public Information and Outreach

The HMPC was also provided with examples of potential mitigation actions for each of the above categories. The HMPC was instructed to consider both future and existing buildings in evaluating possible mitigation actions. Facilitated discussions took place to examine and analyze the options. The HMPC also considered which actions from the previous plan that were not already completed should be continued

in this action plan. A more detailed review of possible actions within each mitigation category that were reviewed by the HMPC is provided in Appendix C.

### 6.2.1 Prioritization Process

In the process of identifying continuing and new mitigation actions, the HMPC was provided with a set of prioritization criteria to assist in deciding why one recommended action might be more important, more effective, or more likely to be implemented than another. HMPC members were asked to rate each action on a set of criteria, which were grouped into three categories: Suitability, Risk Reduction, and Cost. The criteria for the prioritization process included the following:

- ▶ **Suitability**
  - Appropriateness of Action
  - Community Acceptance
  - Technical and Administrative Feasibility
  - Environmental Impact
  - Legal Conformance
  - Consistency with Existing Plans and Other Community Goals
- ▶ **Risk Reduction**
  - Scope of Benefits
  - Potential to Save Lives
  - Importance of Benefits
  - Level of Inconvenience or Unintended Consequence
  - Losses Avoided
  - Number of People to Benefit
- ▶ **Cost**
  - Estimate of Upfront Cost
  - Estimate of Ongoing Cost
  - Benefit to Cost Ratio
  - Financing Availability
  - Affordability
  - Elimination of Repetitive Damages

In accordance with the DMA requirements, an emphasis was placed on the importance of a benefit-cost analysis in determining action priority, as reflected in the prioritization criteria above. For each action, the HMPC considered the benefit-cost analysis in terms of:

- ▶ Ability of the action to address the problem
- ▶ Contribution of the action to save life or property
- ▶ Available technical and administrative resources for implementation
- ▶ Availability of funding and perceived cost-effectiveness

The consideration of these criteria helped to prioritize and refine mitigation actions but did not constitute a full benefit-cost analysis. The cost-effectiveness of any mitigation alternative will be considered in greater detail through performing benefit-cost project analyses when seeking FEMA mitigation grant funding for eligible actions associated with this plan.

Using these prioritization criteria, the HMPC assigned each action a ranking of High, Moderate, or Low priority. The prioritization ranking for each mitigation action considered by the HMPC is provided in Section 7 Mitigation Action Plans.

## 7 Mitigation Action Plans

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**Requirement §201.6(c)(3)(iii): [The mitigation strategy section shall include an] action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.**

This section provides the mitigation action plans for each participating jurisdiction. The plans are organized as follows:

- ▶ Alamance County
- ▶ City of Burlington
- ▶ City of Graham
- ▶ City of Mebane
- ▶ Town of Elon
- ▶ Town of Green Level
- ▶ Town of Haw River
- ▶ Town of Ossipee
- ▶ Town of Swepsonville
- ▶ Village of Alamance
- ▶ Durham County-Durham City
- ▶ Orange County
- ▶ Town of Carrboro
- ▶ Town of Chapel Hill
- ▶ Town of Hillsborough
- ▶ Person County-City of Roxboro

Note that both Durham County and the City of Durham as well as Person County and the City of Roxboro opted to coordinate on joint mitigation action plans. Additionally, several actions pursued by multiple Alamance County jurisdictions were carried forward but consolidated into the Alamance County Mitigation Action Plan. These projects will provide mitigation to all applicable jurisdictions, but the County is serving as the lead party responsible for implementation.

Table 7.1 – Mitigation Action Plan, Alamance County

Action #	Action Description	Applicable Jurisdictions	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention										
P-1	Direct each County office of agency to assess how it can better incorporate hazard mitigation goals into its planning and implementation of its duties	Alamance County	All Hazards	1.2	Moderate	Alamance County Emergency Management	County	2020-2025	Carry forward	Each department is working on a COOP plan and they will address hazard mitigation goals and planning into their duties.
P-2	Maintain shelter agreements with the American Red Cross	Alamance County	All Hazards	2.2	Moderate	Alamance County Emergency Management	County	2020-2025	Carry forward	Alamance County has taken on the responsibilities of opening and maintaining shelters on their own. ARC will be used as a backup if need.
P-3	Review methods of school construction to ensure that all new schools are constructed to the maximum cost feasible standards of wind resistance, flood resistance, and access so that they can be used as shelters for evacuees during and after natural hazard events.	Alamance County	All Hazards	1.2	Moderate	Alamance County Inspections Department	General Fund	2020-2025	Carry forward	No progress made due to administrative limitations. Our Inspections department will follow all guidelines on new projects.
P-4	Review the subdivision regulations and make appropriate changes to encourage alternatives to placing lots in flood-prone areas and to minimize impervious surface coverings, if necessary.	Alamance County	Flood	1.2	Moderate	Alamance County Planning Department	General Fund	2020-2025	Carry forward	Planning is still working on this. No progress has been made due to limited staff resources.
P-5	Propose a policy to the Board of Commissioners prohibiting the development of critical public facilities in the 100-year floodplain in cases where viable alternatives exist. Presently, most critical facilities located in the floodplain are waste pump stations because they must be located at low elevations because the handle gravity flowing sewage.	Alamance County, Town of Green Level, Town of Swepsonville	Flood	1.2	Moderate	Alamance County Planning Department	General Fund	2020-2025	Carry forward	Planning is still working on this. No progress has been made due to limited staff rezsources.
P-6	Develop specific regulations that prohibit dumping in the county's watersheds	Alamance County	Flood	1.1	Moderate	Alamance County Planning Department	Staff time	2020-2025	Carry forward	Planning is still working on this. No progress has been made due to limited staff resources.
P-7	When the county land use plan is complete, create a land use map with an overlay of flood hazards and any other natural hazards that can be mapped.	Alamance County	All Hazards	1.2	Moderate	Alamance County Emergency Management, Alamance County GIS Department	County	2020-2025	Carry forward	Land use study is still in progress. GIS planner will create this overlay when the land use study is completed. Where possible, local community land use mapping should be incorporated.
Property Protection										
PP-1	Look for opportunities to acquire or relocate structures vulnerable to floods	Alamance County	Flood	4.2	Low	Alamance County Emergency Management, Alamance County Planning Department	General Fund	2020-2025	New	EM monitors flood prone areas.
PP-2	Monitor structures affected by flood and track damages and repair costs. If damages and repair costs are high relative to the value of the structure, consider mitigation including elevation, acquisition, or floodproofing.	Alamance County	Flood	4.2	High	Alamance County Emergency Management, Alamance County Planning Department	General Fund	2020-2025	Carry forward	No progress was made on this project. The County will continue to monitor the county properties which are or may be impacted by flooding events.



SECTION 7: MITIGATION ACTION PLANS

Action #	Action Description	Applicable Jurisdictions	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
PP-3	Monitor recreational facilities located in the floodplain and evaluate flood resistance of county structures.	Alamance County	Flood	4.2	Moderate	Alamance County Planning Department	General Fund	2020-2025	Carry forward	No progress was made on this project. The County will monitor the county properties which are or may be impacted by flooding events.
PP-4	Monitor reservoirs for potential flooding problems and note any unexpected flooding issues.	Alamance County	Flood	4.2	High	Alamance County Emergency Management	N/A	2020-2025	Carry forward	No progress was made on this project. The County will coordinate with Municipal watershed owners and operators to monitor levels and control of the dams and gates for flooding.
Structural Projects										
SP-1	Seek funding to the retrofit of critical facilities and County-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	Alamance County	All Hazards	4.2	Moderate	Alamance County Buildings and Inspections Department, Alamance County Planning Department, Alamance County Emergency Management	State grants, UHMA grants, other federal grants	2020-2025	Carry forward	No progress was made on this project due to limited funding. Will evaluate resilience needs and look for grants and resource funding to retrofit county facilities.
SP-2	Seek funding for the installation of backup generators or quick connect hook ups for mobile generators on any newly constructed and existing county critical facilities.	Alamance County	All Hazards	4.2	Moderate	Alamance County Buildings and Inspections Department, Alamance County Planning Department, Alamance County Emergency Management	Local, State grants, UHMA grants, other federal grants	2020-2025	New	Work to install a spare transfer switch to one of our local shelters.
Emergency Services										
ES-1	Coordinate with the North Carolina Department of Transportation (NCDOT) to maintain adequate and effective snow and ice removal plans by the towns/cities and NCDOT. "Adequate" means that all major thoroughfares are cleared and remain clear within 12 hours of last snowfall.	Alamance County, Town of Green Level, Town of Haw River, Town of Swepsonville	Severe Winter Weather	2.2	Moderate	Alamance County Emergency Management	Staff time	2020-2025	Carry forward	Attended local area DOT meetings and gathered updates on their snow and ice removal plans to ensure that they can adequately treat and plow roads.
Public Education & Awareness										
PEA-1	Encourage builders, developers, and architects to become familiar with the National Flood Insurance Program (NFIP) land use and building standards by attending annual workshops presented by the North Carolina Division of Emergency Management (NCEM). This can be accomplished by creating a mailing list and providing it to NCEM to use for its announcements. This task can be further supported by distributing copies of NCEM's announcements from the Alamance County Inspections Department when builders and developers apply for permits.	Alamance County, Town of Green Level, Town of Haw River, Town of Swepsonville	Flood	2.1	Moderate	Alamance County Emergency Management	General Fund	2020-2025	Carry forward	No progress was made on this project due to limited staff resources.
PEA-2	Encourage citizens and businesses/industries to develop emergency preparedness plans.	Alamance County, Town of Green Level	All Hazards	2.1	Moderate	Alamance County Emergency Management; Alamance County LEPC	LEPC	2020-2025	Carry forward	County EM has been working directly with local chemical facilities on developing Emergency Response Plans for 1st responder response.

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Action #	Action Description	Applicable Jurisdictions	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
PEA-3	Encourage homeowners to review insurance policies as part of an overall family disaster plan.	Alamance County	All Hazards	2.1	Moderate	Alamance County Emergency Management	N/A	2020-2025	Carry forward	No progress made on this project due to limited staff. Plan to add this to the Emergency Management website
PEA-4	Increase awareness of the natural hazards potential to local officials, the general public, and private industry.	Alamance County	All Hazards	2.1	Moderate	Alamance County Emergency Management	N/A	2020-2025	Carry forward	We have shared information via our website pertaining to preparation and planning for disasters.
PEA-5	Discourage the public and developers from developing property in flood zones.	Alamance County	Flood	1.2	Moderate	Alamance County Planning Department	General Fund	2020-2025	Carry forward	No progress made on this project due to limited staff.
PEA-6	Maintain documents about flood insurance, flood protections, floodplain management, and natural and beneficial functions of floodplains at the local libraries and government offices.	Alamance County	Flood	2.1	Moderate	Alamance County Planning Department	General Fund	2020-2025	Carry forward	No progress made on this project due to limited staff.
PEA-7	Maintain GIS system at <a href="http://www.alamance-nc.com">www.alamance-nc.com</a> . From this site anyone from a private citizen, builder, insurance company, etc. can see if a property is located in the 1-percent-annual-chance (100-year) floodplain.	Alamance County, Town of Haw River, Town of Ossipee, Town of Swepsonville, Village of Alamance	Flood	2.1	Moderate	Alamance County GIS Department	General Fund	2020-2025	Carry forward	The County Land Use plan is in progress and a land-use GIS layer is expected as a deliverable once the plan is complete.
PEA-8	Provide local real estate agents with handouts that will advise potential buyers to investigate the flood hazard for the property they are considering purchasing.	Alamance County,	Flood	2.1	Moderate	Alamance County Planning Department	Unknown	2020-2025	Carry forward	In Progress. Implementation delayed due to limited staff resources.
PEA-9	Educate citizens to listen for the watches and warnings issued by the National Weather Service	Alamance County, Town of Green Level, Town of Haw River, Town of Ossipee, Village of Alamance	All Hazards	2.2	Moderate	Alamance County Emergency Management	County	2020-2025	Carry forward	The County has utilized our website and social media outlets to share information to the public and local municipalities on listening to and having a warning system in the home. The County is now working with hearing impaired and distributing hearing impaired weather alert radios devices to those who request them.
PEA-10	Maintain Alamance County Communications' capability to monitor weather conditions and advise all emergency services regarding watches and warnings.	Alamance County,	Flood	2.2	Moderate	Alamance County Emergency Management	County	2020-2025	Carry forward	We have updated our Nixle alert system and are promoting personnel to sign up for the service. Will continue to monitor and push weather information to PSAP's and other Emergency Services in the county to keep them aware of impending weather.

Table 7.2 – Mitigation Action Plan, City of Burlington

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Discourage the public and developers from developing property in flood zones.	Flood	1.2	Moderate	City of Burlington Building and Inspections	General fund	2020-2025	Carried Forward	The City works with developers and property owners on a case-by-case basis.
P-2	Adopt policy prohibiting the development of critical public facilities in the 100-year floodplain in cases where viable alternatives exist.	Flood	1.2	Moderate	City of Burlington Building and Inspections	General fund	2020-2025	Carried Forward	This activity is ongoing. This is not an adopted policy, but the City of Burlington Floodplain Manager oversees construction and acquisition of property in flood-prone areas. It is not the policy of the City to place critical systems in areas subject to flooding.
P-3	Expand the City’s Geographic Information System (GIS) capabilities to include more hazard specific information.	All Hazards	1.2	Moderate	City of Burlington GIS Division	Staff time	2020-2025	Carried Forward	This activity is ongoing and continually evaluated for effectiveness and modified as needed. Current capability includes the ability to define hazard areas from historical data as well as the ability to project potential areas of concern. The City will also continue to monitor opportunities to enhance GIS technologies and appropriate datasets for hazard mitigation planning.
P-4	Continue the City’s participation in the National Flood Insurance Program (NFIP) so citizens are eligible for flood insurance.	Flood	1.2	Moderate	City of Burlington Building and Inspections	General fund	2020-2025	Carried Forward	The City maintained active participation in the NFIP.
P-5	Request that each City department/office assess how it can better incorporate hazard mitigation goals into its separate planning processes and/or implementation of its duties.	All Hazards	1.2	Moderate	City of Burlington Office of Emergency Management	City funds	2020-2025	Carried Forward	Informal assessments completed. No formal documentation developed yet due to limited administrative resources.
P-6	Review all fire districts coverage to ensure that there are adequate quantities of water for firefighting purposes and that all water points are maintained on a regular basis.	Wildfire	2.2	Moderate	City of Burlington Fire Department, City of Burlington Water Department	Staff time	2020-2025	Carried Forward	This activity is ongoing based on regular maintenance schedules and is continually evaluated for effectiveness and modified as needed.
P-7	Develop a detailed hazard assessment for dams in Alamance County and add to county hazard mitigation plan.	Dam Failure	3.2	Moderate	City of Burlington Office of Emergency Management	Local, County	2020-2025	Carried Forward	Dam failure is included in this plan update and will continue to be evaluated in future updates.
Property Protection									
PP-1	Monitor structures affected by flood and track damages and repair costs. If damages and repair costs are high relative to the value of the structure, consider mitigation including elevation, acquisition, or floodproofing.	Flood	4.2	High	City of Burlington Office of Emergency Management, City Planning Department	General fund	2020-2025	Carried Forward	This activity was implemented as needed following hazard events. The City has the capability to conduct damage assessments with assistance from the County and the State.
PP-2	Monitor recreational facilities located in the floodplain and evaluate flood resistance of city structures.	Flood	4.2	Moderate	City of Burlington, City Planning Department	General fund	2020-2025	Carried Forward	No progress made due to limited administrative resources.
PP-3	Monitor reservoirs, lakes, and streams for potential flooding problems and note any unexpected flooding issues.	Flood	1.1	High	City of Burlington	N/A	2020-2025	Carried Forward	All reservoirs and water sources located throughout the city have been processed by various companies (i.e. dam review, etc.). City of Burlington reservoirs are assessed each year for potential problems as well as security issues.

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Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Structural Projects									
SP-1	Retrofit critical facilities and City-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, 320 or 361 compliant safe rooms, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	4.2	Moderate	City of Burlington Building and Inspections, Office of Emergency Management, City Planning Department	Internal staff time	2020-2025	Carried Forward	No progress made due to fiscal limitations.
SP-2	Install backup generators or quick connect hook ups for mobile generators on any newly constructed county/town critical facilities.	All Hazards	4.2	Moderate	City of Burlington Building and Inspections, Office of Emergency Management, City Planning Department	Local, State grants, UHMA grants, other federal grants	2020-2025	Carried Forward	No progress made due to fiscal limitations. The City will continue to seek funding to install backup generators as needed for new facilities.
Emergency Services									
ES-1	Meet annually with State Forester for Alamance County to improve coordination of wildfire control and response.	Wildfire	3.2	Moderate	City of Burlington Fire Department	Staff time	2020-2025	Carried Forward	This activity is implemented annually.
Public Education & Awareness									
PEA-1	Encourage builders, developers, and architects to become familiar with the National Flood Insurance Program (NFIP) land use and building standards by attending annual workshops presented by the North Carolina Division of Emergency Management (NCEM).	Flood	1.2	Moderate	City of Burlington Building and Inspections, City of Burlington Office of Emergency Management	General fund	2020-2025	Carried Forward	No progress made due to limited staff resources.
PEA-2	Encourage homeowners to review insurance policies as part of an overall family disaster plan.	All Hazards	2.1	Moderate	City of Burlington Office of Emergency Management	Staff time	2020-2025	Carried Forward	In Progress. The City gives presentations to HOAs and neighborhood groups and distributes literature.
PEA-3	Increase awareness of the natural hazards potential to local officials, the general public, and private industry.	All Hazards	2.1	Moderate	City of Burlington Office of Emergency Management, Burlington Office of Public Information	Staff time	2020-2025	Carried Forward	This activity is ongoing and continually evaluated for effectiveness and modified as needed. Recent outreach methods include giving presentations and maintaining a presence at public events.
PEA-4	Maintain documents about flood insurance, flood protection, floodplain management, and natural and beneficial functions of floodplains at the local libraries and government offices.	Flood	2.1	Low	City of Burlington, Alamance County Planning Department	N/A	2020-2025	Carried Forward	This activity is ongoing. The City will continue to support maintaining these materials at local libraries and government offices.
PEA-5	Provide local real estate agents with handouts that will advise potential buyers to investigate the flood hazard for the property they are considering purchasing.	Flood	2.1	Low	City of Burlington, City Planning Department	Unknown	2020-2025	Carried Forward	No new resources were developed due to limited staff and fiscal resources.
PEA-6	Educate citizens to listen for the watches and warnings issued by the National Weather Service.	All Hazards	2.2	Moderate	City of Burlington Office of Emergency Management	County	2020-2025	Carried Forward	The City of Burlington Office of Emergency Management conducted annual presentations to Burlington Housing authority, Burlington Senior center, and Burlington Community network and has maintained a presence at local community events such as the annual Carousel Festival. Presentations include NWS information as well as inclement and hazardous weather planning/preparation.

Table 7.3 – Mitigation Action Plan, City of Graham

Action #	Action Description	Hazard(s) Addressed	Goal Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Review methods of school construction to ensure that all new schools are constructed to the maximum cost feasible standards of wind resistance, flood resistance, and access so that they can be used as shelters for evacuees during and after natural hazard events.	Flood	1.2	Moderate	City of Graham	General fund	2022	Carried forward	The City of Graham Planning Department reviews plans for all new and existing structures for this. The City of Graham currently has one charter school under construction and will reach out to them regarding use as a shelter.
P-2	Propose a policy prohibiting the development of critical public facilities in the 100-year floodplain in cases where viable alternatives exist. Presently, most critical facilities located in the floodplain are waste pump stations because they must be located at low elevations because the handle gravity flowing sewage.	Flood	1.2	Moderate	City of Graham Public Works Department	General fund	2024	Carried forward	The City is currently moving our most at-risk pump station (Boyd Creek) out of the floodplain.
P-3	Consider expanding the County's Geographic Information System (GIS) capabilities to include maintaining Elevation Certificates in a computer database.	Flood	1.2	Moderate	Alamance County GIS Department	Staff time, General fund	2023	Carried forward	Graham has centralized our Floodplain permitting and Elevation Certificates such that they are ready when requested.
P-4	Continue City of Graham's participation in the National Flood Insurance Program (NFIP) so citizens are eligible for flood insurance.	Flood	1.2	Moderate	City of Graham	General fund	2020	Carried forward	Graham complied with the most recent update of the regulations and maps and will adopt language to allow for the 'most current map' to rule as part of our 160D update.
P-5	Review all fire districts coverage to ensure that there are adequate quantities of water for firefighting purposes and that all water points are maintained on a regular basis.	Wildfire	2.2	Moderate	City of Graham Fire Department	Staff time	2025	Carried forward	No progress reported due to administrative barriers. Timeline based on Rating Schedule dictated by Office of State Fire Marshal.
Property Protection									
PP-1	Monitor recreational facilities located in the floodplain and evaluate flood resistance of county structures.	Flood	4.2	Moderate	City of Graham Public Works Department	Staff time	2022	Carried forward	Graham will continue to monitor. A new route to the Wastewater Treatment Plant was installed in 2019 to provide access outside of the floodplain.
PP-2	Monitor reservoirs, lakes, and streams for potential flooding problems and note any unexpected flooding issues.	Flood	4.2	Moderate	City of Graham/ Alamance County EM	General fund	2025	Carried forward	Dam repairs were completed at reservoir in 2020. Graham will continue to monitor.
Structural Projects									
SP-1	Seek funding to the retrofit of critical facilities and Town-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	4.2	Moderate	City Buildings and Inspections Department, City Planning Department, City Emergency Services	Local, State grants, federal grants	2025	Carried forward	The City of Graham has begun to use smart meters to detect leaks throughout the city and re-ran electrical lines underground to City Hall to increase reliability.
SP-2	Seek funding for the installation of backup generators or quick connect hook ups for mobile generators on any newly constructed and existing county critical facilities.	All Hazards	4.2	Moderate	City Buildings and Inspections Department, City Planning Department, City Emergency Services	Local, State grants, federal grants	2020	Completed	City Hall, Police Department, Fire Department, Water Treatment, Wastewater Treatment, and our pump stations are now all covered by back-up generators. Additional facilities to be identified.
Emergency Services									
ES-1	Meet annually with State Forester for Alamance County to improve coordination of wildfire control and response.	Wildfire	3.2	Moderate	City of Graham	General fund	2021	Carried forward	No progress due to staff limitations. New Fire Chief will reach back out to State Forester and reestablish this link.



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Action #	Action Description	Hazard(s) Addressed	Goal Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
ES-2	Coordinate with the North Carolina Department of Transportation (NCDOT) to maintain adequate and effective snow and ice removal plans by the towns/cities and NCDOT. "Adequate" means that all major thoroughfares are cleared and remain clear within 12 hours of last snowfall.	Severe Winter Weather	2.2	Moderate	City of Graham	General fund	2023	Carried forward	Limited progress due to administrative barriers. It has been difficult to get a response from NCDOT for snow clearing of specific routes. The City continues to reach out and attempt to take over some primary routes.
Public Education & Awareness									
PEA-1	Encourage builders, developers, and architects to become familiar with the National Flood Insurance Program (NFIP) land use and building standards by attending annual workshops presented by the North Carolina Division of Emergency Management (NCEM). This can be accomplished by creating a mailing list and providing it to NCEM to use for its announcements. This task can be further supported by distributing copies of NCEM's announcements from the Alamance County Inspections Department when builders and developers apply for permits.	Flood	2.1	Moderate	City of Graham	General fund	2025	Carried forward	The City of Graham works with Alamance County to ensure that developers are up-to-date when applying for permits and by attending workshops. City staff attends CFP trainings, and reviews all NFIP regulations.
PEA-2	Encourage citizens and businesses/industries to develop emergency preparedness plans.	All Hazards	2.1	Moderate	City of Graham	General fund	2023	Carried forward	No progress reported due to limited staff resources. The City will maintain an Emergency Preparedness page on the City website in conjunction with the County to help inform local residents.
PEA-3	Encourage homeowners to review insurance policies as part of an overall family disaster plan.	All Hazards	2.1	Moderate	City of Graham	General fund	2023	Carried forward	No progress reported due to limited staff resources. The City will maintain an Emergency Preparedness page on the City website in conjunction with the County to help inform local residents.
PEA-4	Increase awareness of the natural hazards potential to local officials, the general public, and private industry.	All Hazards	2.1	Moderate	City of Graham	General fund	2022	Carried forward	The usage of NIXLE has increased awareness of the frequency of hazards. The City will continue to push notifications regarding hazardous weather over this and other media.
PEA-5	Discourage the public and developers from developing property in flood zones.	All Hazards	1.2	Moderate	City of Graham	General fund	2025	Carried forward	Graham adopted a 2' above base flood elevation building requirement to decrease development potential of flood zones.
PEA-6	Maintain documents about flood insurance, flood protections, floodplain management, and natural and beneficial functions of floodplains at the local libraries and government offices.	Flood	2.1	Moderate	City of Graham	General fund	2025	Carried forward	Documents are made available at City Hall.

Table 7.4 – Mitigation Action Plan, City of Mebane

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Maintain Shelter Agreements with the American Red Cross	All Hazards	2.2	Moderate	Alamance County/ City	General Fund	2020-2025	Carried Forward	This is in the CIP for the shelter in Mebane.
P-2	Expand the County's GIS Capabilities to Include Maintaining Elevation Certificates	Flood	2.2	Moderate	Alamance County/ City	Staff Time	2020-2025	Carried Forward	County maintains GIS but City maintains elevation certificates available to county upon request.
P-3	Continue the City of Mebane’s participation in the National Flood Insurance Program	Flood	1.2	Moderate	City	Staff Time	2020-2025	Carried Forward	The City has maintained compliance with the NFIP and will continue to do so as part of plan review and permitting process.
P-4	Monitor Reservoirs, Lakes, and Streams for Potential Flooding Problems and Note any Unexpected Flooding Issues	Flood	1.2	Moderate	City	Staff Time	2020-2025	Carried Forward	City has checked culverts and streams along outfalls ahead of large predicted storm events and cleared debris as necessary to prevent flooding. No major issues beyond maintenance needs have been noted.
P-5	Review All Fire Districts Coverage to Ensure there are Adequate Quantities of Water for Fire Fighting Purposes and that all Water Points are Maintained on a Regular Basis	Wildfire	2.2	Moderate	City	Staff Time	2020-2025	Carried Forward	OSFM conducted ISO inspections in 2018. Will review with OSFM upon next inspection.
P-6	When County Land Use Plan is Complete, Create a Land Use Map with an Overlay for Flood Hazards and any Other Natural Hazards	All Hazards	1.2	Moderate	City	General Fund	2020-2022	Carried Forward	Land use plan completed locally. County has flood hazard on the County GIS. Will look to provide additional mapping as data becomes available.
Property Protection									
PP-1	Monitor Structures Affected by Flood and Track Damages and Repair Costs.	Flood	4.2	Low	City	Hazard Mitigation Grants	2020-2025	Carried Forward	No progress to report due to low priority. City owned structures will be monitored and tracked. Private structures will be tracked by building permits.
Structural Projects									
SP-1	Seek funding to retrofit critical facilities and Town-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, 320 or 361 compliant safe rooms, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	4.2	Moderate	City	State Grants, UHMA Grants, other federal grants	2020-2025	Carried Forward	As buildings are upgraded, we will look into retrofitting facilities with the latest technology. Many facilities have backup generators installed and low water consumption fixtures.
SP-2	Seek funding to install backup generators or quick connect hook ups for mobile generators on any newly constructed county/town critical facilities	All Hazards	4.2	Moderate	City	Local, State Grants, UHMA Grants, other federal grants	2020-2025	Carried Forward	Backup generators have now been installed at nearly all existing facilities. All new construction facilities will be evaluated as part of plan review.
Emergency Services									
ES-1	Meet Annually with State Forester for Alamance County to Improve Coordination of Wildfire Control and Response	Wildfire	3.2	Moderate	City	Staff Time	2020-2025	Carried Forward	No progress due to limited staff resources. Fire department to meet annually with State forester to coordinate Wildfire Control and Response.
ES-2	Coordinate with the NCDOT to Maintain Adequate and Effective Snow Removal Plans by Cities and NCDOT	Severe Winter Weather	3.1	Moderate	Public Works	General Fund	2020-2021	Carried Forward	In process with a municipal agreement with the NCDOT.

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Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Public Education & Awareness									
PEA-1	Encourage Familiarity with National Flood Insurance Program (NFIP)	Flood	2.1	Moderate	Planning, Zoning and Inspections	Staff Time	2020-2025	Carried Forward	No new progress to report due to limited administrative resources. Will continue existing outreach as part of plan review and permitting process.
PEA-2	Encourage Citizens and Businesses to Develop Emergency Preparedness Plans	All Hazards	2.1	Moderate	City	Staff Time	2020-2025	Carried Forward	No progress made due to administrative limitations. Will place information on the website encouraging development of emergency preparedness plans.
PEA-3	Encourage Homeowners to Review Insurance Policies as Part of an Overall Family Disaster Plan	All Hazards	2.1	Moderate	City	Staff Time	2020-2025	Carried Forward	Educational material is posted on website/handouts
PEA-4	Increase Awareness of the Natural Hazards Potential to Officials, Public and Industry	All Hazards	2.1	Moderate	City	Staff Time	2020-2025	Carried Forward	Code Red information is placed on the City's website. Citizens are informed by Code Red notifications as hazards arise.
PEA-5	Provide Local Real Estate Agents with Handouts that Will Advise Potential Buyers to Investigate the Flood Hazards for the Property Under Consideration	Flood	2.1	Low	City	Staff Time	2020-2025	Carried Forward	Planning department provides information to agents and developers.

Table 7.5 – Mitigation Action Plan, Town of Elon

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Review methods of school construction to ensure that all new schools are constructed to the maximum cost feasible standards of wind resistance, flood resistance, and access so that they can be used as shelters for evacuees during and after natural hazard events.	All Hazards	1.2	High	Alamance County, Town of Elon	Elon University	2020-2025	Carried forward	Completed and continuing ongoing implementation. Elon University donated and built a new Elementary school for the residents of Elon and surrounding community. Built in 2019. Estimated cost \$19m.
P-2	Consider adopting a policy prohibiting the development of critical public facilities in the 100-year floodplain in cases where viable alternatives exist. Presently, most critical facilities located in the floodplain are waste pump stations because they must be located at low elevations because the handle gravity flowing sewage.	Flood	1.2	Moderate	Town of Elon Public Works Department, Town of Elon Planning Department	General Fund	2020-2025	Carried forward	Completed and continuing ongoing implementation. The Town of Elon Public Works along with Town of Elon Planning(TRC) coordinate an inventory of all public facilities and identify the facilities that are within the 100 year floodplain-if any.
P-3	Expand the County's Geographic Information System (GIS) capabilities to include maintaining Elevation Certificates in a computer database.	Flood	1.2	Moderate	Alamance County, Town of Elon	General Fund	2020-2025	Carried forward	Completed and continuing ongoing implementation. The Town of Elon works in conjunction with Alamance Co. GIS in computer based driven software on this.
P-4	Continue Town of Elon's participation in the National Flood Insurance Program (NFIP) so citizens are eligible for flood insurance.	Flood	1.2	Moderate	Town of Elon	General Fund	2020-2025	Carried Forward	Completed and continuing ongoing implementation. Elon actively participates in the NFIP for its citizens.
P-5	Review all fire districts coverage to ensure that there are adequate quantities of water for firefighting purposes and that all water points are maintained on a regular basis.	Wildfire	2.2	Moderate	Alamance County, Town of Elon Fire Department	General Fund	2020-2025	Carried forward	Completed and continuing ongoing implementation. Town of Elon contracts with 3rd party testing company to model and project needed water supplies for firefighting and domestic use on a yearly basis to keep up with growth and to help with FD ISO rating. Estimated cost \$10,000.
P-6	When the county land use plan is complete, create a land use map with an overlay of flood hazards and any other natural hazards that can be mapped.	All Hazards	1.2	Moderate	Town of Elon	N/A	2020-2025	Carried forward	Completed and continuing ongoing implementation. Town participated with Alamance Co EM on flood mapping. Mapping was completed in 2015-2016.
P-7	Direct Town of Elon to assess how it can better incorporate hazard mitigation plan goals and objectives into its planning and implementation of its duties with the County's plans.	All Hazards	1.2	Moderate	Alamance County/Town of Elon	General Fund	2020-2025	New	
Property Protection									
PP-1	Monitor reservoirs, lakes, and streams for potential flooding problems and note any unexpected flooding issues.	Flood	1.2	Moderate	Town of Elon, Alamance County	N/A	2020-2025	Carried forward	Completed and continuing ongoing implementation. No new flood risks were identified in the last five years, but the Town and the County will continue to monitor for any new potential flood issues within the area.
Structural Projects									
SP-1	Seek funding to the retrofit of critical facilities and Town-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, 320 or 361 compliant safe rooms, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	4.2	Moderate	Town Buildings and Inspections Department, Town Planning Department, Town Emergency Services	General Fund, Local, State Grants, UHMA Grants, other potential federal grants	2020-2025	Carried forward	The Towns TRC committee together with plans review have been able to review and approve all new construction builds from 2015-2020 particularly with new construction at Elon University with backup generators (where applicable and required by the NC Fire Code) along with fire resistant materials, wind retrofits and upgrades, as well as 911 communications requirements in buildings for effective radio transmissions.
Emergency Services									
ES-1	Meet annually with State Forester for Alamance County to improve coordination of wildfire control and response.	Wildfire	3.2	Moderate	Alamance County, Town of Elon Fire Department	NA	2020-2025	Carried forward	The Town of Elon FD conducts monthly meeting with the local arson task force and topics such as wildland fires are discussed occasionally with local FS Rep.

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Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
ES-2	Coordinate with the North Carolina Department of Transportation (NCDOT) to maintain adequate and effective snow and ice removal plans by the towns/cities and NCDOT. "Adequate" means that all major thoroughfares are cleared and remain clear within 12 hours of last snowfall.	Severe Winter Weather	2.2	Moderate	Town of Elon	General Fund	2020-2025	Carried forward	The Town's Public Works Department provided completed snow removal from the Towns streets during every snow storm from 2015-2020. This was for any storm which produced enough precipitation to cover the roads and maintained them clear.
Public Education & Awareness									
PEA-1	Encourage builders, developers, and architects to become familiar with the National Flood Insurance Program (NFIP) land use and building standards by attending annual workshops presented by the North Carolina Division of Emergency Management (NCEM). This can be accomplished by creating a mailing list and providing it to NCEM to use for its announcements. This task can be further supported by distributing copies of NCEM's announcements from the Alamance County Inspections Department when builders and developers apply for permits.	Flood	1.2	Moderate	Town of Elon	General Fund	2020-2025	Carried forward	The Town of Elon along with Alamance County provides this information during the Town's Technical Review Committee meetings with contractors, architects, etc. The Town continues to provide this information to the institutions with the most development activity such as Elon University, Blakey Hall and Twin Lakes Retirement Centers. A link to the Flood Damage Prevention Ordinance has been placed on the Town's website.
PEA-2	Encourage citizens and businesses/industries to develop emergency preparedness plans.	All Hazards	2.1	Moderate	Town of Elon	General Fund	2020-2025	Carried forward	The Town will continue to coordinate efforts to meet with the major institutions and businesses (Elon University, Twin Lakes, Blakey Hall, Labcorp, Carolina Biological, Sonoco, and Engineering Controls) to encourage continued development of their plans as their operations expand.
PEA-3	Encourage homeowners to review insurance policies as part of an overall family disaster plan.	All Hazards	2.1	Moderate	Town of Elon	Staff Time	2020-2025	Carried forward	The Town of Elon FD's Emergency Management currently maintains an updated preparedness page on their website. This information will continue to be updated periodically to help inform town residents.
PEA-4	Increase awareness of the natural hazards potential to local officials, the general public, and private industry.	All Hazards	2.1	Moderate	Town of Elon	Staff Time	2020-2025	Carried forward	In the Town of Elon FD preparedness page on the Town's website and a link also is added to the Alamance Co. Emergency Preparedness website.
PEA-5	Maintain hazard mitigation plan and floodplain information on the Town's website (www.elonnc.com).	All Hazards	2.1	Moderate	Town of Elon	Staff Time	2020-2025	Carried forward	The website carries you to the Hazard Mitigation Plan, NFIP website, and flood damage prevention ordinance (which is already in the Planning Departments documentation for download).
PEA-6	Maintain documents about flood insurance, flood protections, floodplain management, and natural and beneficial functions of floodplains at the local libraries and government offices.	Flood	2.1	Moderate	Town of Elon, Alamance County	General Fund	2020-2025	Carried forward	The Town of Elon is the FEMA repository for all related documents within its jurisdiction. The Town also works closely in conjunction with Alamance County concerning flooding issues.
PEA-7	Maintain GIS system at www.alamance-nc.com. From this site anyone from a private citizen, builder, insurance company, etc. can see if a property is located in the 1-percent-annual-chance (100-year) floodplain.	Flood	2.1	Moderate	Alamance County	Staff Time	2020-2025	Carried forward	The Town provides a link on the Town's website to the County's GIS. The Town will continue to maintain this link.
PEA-8	Provide local real estate agents with handouts that will advise potential buyers to investigate the flood hazard for the property they are considering purchasing.	Flood	2.1	Moderate	Town of Elon	Staff Time	2020-2025	Carried forward	The Town provides links or info to the County GIS and NC FRIS website.
PEA-9	Educate citizens to listen for the watches and warnings issued by the National Weather Service	Flood	2.2	Moderate	Town of Elon	Staff Time	2020-2025	Carried forward	The Town of Elon in conjunction with Alamance Co. inform the residents via website as well as the countywide emergency alert system, Nixle, of upcoming warnings and watches.



Table 7.6 – Mitigation Action Plan, Town of Green Level

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Review the subdivision regulations and make appropriate changes to encourage alternatives to placing lots in flood-prone areas and to minimize impervious surface coverings, if necessary.	Flood	1.2	Moderate	Town of Green Level	Local	2020-2025	Carried forward	No progress was made due to administrative limitations.
P-2	Discourage the public and developers from developing property in flood zones.	Flood	1.2	Moderate	Town of Green Level	Local	2020-2025	Carried forward	No progress made due to administrative limitations.
P-3	Expand the County's Geographic Information System (GIS) capabilities to include maintaining Elevation Certificates in a computer database	Flood	1.2	Low	Alamance County	Local, County	2020-2025	Carried forward	The Town now maintains ECs, but they are not yet made available on the County's GIS website.
P-4	Continue the Town of Green Level's participation in the National Flood Insurance Program (NFIP) so citizens are eligible for flood insurance.	Flood	1.2	Moderate	Town of Green Level	Local, County	2020-2025	Carried forward	The Town has remained an active participant in the NFIP.
P-5	Review all fire districts coverage to ensure that there are adequate quantities of water for firefighting purposes and that all water points are maintained on a regular basis.	Wildfire	2.2	Moderate	Town of Green Level, Town of Haw River	Local, County	2020-2025	Carried forward	No progress was made due to administrative limitations.
P-6	When the county land use plan is complete, create a land use map with an overlay of flood hazards and any other natural hazards that can be mapped.	All Hazards	1.2	Moderate	Town of Green Level	Local, County	2020-2025	Carried forward	County land use plan is now under development.
Structural Projects									
SP-1	Seek funding to the retrofit of critical facilities and Town-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	4.2	Moderate	Town Buildings and Inspections Department, Town Planning Department, Town Emergency Services	Local, State Grants, UHMA Grants, other potential federal grants	2020-2025	Carried forward	No progress was made due to limited administrative and fiscal resources.
SP-2	Seek funding for the installation of backup generators or quick connect hook ups for mobile generators on any newly constructed and existing county critical facilities.	All Hazards	4.2	Moderate	Town Buildings and Inspections Department, Town Planning Department, Town Emergency Services	Local, State Grants, UHMA Grants, other potential federal grants	2020-2025	Carried forward	No progress was made due to limited administrative and fiscal resources.
Emergency Services									
ES-1	Meet annually with State Forester for Alamance County to improve coordination of wildfire control and response.	Wildfire	3.2	Moderate	Town of Green Level, Town of Haw River	Local, County	2020-2025	Carried forward	No progress was made due to limited staff resources.
Public Education & Awareness									
PEA-1	Encourage residents to sign up for the countywide emergency notification system. Greater awareness of hazard events will help make residents more aware of their risks and encourage them to take preparedness and property protection actions to mitigate their individual hazard risk.	All Hazards	2.1	Moderate	Town of Green Level	Local	2020-2025	New	

Table 7.7 – Mitigation Action Plan, Town of Haw River

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Expand the County's Geographic Information System (GIS) capabilities to include maintaining Elevation Certificates in a computer database.	Flood	1.2	Moderate	Alamance County GIS Department	Local, County	2020-2025	Carried forward	The Town of Haw River now maintains ECs and will work in conjunction with Alamance County GIS Department to make them available in a computer database.
P-2	Continue Town of Haw River's participation in the National Flood Insurance Program (NFIP) so citizens are eligible for flood insurance.	Flood	1.2	Moderate	Town of Haw River	Local	2020-2025	Carried forward	The Town of Haw River has participated in the NFIP Program since 07/18/1975.
P-3	When the county land use plan is complete, create a land use map with an overlay of flood hazards and any other natural hazards that can be mapped.	All Hazards	1.2	Moderate	Town of Haw River	Local, County	2020-2025	Carried forward	The Town is now working on a new comprehensive plan to be completed in Fall 2020. Once complete, the Town can work to provide GIS land use data to the County. The Town of Haw River works in conjunction with Alamance County GIS Department on mapping.
P-4	Review all fire districts coverage to ensure that there are adequate quantities of water for firefighting purposes and that all water points are maintained on a regular basis.	Wildfire	2.2	Moderate	Town of Haw River Fire Department	Local, County	2020-2025	Carried forward	Completed an interconnect with Graham to improve pressure for emergency response. The Town of Haw River has budgeted for a water/fire flow study to be completed by Hazen-Sawyer for the FY 2020-2021.
Property Protection									
PP-1	Monitor recreational facilities located in the floodplain and evaluate flood resistance of county structures.	Flood	4.2	Moderate	Town of Haw River Public Works Department	Local, County	2020-2025	Carried forward	Red Slide Park is in the floodplain and experiences regular flooding and has been closed on several occasions. Regular monitoring will continue.
PP-2	Monitor reservoirs, lakes, and streams for potential flooding problems and note any unexpected flooding issues.	Flood	4.2	Moderate	Town of Haw River	Local, County	2020-2025	Carried forward	The Town will continue to monitor flooding problems. Recent changes to potential flood issues include a mill property being redeveloped with a new river access point. This land will be privately maintained.
Structural Projects									
SP-1	Seek funding to the retrofit of critical facilities and Town-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	4.2	Moderate	Town Buildings and Inspections Department, Town Planning Department, Town Emergency Services	Local, State Grants, UHMA Grants, other potential federal grants	2020-2025	Carried forward	Surge protection was installed for electrical equipment at Town Hall. The Town of Haw River will continue to look for grant money regarding upgrading critical facilities to improve resilience to all hazards and to improve energy usage.
SP-2	Seek funding for the installation of backup generators or quick connect hook ups for mobile generators on any newly constructed and existing county critical facilities.	All Hazards	4.2	Moderate	Town Buildings and Inspections Department, Town Planning Department, Town Emergency Services	Local, State Grants, UHMA Grants, other potential federal grants	2020-2025	Carried forward	Ongoing. The Town of Haw River has installed a back-up generator for Town Hall, the Fire Department, and the Civic Center. The generator is maintained on a regular basis. The Haw River Police Department will be purchasing a generator in the 2020-2021 Budget year using grant money. Most of our pump stations do have generators and we will continue to upgrade pump stations without generators when possible.

SECTION 7: MITIGATION ACTION PLANS

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Emergency Services									
ES-1	Meet annually with State Forester for Alamance County to improve coordination of wildfire control and response.	Wildfire	3.2	Moderate	Town of Haw River Fire Department	Local, County	2020-2025	Carried forward	This has been performed annually with the Haw River Fire Chief and the Alamance County Fire Marshall's office.
Public Education & Awareness									
PEA-1	Encourage citizens and businesses/industries to develop emergency preparedness plans.	All Hazards	2.1	Moderate	Town of Haw River	Local	2020-2025	Carried forward	The Haw River Fire Department has continued to work with business owners on developing emergency response plans.
PEA-2	Encourage homeowners to review insurance policies as part of an overall family disaster plan.	All Hazards	2.1	Moderate	Town of Haw River, Alamance County	Local	2020-2025	Carried forward	The Haw River Fire Department continued to work with homeowners on developing family emergency plans.
PEA-3	Increase awareness of the natural hazards potential to local officials, the general public, and private industry.	All Hazards	2.1	Moderate	Town of Haw River	Local	2020-2025	Carried forward	The Haw River Fire Department continued to promote awareness on natural hazards through education at local schools.
PEA-4	Discourage the public and developers from developing property in flood zones.	All Hazards	1.2	Moderate	Town of Haw River	Local	2020-2025	Carried forward	No progress to report due to limited administrative capability. The Town of Haw River reviews all new development through the TRC process.
PEA-5	Maintain documents about flood insurance, flood protections, floodplain management, and natural and beneficial functions of floodplains at the local libraries and government offices.	Flood	2.1	Moderate	Alamance County, Town of Haw River	Local, County	2020-2025	Carried forward	The Town of Haw River works in conjunction with Alamance County GIS Department on this, and the Town is the repository for all flood documents
PEA-6	Encourage residents to sign up for the countywide emergency notification system. Greater awareness of hazard events will help make residents more aware of their risks and encourage them to take preparedness and property protection actions to mitigate their individual hazard risk.	All Hazards	2.1	Moderate	Town of Haw River	Local	2020-2025	New	

Table 7.8 – Mitigation Action Plan, Town of Ossipee

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Review all fire districts coverage to ensure that there are adequate quantities of water for firefighting purposes and that all water points are maintained on a regular basis.	Wildfire	2.2	Moderate	Town of Ossipee	Local, County	2020-2025	Carried forward	No progress was made due to limited administrative resources.
P-2	When the county land use plan is complete, create a land use map with an overlay of flood hazards and any other natural hazards that can be mapped.	All Hazards	1.2	Moderate	Town of Ossipee	Local, County	2020-2025	Carried forward	The County land use plan is now in the process of being developed.
Property Protection									
PP-1	Monitor reservoirs, lakes, and streams for potential flooding problems and note any unexpected flooding issues.	Flood	4.2	Moderate	Town of Ossipee	Local, County	2020-2025	Carried forward	No progress was made due to limited administrative resources.
Structural Projects									
SP-1	Seek funding to the retrofit of critical facilities and Town-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	4.2	Moderate	Town of Ossipee	Local, State Grants, UHMA Grants, other potential federal grants	2020-2025	Carried forward	No progress was made due to lack of funding.
SP-2	Seek funding for the installation of backup generators or quick connect hook ups for mobile generators on any newly constructed and existing county critical facilities.	All Hazards	4.2	Moderate	Town of Ossipee	Local, State Grants, UHMA Grants, other potential federal grants	2020-2025	Carried forward	No progress was made due to lack of funding.
Emergency Services									
ES-1	Meet annually with State Forester for Alamance County to improve coordination of wildfire control and response.	Wildfire	3.2	Moderate	Town of Ossipee	Local, County	Annually	Carried forward	No progress was made due to limited administrative resources.
Public Education & Awareness									
PEA-1	Encourage homeowners to review insurance policies as part of an overall family disaster plan.	All Hazards	2.1	Moderate	Town of Ossipee	Local	2020-2025	Carried forward	No progress was made due to administrative limitations.
PEA-2	Increase awareness of the natural hazards potential to local officials, the general public, and private industry.	All Hazards	2.1	Moderate	Town of Ossipee	Local	2020-2025	Carried forward	No progress was made due to administrative and technical limitations.
PEA-3	Encourage residents to sign up for the countywide emergency notification system. Greater awareness of hazard events will help make residents more aware of their risks and encourage them to take preparedness and property protection actions to mitigate their individual hazard risk.	All Hazards	2.1	Moderate	Town of Ossipee	Local	2020-2025	New	

Table 7.9 – Mitigation Action Plan, Town of Swepsonville

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Review the subdivision regulations and make appropriate changes to encourage alternatives to placing lots in flood-prone areas and to minimize impervious surface coverings, if necessary.	Flood	1.2	Moderate	Town of Swepsonville	Local	2020-2025	Carried forward	No progress made due to administrative limitations
P-2	Continue Town of Swepsonville's participation in the National Flood Insurance Program (NFIP) so citizens are eligible for flood insurance.	Flood	1.2	Moderate	Town of Swepsonville	Local	2020-2025	Carried forward	The Town has maintained compliance with NFIP requirements for continued participation.
P-3	Develop specific regulations that prohibit dumping in the county's watersheds	Flood	1.1	Moderate	Town of Swepsonville	Local	2020-2025	Carried forward	No progress made due to administrative limitations
P-4	Review all fire districts coverage to ensure that there are adequate quantities of water for firefighting purposes and that all water points are maintained on a regular basis.	Wildfire	2.2	Moderate	Town of Swepsonville	Local, County	2020-2025	Carried forward	No progress made due to administrative limitations
Property Protection									
PP-1	Monitor reservoirs, lakes, and streams for potential flooding problems and note any unexpected flooding issues.	Flood	4.2	Moderate	Town of Swepsonville	Local, County	2020-2025	Carried forward	No progress made due to administrative limitations
Structural Projects									
SP-1	Seek funding to the retrofit of critical facilities and Town-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	4.2	Moderate	Town of Swepsonville	Local, State Grants, UHMA Grants, other potential federal grants	2020-2025	Carried forward	No progress made due to staff and funding limitations.
SP-2	Seek funding for the installation of backup generators or quick connect hook ups for mobile generators on any newly constructed and existing county critical facilities.	All Hazards	4.2	Moderate	Town of Swepsonville	Local, State Grants, UHMA Grants, other potential federal grants	2020-2025	Carried forward	No progress made due to staff and funding limitations.
Public Education & Awareness									
PEA-1	Encourage citizens and businesses/industries to develop emergency preparedness plans.	All Hazards	2.1	Moderate	Town of Swepsonville	Local	2020-2025	Carried forward	No progress made due to lack of administrative resources for outreach.
PEA-2	Encourage homeowners to review insurance policies as part of an overall family disaster plan.	All Hazards	2.1	Moderate	Town of Swepsonville	Local	2020-2025	Carried forward	No progress made due to lack of administrative resources for outreach.
PEA-3	Increase awareness of the natural hazards potential to local officials, the general public, and private industry.	All Hazards	2.1	Moderate	Town of Swepsonville	Local	2020-2025	Carried forward	No progress made due to lack of administrative resources for outreach.
PEA-4	Discourage the public and developers from developing property in flood zones.	All Hazards	1.2	Moderate	Town of Swepsonville	Local	2020-2025	Carried forward	No progress made due to lack of administrative resources for outreach.
PEA-5	Maintain documents about flood insurance, flood protections, floodplain management, and natural and beneficial functions of floodplains at the local libraries and government offices.	Flood	2.1	Moderate	Town of Swepsonville	Local	2020-2025	Carried forward	No progress made due to lack of administrative resources for outreach.



Table 7.10 – Mitigation Action Plan, Village of Alamance

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Continue to expand the County's Geographic Information System (GIS) capabilities to include maintaining Elevation Certificates in a computer database.	Flood	1.2	Moderate	Village of Alamance	Local, County	2020-2025	Carried forward	County now maintains ECs in a computer database. The Village will work to compile and provide ECs to the County.
P-2	Continue the Village of Alamance's participation in the National Flood Insurance Program (NFIP) so citizens are eligible for flood insurance.	Flood	1.2	Moderate	Village of Alamance	Local	2020-2025	Carried forward	The Village has maintained compliance with the NFIP
P-3	Review all fire districts coverage to ensure that there are adequate quantities of water for firefighting purposes and that all water points are maintained on a regular basis.	Wildfire	2.2	Moderate	Village of Alamance	Local, County	2020-2025	Carried forward	No progress made due to administrative limitations.
P-4	When the county land use plan is complete, create a land use map with an overlay of flood hazards and any other natural hazards that can be mapped.	All Hazards	1.2	Moderate	Village of Alamance	Local, County	2020-2025	Carried forward	The County land use plan is now under development.
Property Protection									
PP-1	Monitor reservoirs, lakes, and streams for potential flooding problems and note any unexpected flooding issues.	Flood	4.2	Moderate	Village of Alamance	Local	2020-2025	Carried forward	No progress made due to administrative limitations.
Structural Projects									
SP-1	Seek funding to the retrofit of critical facilities and Village-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	4.2	Moderate	Village of Alamance	Local, State Grants, UHMA Grants, other potential federal grants	2020-2025	Carried forward	No progress made due to administrative and fiscal limitations.
SP-2	Seek funding for the installation of backup generators or quick connect hook ups for mobile generators on any newly constructed and existing county critical facilities.	All Hazards	4.2	Moderate	Village of Alamance	Local, State Grants, UHMA Grants, other potential federal grants	2020-2025	Carried forward	No progress made due to administrative and fiscal limitations.
Emergency Services									
ES-1	Meet annually with State Forester for Alamance County to improve coordination of wildfire control and response.	Wildfire	3.2	Moderate	Village of Alamance	Local, County	Annually	Carried forward	No progress reported
Public Education & Awareness									
PEA-1	Encourage homeowners to review insurance policies as part of an overall family disaster plan.	All Hazards	2.1	Moderate	Village of Alamance	Local	2020-2025	Carried forward	No progress made due to administrative limitations.
PEA-2	Increase awareness of the natural hazards potential to local officials, the general public, and private industry.	All Hazards	2.1	Moderate	Village of Alamance	Local	2020-2025	Carried forward	No progress made due to administrative limitations.
PEA-3	Maintain hazard mitigation plan and floodplain information on the Village's website.	All Hazards	2.1	Moderate	Village of Alamance	Local	2020-2025	Carried forward	No progress made due to administrative limitations.

Table 7.11 – Mitigation Action Plan, Durham County-Durham City

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Implement a Stormwater Utility Fee for all properties within the unincorporated areas of Durham County.	All Hazards	1.2	High	County Engineering and Environmental Services	Fee funded, staff time; estimated cost \$300,000	August 2020	New	The County will implement a stormwater utility fee to collect funds to ensure the County has resources to implement projects throughout the unincorporated areas of the County to meet the future Falls Lake and Jordan Lake rules. Estimated cost includes consultant costs for data development, rate development, public education, and full implementation of the new fee.
Property Protection									
PP-1	Seek funding to install backup generators or quick connect hook ups for mobile generators on any newly constructed County or City critical facilities	All Hazards	4.2	Moderate	Buildings and Inspections Department, Planning Department, Emergency Services	Local, State grants, UHMA grants, other federal grants	2020-2025	Carried forward	No new generators installed in last five years due to competing priorities.
Natural Resource Protection									
NRP-1	Identify and obtain additional properties to increase protected open space as a land-use tool to reduce adverse impacts from floods.	Flood	1.2	Moderate	City-County Planning Department	HMGP or PDM with local or State match	2020-2025	Carried forward	Acquisition and elevation projects are in progress in the City. City and County will work to identify more properties to pursue additional acquisitions.
Structural Projects									
SP-1	Seek funding to retrofit critical facilities and City- and County-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, 320 or 361 compliant safe rooms, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	4.2	Moderate	Buildings and Inspections Department, Planning Department, Emergency Services	Local, State grants, UHMA grants, other federal grants	2020-2025	Carried forward	No retrofits were completed due to competing priorities and funding limitations. A new police department headquarters and emergency communications center was completed and opened in 2018 and incorporated resilient design including hurricane-resistant glass and low energy consumption features. City and County will work to identify existing facilities in need of retrofits.

Table 7.12 – Mitigation Action Plan, Orange County

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Continue implementation of the Orange County 2030 Comprehensive Plan	All Hazards	1.1	Moderate	Orange County Planning and Inspections Department	General Fund (existing staff salaries)	2020-2025	Carried Forward	This action is in progress and Orange County Planning staff continues to implement the 2030 Comprehensive Plan. Updates to the Comprehensive Plan may take place within the next 5 years or may result from the 2020 Census, however, at this time staff is not positive if/when that may actually occur.
P-2	Continue participation in the Community Rating System (CRS) and annual recertification in order to increase public safety, reduce property damage, avoid economic loss, and allow for a decrease in flood insurance premiums for Orange County residents.	Flood, Hurricane and Tropical Storm	1.1	High	Orange County Planning and Inspections Department	General Fund (existing staff salaries)	2020-2025	Carried Forward	For 2015 the Orange County CRS rating was an 8. Since 2016 the CRS rating for Orange County has been a 6. Last recertification date was September 16, 2019.
P-3	Continue to enforce floodplain regulations through the county's Special Flood Hazard Area (SFHA) Overlay District contained within the Orange County Unified Development Ordinance and continue training efforts for the Certified Floodplain Manager (CFM).	Flood, Hurricane and Tropical Storm	1.2	High	Orange County Planning and Inspections Department	General Fund (existing staff salaries)	2020-2025	Carried Forward	Orange county continues to enforce floodplain regulations through the County's Special Flood hazard Area Overlay District contained within the Orange county Unified Development ordinance. Michael Harvey is the Orange County Floodplain Manager and he is credentialed as a Certified Floodplain Manager (CFM) as of 2009.
P-4	Continue to collaborate and support municipal mitigation strategies	All Hazards	3.2	Moderate	Orange County Emergency Services	General Fund (existing staff salaries)	2020-2025	New	
P-5	Engage in assessments of local supply chain resiliency for critical commodities	Drought	3.1	Moderate	Orange County Emergency Services; Orange County Sustainability	General Fund (existing staff salaries)	2020-2025	New	
P-6	Continue to develop, review, update, and implement recommendations in local and regional plans to improve the reliability, redundancy, and resiliency of water resources (water, wastewater, reclaimed water).	All Hazards	3.1	Moderate	OWASA, Orange County Planning and Inspections Department	CIP and Operating Budgets	2020-2025	New	
Property Protection									
PP-1	Continue enforcement of the North Carolina State Building Code.	All Hazards	1.2	High	Orange County Planning and Inspections Department	General Fund (existing staff salaries)	2020-2025	Carried Forward	Currently operating under the 2018 edition of the NC State Building Codes and 2017 edition of the National Electrical Code. Updated every 6 years and next scheduled update is January 2025.
PP-2	Continue participation in the National Flood Insurance Program (NFIP) to reduce the impact of a future flood event, mitigate effects of flooding, and allow citizens to be eligible for affordable flood insurance.	Flood, Hurricane and Tropical Storm	1.2	High	Orange County Planning and Inspections Department	General Fund (existing staff salaries)	2020-2025	Carried Forward	Orange County has expanded its mapping and public outreach program. We will prohibit development in the floodway/special flood hazard area and require buffers (Per Section 6.13 of the UDO) from the 1% annual area of inundation (buffers range from 65ft to 80ft based on slope. No setbacks have been noted.
PP-3	Identify potential flood hazards of critical infrastructure and mitigation measures to address.	Flood, Hurricane, Tropical Storm	4.2	High	OWASA	CIP and Operating Budgets	2020-2025	New	
PP-4	Explore expanding situational awareness tools and strategies for increased monitoring of local hazards such as installation of additional stream gauges	All Hazards	2.2	Moderate	Emergency Services, OWASA	General Fund (existing staff salaries)	2020-2025	New	

SECTION 7: MITIGATION ACTION PLANS

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Natural Resource Protection									
NRP-1	Strive to ensure future development occurs in a manner that protects floodplains, streams, wetlands, and other natural features which work to reduce flood hazard susceptibility and continue to enforce existing regulations pertaining to stormwater management and erosion control standards contained within the Orange county Unified Development Ordinance.	Flood, Hurricane and Tropical Storm	1.1	High	Orange County Planning and Inspections Department	General Fund (existing staff salaries)	2020-2025	Carried Forward	<p>The County enforces floodplain development regulations and riparian/floodplain buffers standards exceeding minimum FEMA model ordinance and State riparian buffer requirements.</p> <p>The County prevents development activities (i.e. grading, placement of fill material, etc.) within SFHAs and requires preservation of a floodplain buffer, measured from the edge of the 1%-annual area of inundation. This ‘floodplain buffer’ is required to be preserved in its natural state to assist with the natural infiltration of storm water runoff and serve as an overall flood control measure. The size of the buffer, which is based on the slope of the subject property, can range anywhere from 65 ft. to 80 ft.</p> <p>With respect to the County’s storm water and erosion control programs, the County pushes development projects to adhere to low impact storm water design principles where practical and design erosion control basins in key critical watershed areas to the 25 year storm event.</p>
Structural Projects									
SP-1	Explore the possibility of retrofitting critical facilities to harden against high winds and lightening.	All Hazards	4.2	Moderate	Emergency Services, Asset Management	Unified hazard Mitigation Assistance (UHMA)	2020-2025	Carried Forward	Asset Management (AMS) staff worked with an architect (Jim Stumbo) in the Spring of 2018 and before to explore hardening the ES center. This produced drawings and specs which formed the basis for a grant application to the NC 9-1-1 Board for funding to create a hardened, updated, and more secure "Orange County Resilient PSAP" built to withstand wind speeds of up to 150 MPH. This was submitted on June 15th, 2018 but was not funded. AMS staff is currently exploring the possibility of hardening a new Emergency Services Substation in Efland.
SP-2	Conduct a cost-benefit review during the planning and design phase of construction of new government owned facilities or critical facilities to determine the feasibility of equipping the facility with back-up generators, lightening protection, high wind protection, and/or 361 compliant tornado shelters.	All Hazards	4.2	Moderate	Emergency Services, Asset Management	Unified hazard Mitigation Assistance (UHMA)	2020-2025	Carried Forward	This is being completed on a case-by-case basis with each new facility and major retrofit.
SP-3	Continue to identify and explore possibility of improving or retrofitting existing critical facilities with on site energy generation.	All Hazards	4.2	Moderate	Emergency Services, Asset Management, OWASA	Unified hazard Mitigation Assistance (UHMA)	2020-2025	New	
Emergency Services									
ES-1	Identify and implement strategies to increase swift water rescue capacity.	Flooding, Severe Weather, Hurricane and Tropical Storm	2.2	Moderate	Emergency Services	Emergency Management Performance Grant (EMPG)	2020-2025	New	

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Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
ES-2	Engage with regional stakeholders in comprehensive emergency response planning including Complex Coordinated Terror Attack response and Mass Casualty Incident response planning.	All Hazards	3.2	Moderate	Emergency Services	General Fund (existing staff salaries)	2020-2025	New	
Public Education & Awareness									
PEA-1	Provide education and outreach to Orange County residents in multiple languages in order to increase awareness of natural hazard potential in the county and maintain a link to the Eno-Haw Regional Hazard Mitigation Plan on Orange County's Website.	All Hazards	2.1	Moderate	Orange County Planning and Inspections Department; Emergency Services	General Fund (existing staff salaries)	2020-2025	Carried Forward	Revised to pursue outreach in multiple languages. Orange County continues to host and sponsor the Community Emergency Response Team (CERT) training. Since 2015, Orange County has hosted 8 CERT Basic Training Courses. In 2018, Orange County hosted a FEMA Community Mitigation Workshop to educate residents about mitigation options. In 2018-2019, Emergency Services staff worked with both Chamber of Commerces to develop and host 6 business emergency preparedness workshops. Also in 2018, the Orange County Health and Emergency Services Departments partnered to deliver 4 preparedness workshops to the limited English proficiency community. These workshops included take home preparedness kits for participants. Orange County EM continues to utilize social media and other platforms to inform and educate residents of natural hazards.
PEA-2	Engage in regional events, activities, and training opportunities related to natural hazards in order to improve communication, enhance, partnerships, and improve planning efforts with other local jurisdictions.	All Hazards	3.2	Moderate	Emergency Services	General Fund (existing staff salaries)	2020-2025	Carried Forward	Orange County participated in the Triangle Regional Resilience Assessment-2018
PEA-3	Strive to improve communication and outreach in multiple languages to Orange County residents before, during, and after hazard weather event with the county's website, press releases, social media accounts, and the OC Alerts system in order to keep residents informed and improve public safety in and around the county.	All Hazards	2.1	Moderate	Emergency Services	General Fund (existing staff salaries)	2020-2025	Carried Forward	Revised to pursue outreach in multiple languages. Orange County upgraded the website hosting and design vendor in August of 2018 from Revive to CivicPlus. Distribution of press releases was also changed from IContact to CivicSend in August 2018. Participating in Nextdoor, text 911, implemented citizen self reporting, hosted a FEMA Community Mitigation Workshop, Continually holding CERT classes and assisting in facilitating their success.
PEA-4	Provide staff support and information on Orange County's website to provide education and assistance to residents experiencing floodplain, stormwater, and erosion control issues.	Flood, Hurricane and Tropical Storm	2.1	Moderate	Orange County Planning and Inspections Department; Emergency Services	General Fund (existing staff salaries)	2020-2025	Carried Forward	Updated information was posted at <a href="http://www.orangecountync.gov/1309/Floodplain-Information">http://www.orangecountync.gov/1309/Floodplain-Information</a>



Table 7.13 – Mitigation Action Plan, Town of Carrboro

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	The Town of Carrboro, as a member of the Orange County hazard Mitigation Planning Team, will coordinate with Orange County to reevaluate and update its hazard mitigation planning component at least once every five years or sooner as deemed appropriate by the Orange County Planning Director	All Hazards	1.2	High	Orange County, Town of Carrboro	Self-funded	2025	Carried Forward	Participating in update process with local government partners in Eno-Haw Region.
P-2	The Town of Carrboro intends to submit a Community Rating System (CRS) application to the ISO for a flood insurance rating that will benefit owners of flood-prone properties	Flood	1.2	Moderate	Town of Carrboro Planning Department	N/A	2020-2025	Carried Forward	The Town has not yet pursued CRS participation due to limited funding and administrative resources. Moving forward, the Town will continue to reevaluate the cost-benefit ration of this action. Specific exploration will occur as part of comprehensive planning process which is in progress.
P-3	The Town of Carrboro will continue to monitor ongoing efforts by the State and the US Army Corps of Engineers to complete new floodplain mapping for the planning area. Local staff resources will be needed to implement and encourage the completion of these activities.	Flood	1.1	High	Town of Carrboro Planning Department; Town Engineer; Town of Carrboro Stormwater Utility; Town of Chapel Hill Engineering Department	N/A	2023	Carried forward	New maps were adopted in 2017. Updates are currently expected to take place in 2023. Stormwater utility established in 2017.
P-4	Establish comprehensive framework for plans, policies, and regulations pertaining to land use, generally, and the relationship to natural hazard mitigation	All Hazards	1.2	Moderate	Town of Carrboro Planning Department	Self-funded	2020-2025	Carried Forward	To be incorporated into Townwide Comprehensive planning process, which is in progress as of late May 2020.
P-5	Establish framework for assessing urban wildfire risk, communicating with the public on measures that can reduce risk.	Wildfire	2.1	Moderate	Town of Carrboro Fire Rescue; Town of Carrboro Planning	Self-funded; outside grants if available	2020-2025	New	
Property Protection									
PP-1	Seek funding to retrofit critical facilities and Town-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, 320 or 361 compliant safe rooms, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	4.2	Moderate	Town of Carrboro Planning Department; Town of Carrboro Stormwater Utility; Town of Carrboro Fire-Rescue	Local, State grants, other federal grants	2020-2025	Carried Forward	The Town will continue to assess facilities and seek funding sources related to needs identified. Generators are included in the scope for the Town's 203 S. Greensboro Street project.
PP-2	The Town of Carrboro will administer a Stormwater Utility Fee to fund stormwater services/operations and provide residential and commercial assistance for stormwater related issues by expanding technical assistance, outreach, and other program components.	Flood, Hurricane & Tropical Storm, Landslide	1.2	High	Town of Carrboro Stormwater Utility	Self-funded	2020-2022	New	Stormwater utility established in 2017.

SECTION 7: MITIGATION ACTION PLANS

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Natural Resource Protection									
NRP-1	The Town of Carrboro needs assistance and support for the development of greenways and parklands dedicated to public use along streams and easements. The Town will seek to secure funding from federal, state, and local sources to implement the Town's greenway system, which will in turn mitigate flood hazards.	Flood	1.1	Moderate	Town of Carrboro Planning Department; Town of Carrboro Recreation and Parks Department; Town of Carrboro Public Works	N/A	2020-2025	Carried Forward	Phase 1B/Homestead-Chapel Hill High School Multi-use Path is substantially complete. Morgan Creek and Jones Creek greenway projects expected to be complete in 2021.
NRP-2	Protect and conserve land with environmental and natural hazard mitigation value as open space.	Flood, Hurricane & Tropical Storm, Landslide	1.1	High	Town of Carrboro Planning Department	Self-funded	2020-2025	Carried Forward	Implementation underway for several projects and multiple approaches including land use regulations for developments, policy analysis/framework for comprehensive planning, and grant funding for repetitive loss properties.
Structural Projects									
SP-1	Require new developments to install electric, cable, and telephone wires underground.	Hurricane & Tropical Storm, Severe Weather, Severe Winter Weather	1.2	Moderate	Town of Carrboro Planning Department; Town of Carrboro Public Works Department; Public Utilities	N/A	2020-2025	Carried Forward	Revised. The Town of Carrboro will continue to require new developments to install electric, cable, telephone wires underground.
SP-2	Look for opportunities to mitigate repetitive loss structures	Flood	4.2	Moderate	Town of Carrboro Planning Department; Town of Carrboro Stormwater Utility; Office of the Carrboro Town Manager	N/A	2020-2025	Carried Forward	2020 In progress. Two elevations to be completed by July 2020. Applications for two additional elevations have been submitted and funding for Public Works site relocation is being explored.
Public Education & Awareness									
PEA-1	Maintenance and implementation of adopted (2017) Community Climate Action Plan	All Hazards	1.2	High	Town Manager's Office	Self-funded; grants, other revenue as available	2020-2025	New	Includes implementation of 2014 Strategic Energy Plan. Will serve as coordinating focus of actions underscoring Town's emphasis on building community resilience. Could potentially be included under Structural Projects, Prevention and Property Protection as well.
PEA-2	Create and maintain a webpage for hazard risk, mitigation, and preparedness information on the Town's website.	All Hazards	1.2	High	Town of Carrboro Planning Department	Self-funded	2020-2025	New	May be expanded in the future to included detailed flood risk information, flood gage data,

Table 7.14 – Mitigation Action Plan, Town of Chapel Hill

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Consider creative zoning options.	Flood, Hurricane and Tropical Storm, Severe Weather	1.2	Moderate	Town of Chapel Hill - Planning Department/ Managers Office	General Fund (existing staff salaries)	2020-2025	Carried Forward	In Progress. ToCH continues to try to engage with developers to pursue creative zoning options including conditional zoning which allows flexible and open conversations.-The Blue Hill District and the Innovative, Light Industrial Conditional Zoning District are other examples of creative zoning options. The Town Council and Town staff review zoning requirements and make adjustments as needed to achieve hazard mitigation goals.
P-2	Encourage mixed-use development forms.	Flood, Hurricane and Tropical Storm	1.2	Moderate	Town of Chapel Hill - Planning Department/ Managers Office	General Fund (existing staff salaries)	2020-2025	Carried Forward	In Progress. ToCH continues to emphasize mixed-use redevelopment in the downtown and in future focus areas, as per the comprehensive plan. The Town is undertaking an evaluation of its future land use map and development through an initiative called "Charting Our Future" ( <a href="http://chartingourfuture.info/">http://chartingourfuture.info/</a> ).
P-3	Establish a growth management protocol to maintain sufficient infrastructure capacity.	Flood, Hurricane and Tropical Storm, Severe Weather	4.1	Moderate	Town of Chapel Hill	N/A	2015-2020	Carried Forward	In Progress. The Town will continue existing growth management protocols to maintain sufficient infrastructure capacity including the Town's urban services district and the rural buffer, both of which continue to guide development decisions within the municipal boundaries. The Town is undertaking an evaluation of its future land use map through an initiative called "Charting Our Future" which will provide additional guidance on maintaining sufficient infrastructure capacity. ( <a href="http://chartingourfuture.info/">http://chartingourfuture.info/</a> ).
P-4	Improve the Development Review Process	Flood, Hurricane and Tropical Storm	1.2	Moderate	Town of Chapel Hill - Planning Department	General Fund (existing staff salaries)	2020-2025	Carried Forward	In Progress. This continues to be an ongoing effort since 2009. ToCH is in the middle of future land use plan update. After this update,-a complete rewrite of the development ordinance ("Charting Our Future") will follow, which will include a comprehensive review of the Development Review Process.
P-5	Continue to enforce the stormwater management regulations through the Town's Land Use Management Ordinance and the floodplain regulations through the town's Flood Damage Prevention Ordinance. Continue training initiatives to maintain the Certified Floodplain Manager (CFM) registrations.	Flood, Hurricane and Tropical Storm	1.2	Moderate	Town of Chapel Hill - Stormwater Division	Stormwater Fund (existing staff salaries)	2020-2025	Carried Forward	Revised to remove development of a comprehensive stormwater program master plan because this action has been completed. The Town now has a Certified Floodplain Manager and will continue to support training.
P-6	Continue to participate in county-wide collaborative efforts and mitigation strategies	All Hazards	3.2	Moderate	Town of Chapel Hill - Emergency Management Division	General Fund (existing staff salaries)	2020-2025	New	
P-7	Continue enforcement of the North Carolina State Building Code.	All Hazards	1.2	Moderate	Town of Chapel Hill - Inspections Department	General Fund (existing staff salaries)	2020-2025	New	
P-8	Continue participation in the National Flood Insurance Program (NFIP) to allow citizens to be eligible for affordable flood insurance.	Flood, Hurricane and Tropical Storm	1.2	Moderate	Town of Chapel Hill - Stormwater Division	Stormwater Fund (existing staff salaries)	2020-2025	New	

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Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
P-9	Explore expanding situational awareness tools and strategies for increased monitoring of local hazards	All Hazards	2.2	Moderate	Town of Chapel Hill - Emergency Management Division	General Fund (existing staff salaries)	2020-2025	New	
Property Protection									
PP-1	Develop a network of greenways with regional connections.	Flood, Hurricane and Tropical Storm, Severe Weather	1.1	Moderate	Town of Chapel Hill - Parks and Recreation and Planning Department	General Fund (existing staff salaries)	2020-2025	Carried Forward	In Progress. Have greenway master plan which is folded into mobility plan. Almost complete with Bolin Creek Trail connection and in design for Morgan Creek Trail that will extend trail towards Carrboro town limits. Town is in conversations with the County to discuss plan for a greenway that would connect Chapel Hill and Hillsborough. Town of Chapel Hill has 15½ miles of greenways trails (some paved and some soft surface) and 1000 acres of open space. NOTE: There is no open space plan or recreation master plan. NOTE: There is a Recreation Standards and Needs Assessment included as a component of the Comprehensive Parks Plan, adopted 5/29/2013. Recommendations for open space and recreation are also included. ( <a href="https://www.townofchapelhill.org/town-hall/departments-services/parks-recreation/planning-and-development/comprehensive-parks-plan-adopted-may-29-2013">https://www.townofchapelhill.org/town-hall/departments-services/parks-recreation/planning-and-development/comprehensive-parks-plan-adopted-may-29-2013</a> ).
PP-2	Preserve open space in residential developments through the application of conservation development principles.	Flood, Hurricane and Tropical Storm, Severe Weather	1.1	Moderate	Town of Chapel Hill - Planning Department/Managers Office	General Fund (existing staff salaries)	2020-2025	Carried Forward	ToCH is in the middle of future land use plan update. After this update, a complete rewrite of the development ordinance ("Charting Our Future") will follow, which will be an opportunity to further address conservation development.
Natural Resource Protection									
NRP-1	Manage watersheds, stormwater, and water quality and seek funding to design and construct projects on the subwatershed study reports' priority project lists, which have been identified and approved by the Town Council.	Flood, Hurricane and Tropical Storm, Severe Weather	1.1	Moderate	Town of Chapel Hill - Stormwater Division	Stormwater Fund (existing staff salaries)	2020-2025	Carried Forward	In 2014, the Town Council adopted the Stormwater Master Plan, which included a recommendation for conducting subwatershed studies. These studies evaluate existing conditions and identify problems – failing/undersized infrastructure, drainage and flooding, water quality, and stream conditions – then develop integrated watershed plans for improvements based on a full build-out condition, using zoning and land use plans. The studies began in the Booker Creek watershed - the Lower Booker Creek subwatershed study has been completed; the Eastwood Lake subwatershed study is under review; and the Cedar Fork subwatershed study is underway. With the Council approval of the Lower Booker Creek Subwatershed Study report and project recommendations, the Town now has a list of priority capital projects to be designed, permitted, and constructed.

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Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
NRP-2	Strive to ensure future development occurs in a manner that protects floodplains, streams, wetlands, and other natural features which work to reduce flood hazard susceptibility and continue to enforce existing regulations.	Flood, Hurricane and Tropical Storm	1.1	Moderate	Town of Chapel Hill - Planning Department/Managers Office	General Fund (existing staff salaries)	2020-2025	New	
NRP-3	Coordinate with OWASA on long-term water supply planning and local conservation measures.	Drought, Extreme Heat	1.1	Moderate	Town of Chapel Hill - Resilience	OWASA	2020-2025	New	
NRP-4	Strategically preserving, acquiring, or protecting additional open spaces to provide environmental buffer. Work to implement open space recommendations as outlined in the Recreation Standards and Needs Assessment included as a component of the Comprehensive Parks Plan, adopted 5/29/2013. ( <a href="https://www.townofchapelhill.org/town-hall/departments-services/parks-recreation/planning-and-development/comprehensive-parks-plan-adopted-may-29-2013">https://www.townofchapelhill.org/town-hall/departments-services/parks-recreation/planning-and-development/comprehensive-parks-plan-adopted-may-29-2013</a> ).	Flood, Hurricane & Tropical Storm, Severe Weather	1.1	Moderate	Town of Chapel Hill	N/A	2015-2020	Carried Forward	In Progress. ToCH has open space standards in the ordinances for residential property. In addition, there are environmental resections for development town-wide. The Town has adopted the Jordan Watershed Stormwater Management for New Develop ordinance in an effort to further protect land with environmental value.
NRP-5	Encourage public and private partnerships to restore and maintain the Town's environmental resources.	Flood, Hurricane & Tropical Storm, Severe Weather	1.1	Moderate	Town of Chapel Hill	N/A	2015-2020	Carried Forward	In Progress. These types of partnerships are negotiated on a case-by-case basis. Currently, the town is working with UNC Healthcare at Eastowne, which contains a natural heritage site that the Town is working to preserve.
Structural Projects									
SP-1	Continue to identify and explore possible retrofits to critical facilities and Town-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, back up generators, ignition-resistant materials, 320 or 361 compliant safe rooms, lightning protection, hail resistant roofing, anchoring fixed building equipment.	Flood, Hurricane & Tropical Storm, Severe Weather	4.2	Moderate	Town of Chapel Hill - Public Works	General Fund (existing staff salaries) / Unified Hazard Mitigation Assistance (UHMA)	2020-2025	Carried Forward	No progress made due to funding limitations.
SP-2	Seek funding to install backup generators or quick connect hook ups for mobile generators on any newly constructed county/town critical facilities.	Flood, Hurricane & Tropical Storm, Severe Weather	4.2	Moderate	Town of Chapel Hill	Local, State grants, other federal grants	2015-2020	Carried Forward	No progress made due to funding limitations.
SP-3	Coordinate with utility partners and property owners regarding the use of microgrids and other forms of distributed energy to provide backup power to critical facilities.	Severe Weather, Hurricane and Tropical Storm	4.2	Moderate	Town of Chapel Hill - Resilience	General Fund, Utilities, Developers, Federal Grants (DOE)	2020-2025	New	
SP-4	Coordinate with OWASA to enhance the capacity of regional water system interconnects, as needed.	Drought, Extreme Heat	4.2	Moderate	Town of Chapel Hill - Resilience	OWASA	2020-2025	New	
SP-5	Coordinate with OWASA to limit the impacts of water supply leaks through infrastructure planning, maintenance and design.	Critical Infrastructure Failure	4.2	Moderate	Town of Chapel Hill - Resilience	OWASA	2020-2025	New	



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Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Emergency Services									
ES-1	Engage in regional events, activities, and training opportunities related to natural hazards in order to improve communication, enhance, partnerships, and improve planning efforts both within the Town and with other local jurisdictions.	Flood, Hurricane & Tropical Storm, Severe Weather	3.2	Moderate	Town of Chapel Hill - Emergency Management Division	General Fund (existing staff salaries)	2020-2025	Carried Forward	The Town of Chapel Hill Office of Emergency Management (EM) routinely engages with emergency management services in surrounding jurisdictions and participates in joint meetings, planning sessions, and briefings with other agencies and jurisdictions. The Town has maintained an agreement for a countywide alert system.
ES-2	Identify and implement strategies to increase swift water rescue capacity.	Flood, Severe Weather, Hurricane and Tropical Storm	3.1	Moderate	Town of Chapel Hill - Fire Department	Emergency Management Performance Grant (EMPG)??	2020-2025	New	
ES-3	Engage with regional and county stakeholders in comprehensive emergency response planning including Complex Coordinated Terror Attack response and Mass Casualty Incident response planning.	All Hazards	3.2	Moderate	Town of Chapel Hill - Emergency Management Division	General Fund (existing staff salaries)	2020-2025	New	
Public Education & Awareness									
PEA-1	Encourage low-impact development for addressing stormwater quality and quantity concerns.	Flood, Hurricane and Tropical Storm	1.2	Moderate	Town of Chapel Hill - Planning Department	General Fund (existing staff salaries)	2020-2025	Carried Forward	In Progress. Low Impact Design (LID) is encouraged throughout the Town (The central theme of these regulations is to encourage "low-impact design" that disperses pavement into small modules, and replicates the natural hydrological system of the site." LUMO Article 5 Design and Development Standards).
PEA-2	Provide education and outreach to Chapel Hill residents in multiple languages in order to increase awareness of natural hazard potential in the town.	All Hazards	2.1	Moderate	Town of Chapel Hill - Emergency Management Division and Communications and Public Affairs	General Fund (existing staff salaries)	2020-2025	New	
PEA-3	Strive to improve communication and outreach in multiple languages to Town of Chapel Hill residents before, during, and after hazard weather event with the county's website, press releases, social media accounts in order to keep residents informed and improve public safety in and around the Town.	All Hazards	2.1	Moderate	Town of Chapel Hill - Emergency Management Division and Communications and Public Affairs	General Fund (existing staff salaries)	2020-2025	New	
PEA-4	To achieve Comprehensive Plan objectives: The Town is undertaking an evaluation of its future land use map (FLUM) and planning to rewrite the Town's UDO through an initiative called "Charting Our Future" ( <a href="http://chartingourfuture.info/">http://chartingourfuture.info/</a> ). The FLUM includes Resiliency Maps that depict areas of Town subject to flooding. It is anticipated that the new UDO will utilize these maps to attempt to mitigate flooding through updated regulations.	Flood, Hurricane and Tropical Storm	1.2	Moderate	Orange County Planning and Inspections Department; Emergency Services	General Fund (existing staff salaries)	2020-2025	New	

Table 7.15 – Mitigation Action Plan, Town of Hillsborough

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Work with the Tree Board, Public Works Department, and utility companies to ensure that dangerous situations are addressed in a timely manner	All Hazards	3.1	Moderate	Town of Hillsborough Public Works Department	Grants; estimated cost \$20,000	2019-2025	Carried Forward	This has been partially completed. We will continue to work towards completion. This can be a moving target due to new threats such as leaning or dead trees, aging infrastructure, etc.
P-2	Work with State efforts to study hydrology and maps/designate any new flood prone areas	Flood	1.1	High	Town of Hillsborough Planning Department	N/A	2019-2025	Carried Forward	New flood maps and GIS maps have been drawn for a good portion of our jurisdiction as of 2017, but the northwest, south, and southwest areas of town still utilize 2007 FIRM panels.
Structural Projects									
SP-1	Construct new recreational facilities out of flood-resistant and resilient building materials due to their locations in flood-prone areas	Flood	4.2	Moderate	Town of Hillsborough Public Space and Public Works	Town Budget, grants	2020-2025	New	Due to the propensity for recreational land and structures to be located in flood prone areas, this will become a higher priority as the Town develops new public spaces and amenities
SP-2	Relocate the Public Works operation to a non-floodprone site. This is a sizable project and is expected to be completed in the next 5-7 years.	Flood	4.2	Moderate	Town of Hillsborough Public Works Department	Town Budget, grants; estimated cost \$1.1m	2023-2024	Carried Forward	This was originally budgeted for a contract for the 2016-2017 budget cycle, but due to funding and project delays, this will likely be re-prioritized to the 2023-2024 budget
Emergency Services									
ES-1	Conduct Emergency Operations Center (EOC) exercises and staff drills to address the increasing threat of terrorism and to increase staff coordination and response time for hazards	All Hazards	2.2	High	All Town Staff	Town Budget; estimated cost \$20,000	2020-2025	New	For FY2020 the town command/EOC staff conducted an exercise/training session on 11-14-2019 with a town wide event expected in the spring of 2020.
Public Education & Awareness									
PEA-1	Construct an extension of a fiber optic loop to serve underprivileged and rural residents with high speed internet service for better access to emergency information.	All Hazards	2.2	High	Town of Hillsborough Administration, Orange County Emergency Services	Grants	2020-2025	New	This program would expand much-needed access to high speed internet infrastructure to underserved, under-represented, and rural areas of Town, thus providing access to different types of emergency information in the event of an emergency. The Town is currently in the planning stages of this expansion, and construction is scheduled to begin in FY20.

Table 7.16 – Mitigation Action Plan, Person County-City of Roxboro

Action #	Action Description	Applicable Jurisdictions	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Status Comments
Prevention										
P-1	At next land Use Plan Update, incorporate a stand-alone element for hazard mitigation and involve citizens in comprehensive planning activities that identify and mitigate hazards.	Person County, City of Roxboro	All Hazards	1.2	Moderate	PC/CR PLAN	Local	2020/2021	Carried Forward	Carried forward from PC (P-1). Land Use Plan update is in progress
P-2	Update the Person County Subdivision Ordinance by reviewing and incorporating hazard mitigation objectives.	Person County	All Hazards	1.1	Low	PC PLAN	Local	2025	Carried Forward	Carried forward from PC (P-4). Not completed due to staffing issues 2015-2016. Current staff is interested in updating the Subdivision Ordinance in general and plans to address this item.
P-3	Update the Person County Floodplain Ordinance to comply with state and national standards.	Person County	Flood	1.2	High	PC PLAN	Local	2020	Carried Forward	Carried forward from PC (P-3). Floodplain Ordinance update is in progress
P-4	Revise and update the regulatory floodplain maps.	Person County, City of Roxboro	Flood	4.1	Moderate	PC/CR PLAN & GIS	Local	2020	Carried Forward	Carried forward from PC (P-6) and CR (PI-23). Floodplain map updates are in progress (per FEMA).
P-5	Use GIS to map 50' riparian buffers as required by the State within watersheds.	Person County, City of Roxboro	Flood	1.1	Moderate	GIS	Local	2021	Carried Forward	Carried forward from CR (P-8). Riparian buffers have not yet been mapped by the County due to administrative limitations.
P-6	Identify at risk-populations that may be exceptionally vulnerable in the event of long-term power outages.	Person County, City of Roxboro	Extreme Heat, Severe Weather, Severe Winter Storm	2.2	High	PC/CR PLAN & ES	Local	2025	New	
P-7	Organize outreach to vulnerable populations during long-term power outage events	Person County, City of Roxboro	Extreme Heat, Severe Weather, Severe Winter Storm	2.1	High	ES	Local	2025	New	
P-8	Public Services receive training on erosion and sedimentation control and assists property owners and developers with issues.	City of Roxboro	Flood	1.1	High	CR ADMN, CR PLAN, CR PUBLIC SERVICES	Local	2020-2025	Carry forward	Planning Director, who serves FPA, attends regular NFIP workshops for updates and provides information to property owners regarding proper floodplain development practices. Public Services Director requires sedimentation and erosion control data on all new development projects.
P-9	At the next update of the Land Use Plan, consider incorporating a Greenway or Open Space Plan	City of Roxboro	Flood	2.1	Moderate	CR PLAN	Local	2020	On-going/carry forward	There are some provisions in the existing UDO, additional improvements may be considered, pending the political climate.
P-10	Enforce impervious surface calculation/ limitation for residential and non-residential development.	City of Roxboro	Flood	3.1	High	CR PLAN	Local	2024	On-going/carry forward	City requires Stormwater Administrator review and approval of all new construction/ redevelopment projects.
Property Protection										
PP-1	Enforce minimum housing standards ordinance	City of Roxboro	All Hazards	1.2	High	CR PLAN & CR CODE ENFORCEMENT	Local	2020-2025	Carried forward	Carried forward from CR (PP-14). Have increased contracted hours with Code Enforcement officer to be able to maintain activity on minimum housing enforcement issues throughout the City and will continue to monitor

SECTION 7: MITIGATION ACTION PLANS

Action #	Action Description	Applicable Jurisdictions	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Status Comments
										the need to determine if further increases are necessary.
PP-2	Create and maintain a list of repetitive flood loss properties. Currently none to record/map	Person County, City of Roxboro	Flood	4.2	Moderate	PC/CR PLAN, GIS, & INSP	Local	2021	Carried forward	Carried forward from PC (PP-10). Continue to track flood loss properties through GIS and Building Inspections using Crisis Track Software. No flood loss properties as of 2019.
PP-3	Enforce Stormwater Ordinance for new and redevelopment on residential and commercial properties.	Person County, City of Roxboro	Flood	1.1	High	PC/CR PLAN	Local	2025	Carried forward	Carried forward from PC (P-7). Person County plans to continue enforcing the Stormwater Ordinance
Natural Resource Protection										
NRP-1	Establish Enhanced Voluntary Ag District (EVAD) Ordinance	Person County, City of Roxboro	Flood, Erosion	1.1	Moderate	SW	Local	2025	New	
NRP-2	Develop a conservation easement program	Person County, City of Roxboro	Flood, Erosion	1.1	Moderate	SW, CR PLAN	Federal; Local; State	2025	New	
NRP-3	Encourage participation in State & Federal Cost Share programs	Person County, City of Roxboro	Drought, Flood, Erosion	1.1	High	SW, NRCS, & FORESTRY	Federal; Local; State	2020-2025	New	
NRP-4	Conduct landowner/farmer workshops on conservation practices	Person County, City of Roxboro	Drought, Flood, Erosion	1.1	Moderate	SW & AG	State; Local	2020-2025	New	
Structural Projects										
SP-1	Identify at risk facilities and evaluate potential mitigation techniques for all hazards	Person County, City of Roxboro	All Hazards	4.2	High	PC/CR PLAN, GIS, & ES	Local	2025	New	
SP-2	Retrofit existing public facilities and critical facilities to withstand impacts from all hazards	Person County, City of Roxboro	All Hazards	4.2	High	ES	Federal; State; Local	2025	New	Grant application in progress.
SP-3	Identify and strengthen public facilities to act as shelters for all hazards	Person County, City of Roxboro	All Hazards	4.2	High	ES	Federal; State; Local	2025	New	Grant application in progress.
SP-4	Any and all portions of the buildings that have been submerged for any length of time will be inspected for flood related damage as well as other conditions that may be dangerous to live, health or property	Person County, City of Roxboro	Flood	4.2	High	INSP	Federal; State; Local	2020-2025	Carried forward	Carried forward from PC (PI-8). Performed by Building Inspections on a case-by-case basis, as needed. Re-evaluate program success in next update
SP-5	Encourage the identification and retrofitting of safe rooms in public buildings, critical facilities, schools, and nursing homes.	Person County, City of Roxboro	Severe Weather	4.2	Moderate	ES	Local	2025	New	
Emergency Services										
ES-1	Ensure adequate evacuation warning in case of major hazard event.	Person County, City of Roxboro	All Hazards	3.1	High	ES	Local	2020-2025	Carried forward	Carry forward from PC (ES-11). County now has several warning procedures like emergency notification system, social & news media, message boards, etc. We continue to re-evaluate after events.

SECTION 7: MITIGATION ACTION PLANS

Action #	Action Description	Applicable Jurisdictions	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Status Comments
ES-2	Maintain/improve shelter capacities with alternative power/heat sources.	Person County, City of Roxboro	All Hazards	4.2	High	ES	Federal; State; Local	2025	Carried forward	Carry forward from PC (ES-12). Shelters do not have alternative power sources. Grant application in progress.
ES-3	Review program to maintain continuity of government operations.	Person County, City of Roxboro	All Hazards	3.1	Low	ES	Local	2025	Carried forward	Carry forward from PC (ES-13). County's COOP Plan was rewritten in 2018 and reviewed annually.
ES-4	Identify alternate/new Emergency Operations Center locations.	Person County, City of Roxboro	All Hazards	3.1	High	ES	Local	2025	Carried forward	Carry forward from PC (ES-14). Current EOC is inadequate. The EOC location and Alternate location are ID in the EOP and tested.
ES-5	Update and maintain Emergency Plan. Review and update EOP every four years.	Person County, City of Roxboro	All Hazards	3.1	Low	ES	Local	2025	Carried forward	Carry forward from PC (ES-15). OEM reviews the EOP annually and updates as needed. The EOP is re-adopted every four years.
ES-6	Track drainage, erosion, and flooding problems within the City planning jurisdiction.	City of Roxboro	Flood	1.1	High	CR PLAN & CR PUBLIC SERVICES	Local	2020-2025	Carried forward	Carried forward from CR (ES-19). Tracking underway and will be ongoing through next plan update from OEM, Plans and GIS.
ES-7	Continue to maintain a debris removal program for problem sites.	City of Roxboro	Flood	3.2	Moderate	CR PLAN	Local	2020-2025	Carried forward	Some work complete, further may be necessary. County is looking at participating in the State's Pre-Position Debris Contract Program and we are in conversation with Private Sector about contractor. This is ongoing through next plan update.
Public Education & Awareness										
PEA-1	The Emergency Services Department will periodically make various hazard education items available through various media outlets including websites, newspaper, radio	Person County, City of Roxboro	All Hazards	2.1	Moderate	ES	Local	2020-2025.	Carried forward	Carried forward from PC (PI-19). OEM and Plans Dept. conducts HM awareness during Emergency Preparedness week annually or as requested and OEM host regular NWS Storm Ready/Spotter seminars or as requested.
PEA-2	The Emergency Services Department will establish an annual hazard awareness week in coordination with the media to promote hazard awareness.	Person County, City of Roxboro	All Hazards	2.1	Moderate	ES	Local	2020-2025	Carried forward	Carried forward from PC (PI-20). Established in 2019. To be performed annually. OEM conducts HM awareness along with Emergency Preparedness week annually or as requested and we host regular NWS Storm Ready/Spotter seminars or as requested.
PEA-3	Place flood protection and other hazard mitigation education materials in public buildings (i.e. City Hall, County offices, library etc.).	Person County, City of Roxboro	All Hazards	2.1	Moderate	PC/CR PLAN & ES	Local	2025	New	
PEA-4	Post warning signage at local parks and outdoor venues with information about severe weather.	Person County, City of Roxboro	Severe Weather	2.1	High	ES	Local	2025	New	
PEA-5	Ensure school officials are aware of the best area of refuge in school buildings during orientation.	Person County, City of Roxboro	Severe Weather	2.1	High	ES	Local	2025	New	

Lead Agency/Department: PC = PERSON COUNTY / CR = ROXBORO / INSP = INSPECTIONS / ES = EMERGENCY SERVICES / SW = SOIL & WATER / AG = AG EXTENSION / PLAN = PLANNING





## 8 Plan Maintenance

**Requirement §201.6(c)(4): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.**

Implementation and maintenance of the plan is critical to the overall success of hazard mitigation planning. This section discusses how the Mitigation Action Plans will be implemented by participating jurisdictions and outlines the method and schedule for monitoring, updating, and evaluating the plan. This section also discusses incorporating the plan into existing planning mechanisms and how the public will continue to be involved in the planning process. It consists of the following three subsections:

- 8.1 Implementation
- 8.2 Monitoring, Evaluation, and Enhancement
- 8.3 Continued Public Involvement

### 8.1 IMPLEMENTATION

Each jurisdiction participating in this plan update is responsible for implementing specific mitigation actions as prescribed in their Mitigation Action Plan (found in Section 7). In each Mitigation Action Plan, every proposed action is assigned to a specific local department or agency to ensure responsibility and accountability and increase the likelihood of subsequent implementation. This approach enables individual jurisdictions to update their own unique mitigation action list as needed without altering the broader focus of the regional plan.

In addition to the assignment of a local lead department or agency, an implementation timeline or a specific implementation date or window has been assigned to each mitigation action to help assess whether reasonable progress is being made toward implementation. The participating jurisdictions 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.

An important implementation mechanism that is highly effective and low-cost is incorporation of the Hazard Mitigation Plan recommendations and their underlying principles into other plans and mechanisms. Where possible, plan participants will use existing plans and/or programs to implement the Mitigation Action Plan. It will be the responsibility of the HMPC representatives from each participating jurisdiction to determine and pursue opportunities for integrating the requirements of this plan with other local planning documents and ensure that the goals and strategies of new and updated local planning documents for their jurisdictions or agencies are consistent with the goals and actions of the Hazard Mitigation Plan and will not contribute to increased hazard vulnerability in the Plan Area. Methods for integration may include:

- ▶ Monitoring other planning/program agendas;
- ▶ Attending other planning/program meetings;
- ▶ Participating in other planning processes; and
- ▶ Monitoring community budget meetings for other community program opportunities.

In addition to the above opportunities that HMPC representatives of all participating jurisdictions will pursue, the following jurisdictions noted specific plans for integration of this plan update:

- ▶ The Town of Carrboro is beginning the process of updating its Comprehensive Plan this year and will integrate findings from the HMP in that effort.
- ▶ The City of Roxboro is updating its Future Land Use Plan along with Person County and will integrate information on known hazard risks and potential policies for mitigation.
- ▶ The Town of Hillsborough will update its Historic District Design Guidelines next year to include hazard mitigation strategies for the preservation of historic resources.
- ▶ The Town of Chapel Hill is updating its Future Land Use Map and land development regulations and will include information on known hazard areas and policies for mitigation.

Opportunities to integrate the requirements of this Plan into other local planning mechanisms shall continue to be identified through future meetings of the HMPC and through the five-year review process described herein. Although it is recognized that there are many possible benefits to integrating components of this plan into other local planning mechanisms, the development and maintenance of this stand-alone Hazard Mitigation Plan is deemed by the HMPC to be the most effective and appropriate method to implement local hazard mitigation actions at this time.

### 8.2 MONITORING, EVALUATION, AND ENHANCEMENT

#### 8.2.1 Role of HMPC in Implementation, Monitoring and Maintenance

With adoption of this plan, each jurisdiction will be responsible for the implementation and maintenance of their mitigation actions. County Emergency Managers will take the lead in all plan monitoring and update procedures. As such, each jurisdiction, led by their County Emergency Manager, agrees to continue their relationship with the HMPC and:

- ▶ Act as a forum for hazard mitigation issues;
- ▶ Disseminate hazard mitigation ideas and activities to all participants;
- ▶ Pursue the implementation of high-priority, low/no-cost recommended actions;
- ▶ Ensure hazard mitigation remains a consideration for community decision makers;
- ▶ Maintain a vigilant monitoring of multi-objective cost-share opportunities to help the community implement the plan's recommended actions for which no current funding exists;
- ▶ Monitor and assist in implementation and update of this plan;
- ▶ Report on plan progress and recommended revisions to the local governing boards; and
- ▶ Inform and solicit input from the public.

The HMPC's primary duty moving forward is to see the plan successfully carried out and report to the local governing boards, NCEM, FEMA, and the public on the status of plan implementation and mitigation opportunities. Other duties include reviewing and promoting mitigation proposals, considering stakeholder concerns about mitigation, passing concerns on to appropriate entities, and providing relevant information for posting on community websites (and others as appropriate).

Simultaneous to these efforts, it will be important to maintain a constant monitoring of funding opportunities that can be leveraged to implement some of the costlier recommended actions. This will include creating and maintaining a bank of ideas on how to meet local match or participation requirements. When funding does become available, the Region will be positioned to capitalize on the opportunity. Funding opportunities to be monitored include special pre- and post-disaster funds, state and federal earmarked funds, benefit assessments, and other grant programs, including those that can serve or support multi-objective applications.

#### 8.2.2 Maintenance Schedule

Plan maintenance implies an ongoing effort to monitor and evaluate plan implementation and to update the plan as progress, roadblocks, or changing circumstances are recognized. The County Emergency

Managers will be responsible for convening the HMPC and initiating regular reviews. Regular maintenance will take place through quarterly conference calls and an annual meeting of the HMPC. The HMPC will also convene to review the plan after significant hazard events. If determined appropriate or as requested, an annual report on the plan will be developed and presented to local governing bodies of participating jurisdictions to report on implementation progress and recommended changes.

The five-year written update to this plan will be submitted to the NCEM and FEMA Region IV, unless disaster or other circumstances (e.g., changing regulations) require a change to this schedule. With this plan update anticipated to be adopted and fully approved by 2020, the next plan update for the Eno-Haw region will be completed by 2025.

### 8.2.3 Maintenance Evaluation Process

Evaluation of progress can be achieved by monitoring changes in vulnerabilities identified in the plan. Changes in vulnerability can be identified by noting:

- Decreased vulnerability as a result of implementing recommended actions;
- Increased vulnerability as a result of failed or ineffective mitigation actions; and/or
- Increased vulnerability as a result of new development (and/or annexation).

Updates to this plan will:

- Consider changes in vulnerability due to project implementation;
- Document success stories where mitigation efforts have proven effective;
- Document areas where mitigation actions were not effective;
- Document any new hazards that may arise or were previously overlooked;
- Incorporate new data or studies on hazards and risks;
- Incorporate new capabilities or changes in capabilities;
- Incorporate growth and development-related changes to asset inventories; and
- Incorporate new project recommendations or changes in project prioritization.

In order to best evaluate any changes in vulnerability as a result of plan implementation, the HMPC will follow the following process:

- ▶ The HMPC representatives from each jurisdiction will be responsible for tracking and reporting on their mitigation actions. Jurisdictional representatives should provide input on whether the action as implemented met the defined objectives and/or is likely to be successful in reducing vulnerabilities.
- ▶ If the action does not meet identified objectives, the jurisdictional representatives will determine what additional measures may be implemented and will make any required modifications to the plan.
- ▶ All monitoring and implementation information will be reported to the full HMPC, led by the County Emergency Managers, during quarterly meetings. An annual plan maintenance report may be drafted as deemed necessary.

Changes will be made to the plan as needed to accommodate for actions that have failed or are not considered feasible after a review of their consistency with established criteria, time frame, community priorities, and/or funding resources. Actions that were not ranked high but were identified as potential mitigation activities will be reviewed during the monitoring and update of this plan to determine feasibility of future implementation. Updating of the mitigation action plans will be by written changes and submissions, as is appropriate and necessary, and as approved by the appropriate jurisdiction's local governing body.

Following a disaster declaration, the plan will be revised as necessary to reflect lessons learned, or to address specific issues and circumstances arising from the event. It will be the responsibility of the County Emergency Managers to collaborate on reconvening the HMPC and ensuring the appropriate stakeholders are invited to participate in the plan revision and update process following declared disaster events.

### Criteria for Quarterly Reviews in Preparation for 5-Year Update

The criteria recommended in 44 CFR 201 and 206 will be utilized in reviewing and updating the plan. More specifically, quarterly reviews will monitor changes to the following information:

- ▶ Community growth or change in the past quarter.
- ▶ The number of substantially damaged or substantially improved structures by flood zone.
- ▶ The renovations to public infrastructure including water, sewer, drainage, roads, bridges, gas lines, and buildings.
- ▶ Natural hazard occurrences that required activation of any Emergency Operations Center (EOC) in the Region and whether the event resulted in a presidential disaster declaration.
- ▶ Natural hazard occurrences that were not of a magnitude to warrant activation of the EOC or a federal disaster declaration but were severe enough to cause damage in the community or closure of businesses, schools, or public services.
- ▶ The dates of hazard events descriptions.
- ▶ Documented damages due to the event.
- ▶ Closures of places of employment or schools and the number of days closed.
- ▶ Road or bridge closures due to the hazard and the length of time closed.
- ▶ Assessment of the number of private and public buildings damaged and whether the damage was minor, substantial, major, or if buildings were destroyed. The assessment will include residences, mobile homes, commercial structures, industrial structures, and public buildings, such as schools and public safety buildings.
- ▶ Review of any changes in federal, state, and local policies to determine the impact of these policies on the community and how and if the policy changes can or should be incorporated into the Hazard Mitigation Plan. Review of the status of implementation of projects (mitigation strategies) including projects completed will be noted. Projects behind schedule will include a reason for delay of implementation.

### 8.3 CONTINUED PUBLIC INVOLVEMENT

Continued public involvement is imperative to the overall success of the plan's implementation. The quarterly review process will provide an opportunity to solicit participation from new and existing stakeholders and to publicize success stories from the plan implementation and seek additional public comment. Efforts to involve the public in the maintenance, evaluation and revision process may include:

- ▶ Advertising HMPC meetings in the local newspaper, public bulletin boards and/or local government office buildings;
- ▶ Designating willing citizens and private sector representatives as official members of the HMPC;
- ▶ Utilizing local media to update the public of any maintenance and/or review activities;
- ▶ Utilizing local government websites to advertise any maintenance and/or review activities;
- ▶ Maintaining copies of the plan in public libraries or other appropriate venues;
- ▶ Posting annual progress reports on the Plan to local government websites;
- ▶ Heavy publicity of the plan and potential ways for the public to be involved after significant hazard events, tailored to the event that has just happened;
- ▶ Keeping websites, social media outlets, etc. updated;
- ▶ Drafting articles for the local community newspapers/newsletters;

- ▶ Utilizing social media accounts (e.g. Twitter, Facebook).

### **Public Involvement for Five-year Update**

When the HMPC reconvenes for the five-year update, they will coordinate with all stakeholders participating in the planning process—including those that joined the committee since the planning process began—to update and revise the plan. In reconvening, the HMPC will be responsible for coordinating the activities necessary to involve the greater public, including disseminating information through a variety of media channels detailing the plan update process. As part of this effort, public meetings will be held and public comments will be solicited on the plan update draft.

## 9 Plan Adoption

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**Requirement §201.6(c)(5): [The plan shall include] documentation that the plan has been formally approved by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council).**

The purpose of formally adopting this plan is to secure buy-in, raise awareness of the plan, and formalize the plan's implementation. The adoption of this plan completes Planning Step 9 (Adopt the Plan) of the 10-step planning process, in accordance with the requirements of DMA 2000. FEMA Approval Letters and community adoption resolutions are provided below.



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



FEMA

September 22, 2020

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: Multi-Jurisdictional Hazard Mitigation Plan: Eno-Haw Regional

Dear Mr. McGugan:

We are pleased to inform you the Eno-Haw Regional Multi-Jurisdictional Hazard Mitigation Plan update is in compliance with the Federal hazard mitigation planning requirements resulting from the Disaster Mitigation Act of 2000, as contained in 44 CFR 201.6. Effective September 22, 2020, the plan is approved for a period of five (5) years, to September 21, 2025.

This plan approval extends to the following participating jurisdictions that provided copies of their resolutions adopting the plan:

- Alamance County
- Town of Elon
- Town of Haw River
- City of Mebane
- Orange County
- Town of Carrboro
- City of Graham
- Town of Hillsborough
- City of Roxboro
- Person County

The approved participating jurisdictions are hereby eligible applicants through the State for the following mitigation grant programs administered by the Federal Emergency Management Agency (FEMA):

- Hazard Mitigation Grant Program (HMGP)
- Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)

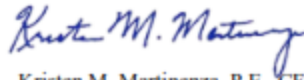
National Flood Insurance Program (NFIP) participation is required for some programs.

We commend the participants of Eno-Haw Regional Multi-Jurisdictional Hazard Mitigation Plan for the development of a solid, workable plan that will guide hazard mitigation activities over the coming years. Please note that 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 in 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.

The State and the participants in the Eno-Haw Regional Multi-Jurisdictional 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 Neuse River Regional Multi-Jurisdictional Hazard Mitigation Plan have any questions or need any additional information, please do not hesitate to contact Jean Neptune, of the Hazard Mitigation Assistance Branch, at (770) 220-5474 or Edwardine S. Marrone, of my staff, at (404) 433-3968.

Sincerely,



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

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



FEMA

October 27, 2020

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: Multi-Jurisdictional Hazard Mitigation Plan: Eno-Haw Regional

Dear Mr. McGugan:

This is a follow-up to our previous correspondence of September 22, 2020, in which we approved the Eno-Haw Regional Multi-Jurisdictional Hazard Mitigation Plan and all the participating communities that submitted their resolutions at the time of plan approval. We have recently received from your office the following resolution for inclusion within this plan and subsequently have approved the community under the approved Eno-Haw Regional Multi-Jurisdictional Hazard Mitigation Plan effective October 27, 2020:

- Durham County, Unincorporated

The approved participating community 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 Eno-Haw Regional Multi-Jurisdictional Hazard Mitigation Plan for the development of a solid, workable plan that will guide hazard mitigation activities over the coming years. Please note that 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.

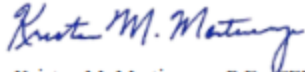
We strongly encourage each community to perform an annual review and assessment of the effectiveness of their hazard mitigation plan; however, a formal plan update is required at least every five (5) years. We also encourage each community to conduct a plan update process within one (1) year of being 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.

[www.fema.gov](http://www.fema.gov)

When the Plan is amended or revised, the amendments and revisions should be incorporated into the next plan update. 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.

If you or the participants in the Eno-Haw Regional Multi-Jurisdictional Hazard Mitigation Plan have any further questions or need any additional information, please do not hesitate to contact Catherine Strickland, of the Hazard Mitigation Assistance Branch, at (770) 220-5328 or Edwardine S. Marrone, of my staff, at (404) 433-3968.

Sincerely,



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

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



FEMA

January 5, 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: Multi-Jurisdictional Hazard Mitigation Plan: Eno-Haw Regional

Dear Mr. McGugan:

This is a follow-up to our previous correspondence of September 22, 2020, in which we approved the Eno-Haw Regional Multi-Jurisdictional Hazard Mitigation Plan and all the participating communities that submitted their resolutions at the time of plan approval. We have recently received from your office the following resolutions for inclusion within this plan and subsequently have approved the jurisdictions under the approved the Eno-Haw Regional Multi-Jurisdictional Hazard Mitigation Plan effective September 22, 2020.

- City of Durham

The approved participating communities are hereby eligible applicants through the State for the following mitigation grant programs administered by the Federal Emergency Management Agency (FEMA):

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

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

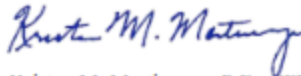
We commend the participants in the Eno-Haw Regional Multi-Jurisdictional Hazard Mitigation Plan for the development of a solid, workable plan that will guide hazard mitigation activities over the coming years. Please note that all requests for funding will be evaluated individually according to the specific 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 the Plan is amended or revised, the amendments and revisions should be incorporated into the next plan update. 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.

If you or the participants in the Eno-Haw Regional Multi-Jurisdictional Hazard Mitigation Plan have any further questions or need any additional information please do not hesitate to contact Celicia A. Davis, of the Hazard Mitigation Assistance Branch, at (770) 220-5253, Dontrey L. Garnett, of the Hazard Mitigation Assistance Branch, at (770) 220-3145, or Edwardine S. Marrone, of my staff, at (404) 433-3968.

Sincerely,



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



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



FEMA

March 26, 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: Multi-Jurisdictional Hazard Mitigation Plan: Eno-Haw Regional

Dear Mr. McGugan:

This is a follow-up to our previous correspondence of September 22, 2020, in which we approved the Eno-Haw Regional Multi-Jurisdictional Hazard Mitigation Plan and all the participating communities that submitted their resolutions at the time of plan approval. We have recently received from your office the following resolutions for inclusion within this plan and subsequently have approved the jurisdictions under the approved Eno-Haw Regional Multi-Jurisdictional Hazard Mitigation Plan effective March 26, 2021.

- City of Burlington
- Town of Chapel Hill
- Town of Swepsonville

The approved participating communities are hereby eligible applicants through the State for the following mitigation grant programs administered by the Federal Emergency Management Agency (FEMA):

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

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

We commend the participants in the Eno-Haw Regional Multi-Jurisdictional Hazard Mitigation Plan for the development of a solid, workable plan that will guide hazard mitigation activities over the coming years. Please note that 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 the Plan is amended or revised, the amendments and revisions should be incorporated into the next plan update. 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.

If you or the participants in the Eno-Haw Regional Multi-Jurisdictional Hazard Mitigation Plan have any further questions or need any additional information, please do not hesitate to contact Celicia A. Davis, of the Hazard Mitigation Assistance Branch, at (770) 220-5253, Dontrey L. Garnett, of the Hazard Mitigation Assistance Branch, at (770) 220-3145 or Edwardine S. Marrone, of my staff, at (404) 433-3968.

Sincerely,



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

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



**FEMA**

July 1, 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: Multi-Jurisdictional Hazard Mitigation Plan: Eno-Haw Regional

Dear Mr. McGugan:

This is a follow-up to our previous correspondence of September 22, 2020, in which we approved the Eno-Haw Regional Multi-Jurisdictional Hazard Mitigation Plan and all the participating communities that submitted their resolutions at the time of plan approval. We have recently received from your office the following resolutions for inclusion within this plan and subsequently have approved the jurisdictions under the approved the Eno-Haw Regional Multi-Jurisdictional Hazard Mitigation Plan effective July 1, 2021.

- Village of Alamance
- Town of Ossipee

The approved participating communities are hereby eligible applicants through the State for the following mitigation grant programs administered by the Federal Emergency Management Agency (FEMA):

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

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

We commend the participants in the Eno-Haw Regional Multi-Jurisdictional Hazard Mitigation Plan for the development of a solid, workable plan that will guide hazard mitigation activities over the coming years. Please note that 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.

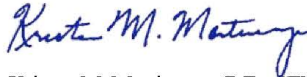
We strongly encourage each community to perform an annual review and assessment of the effectiveness of their hazard mitigation plan; however, a formal plan update is required at least every five (5) years. We also encourage each community to conduct a plan update process within one (1) year of being included within a Presidential Disaster Declaration or of the adoption of major modifications to their local

[www.fema.gov](http://www.fema.gov)

Comprehensive Land Use Plan or other plans that affect hazard mitigation or land use and development. When the Plan is amended or revised, the amendments and revisions should be incorporated into the next plan update. 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.

If you or the participants in the Eno-Haw Regional Multi-Jurisdictional Hazard Mitigation Plan have any further questions or need any additional information, please do not hesitate to contact Celicia Davis, of the Hazard Mitigation Assistance Branch, at (202) 997-7490, Carol Maldonado, of the Hazard Mitigation Assistance Branch, at (470) 307-6294, 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, P.E., CFM  
Branch Chief  
Risk Analysis  
FEMA Region IV



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

**FEMA**

August 19, 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: Multi-Jurisdictional Hazard Mitigation Plan: Eno-Haw Regional

Dear Mr. McGugan:

This is a follow-up to our previous correspondence of September 22, 2020 in which we approved the Eno-Haw Regional Multi-Jurisdictional Hazard Mitigation Plan and all the participating communities that submitted their resolutions at the time of plan approval. We have recently received from your office the following resolutions for inclusion within this plan and subsequently have approved the communities under the approved Eno-Haw Regional Hazard Mitigation Plan effective August 19, 2021:

- Town of Green Level

The approved participating community 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.

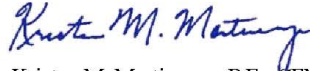
We commend the participants in Eno-Haw Regional Hazard Mitigation Plan for the development of a solid, workable plan that will guide hazard mitigation activities over the coming years. Please note that all requests for funding will be evaluated individually according to the specific eligibility and other requirements of the 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 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 the Plan is amended or revised, the amendments and revisions should be incorporated into the next plan update. 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.

If you or the participants in Eno-Haw Regional Hazard Mitigation Plan have any further 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,

A handwritten signature in blue ink that reads "Kristen M. Martinenza".

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



**ALAMANCE COUNTY BOARD OF COMMISSIONERS**

**RESOLUTION OF ADOPTION  
ENO-HAW REGIONAL HAZARD MITIGATION PLAN**

**WHEREAS**, in October 2000, the President of the United States signed into law the "Disaster Mitigation Act of 2000" (PL 106-390) to amend the "Robert T. Stafford Disaster Relief and Emergency Act of 1988" which requires local governments to adopt a mitigation plan in order to be eligible for hazard mitigation funding; and

**WHEREAS**, Federal mitigation planning regulations require local mitigation plans to be updated and resubmitted to the Federal Emergency Management Agency for approval every five years in order to continue eligibility for Federal Emergency Management Agency hazard mitigation assistance programs; and

**WHEREAS**, North Carolina General Statute §166-A - 19.41, approved by the North Carolina General Assembly in June 2001 requires local governments to have a hazard mitigation plan approved in order to receive state public assistance funds; and

**WHEREAS**, County staff along with representatives from partnering jurisdictions in conjunction with contract services have performed a comprehensive review and evaluation of the newly created Eno-Haw Regional Hazard Mitigation Plan and have updated the plan as required under regulations at 44 CFR Part 201 and according to guidance issued by the North Carolina Division of Emergency Management; and

**WHEREAS**, the North Carolina Division of Emergency Management has deemed the Eno-Haw Regional Hazard Mitigation Plan compliant with Section 322 of the Disaster Mitigation Act of 2000, as well as with relevant state requirements; and


**WHEREAS**, the Eno-Haw Regional Hazard Mitigation Plan is currently under review for approval by the Federal Emergency Management Agency;

**NOW THEREFORE**, BE IT RESOLVED, that the Board of County Commissioners of Alamance County hereby adopt, by way of this resolution, the "Eno-Haw Regional Hazard Mitigation Plan" as approved by the North Carolina Division of Emergency Management.

This the 8<sup>th</sup> day of Sept., 2020.

  
Amy Scott Galey, Chair  
Alamance County Board of Commissioners

ATTEST:

  
Tory Frink  
Clerk to the Board



**RESOLUTION  
ADOPTING ENO-HAW REGIONAL  
HAZARD MITIGATION PLAN**

WHEREAS, the citizens and property within City of Burlington are subject to the effects of natural hazards that pose threats to lives and cause damage to property, and with the knowledge and experience that certain areas of the county are particularly vulnerable to drought, extreme heat, hailstorm, hurricane and tropical storm, lightning, thunderstorm wind/high wind, tornado, winter storm and freeze, flood, hazardous material incident, and wildfire; and

WHEREAS, the City of Burlington desires to seek ways to mitigate the impact of identified hazard risks; and

WHEREAS, the Legislature of the State of North Carolina has in Part 6, Article 21 of Chapter 143; Parts 3, 5, and 8 of Article 19 of Chapter 160A; and Article 8 of Chapter 160A of the North Carolina General Statutes, delegated to local governmental units the responsibility to adopt regulations designed to promote the public health, safety, and general welfare of its citizenry; and

WHEREAS, the Legislature of the State of North Carolina has enacted General Statute Section 166A-19.41 (*State emergency assistance funds*) which provides that for a state of emergency declared pursuant to G.S. 166A-19.20(a) after the deadline established by the Federal Emergency Management Agency pursuant to the Disaster Mitigation Act of 2002, P.L. 106-390, the eligible entity shall have a hazard mitigation plan approved pursuant to the Stafford Act; and.

WHEREAS, Section 322 of the Federal Disaster Mitigation Act of 2000 states that local governments must develop an All-Hazards Mitigation Plan in order to be eligible to receive future Hazard Mitigation Grant Program Funds and other disaster-related assistance funding and that said Plan must be updated and adopted within a five year cycle; and

WHEREAS, the City of Burlington has performed a comprehensive review and evaluation of each section of the previously approved Hazard Mitigation Plan and has updated the said plan as required under regulations at 44 CFR Part 201 and according to guidance issued by the Federal Emergency Management Agency and the North Carolina Division of Emergency Management.

WHEREAS, it is the intent of the City Council of City of Burlington to fulfill this obligation in order that the City of Burlington will be eligible for federal and state assistance in the event that a state of disaster is declared for a hazard event affecting the City;

NOW, THEREFORE, be it resolved that the City Council of City of Burlington hereby:

1. Adopts the Eno-Haw Regional Hazard Mitigation Plan.
2. Vests City of Burlington with the responsibility, authority, and the means to:
  - (a) Inform all concerned parties of this action.

- (b) Cooperate with Federal, State and local agencies and private firms which undertake to study, survey, map and identify floodplain areas, and cooperate with neighboring communities with respect to management of adjoining floodplain areas in order to prevent exacerbation of existing hazard impacts.
3. Appoints City of Burlington to assure that the Hazard Mitigation Plan is reviewed annually and every five years as specified in the Plan to assure that the Plan is in compliance with all State and Federal regulations and that any needed revisions or amendments to the Plan are developed and presented to the City of Burlington City Council for consideration.
4. Agrees to take such other official action as may be reasonably necessary to carry out the objectives of the Hazard Mitigation Plan.

Adopted this the 5<sup>th</sup> day of January, 2021.



  
Ian Baltutis, Mayor  
Burlington City Council

  
Beverly D. Smith, City Clerk  
City of Burlington, NC

**A RESOLUTION TO ADOPT THE ENO-HAW HAZARD MITIGATION PLAN**

**WHEREAS**, in October 2000, the President of the United States signed into law the "Disaster Mitigation Act of 2000" (PL 106-390) to amend the "Robert T. Stafford Disaster Relief and Emergency Act of 1988" which requires local governments to adopt a mitigation plan in order to be eligible for hazard mitigation funding; and

**WHEREAS**, Federal mitigation planning regulations require local mitigation plans to be updated and resubmitted to the Federal Emergency Management Agency for approval every five years in order to continue eligibility for Federal Emergency Management Agency hazard mitigation assistance programs; and

**WHEREAS**, North Carolina General Statute §166-A - 19.41, approved by the North Carolina General Assembly in June 2001 requires local governments to have a hazard mitigation plan approved in order to receive state public assistance funds; and

**WHEREAS**, Alamance County staff along with representatives from partnering jurisdictions in conjunction with contract services have performed a comprehensive review and evaluation of the newly created Eno-Haw Regional Hazard Mitigation Plan and have updated the plan as required under regulations at 44 CFR Part 201 and according to guidance issued by the North Carolina Division of Emergency Management; and

**WHEREAS**, the North Carolina Division of Emergency Management has deemed the Eno-Haw Regional Hazard Mitigation Plan compliant with Section 322 of the Disaster Mitigation Act of 2000, as well as with relevant state requirements; and

**WHEREAS**, the Federal Emergency Management Agency has received a draft of the Eno-Haw Regional Hazard Mitigation Plan and is currently reviewing;

**NOW THEREFORE, BE IT RESOLVED**, that the City Council of The City of Graham hereby adopt, by way of this resolution, the "Eno-Haw Regional Hazard Mitigation Plan" 2020 edition as approved by the North Carolina Division of Emergency Management.

Adopted this the Eleventh day of August, 2020

ATTEST:  
  
Darcy L. Sperry, City Clerk

  
Gerald R. Peterman, Mayor



City of Mebane City Council  
RESOLUTION OF ADOPTION  
THE ENO-HAW REGIONAL HAZARD MITIGATION PLAN

**WHEREAS**, the City of Mebane is vulnerable to an array of natural hazards that can cause loss of life and damages to public and private property; and

**WHEREAS**, the City of Mebane desires to seek ways to mitigate situations that may aggravate such circumstances; and

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

**WHEREAS**, it is the intent of the Mebane City Council to protect its citizens and property from the effects of natural hazards by preparing and maintaining a local hazard mitigation plan; and

**WHEREAS**, it is also the intent of the Mebane City Council 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 City of Mebane; and


**WHEREAS**, the City of Mebane, in coordination with all other participating jurisdictions of the Eno-Haw Region, has prepared a regional hazard mitigation plan with input from the appropriate local and state officials; and

**WHEREAS**, the North Carolina Division of Emergency Management and the Federal Emergency Management Agency will receive a draft of the Eno-Haw Regional Hazard Mitigation Plan to review for legislative compliance and approve pending the completion of local adoption procedures;

**NOW, THEREFORE, BE IT RESOLVED** that the City Council of the City of Mebane hereby:

1. Adopts the Eno-Haw 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.

This the 6<sup>th</sup> day of July, 2020.



Ed Hooks, Mayor

ATTEST:

  
Stephanie W. Shaw, City Clerk





Resolution# 20-674

**RESOLUTION  
ADOPTING THE ENO-HAW REGIONAL HAZARD MITIGATION PLAN**

**WHEREAS**, the Town of Elon is vulnerable to an array of natural hazards that can cause loss of life and damages to public and private property; and

**WHEREAS**, the Town of Elon desires to seek ways to mitigate situations that may aggravate such circumstances; and

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

**WHEREAS**, it is the intent of the Board of Aldermen to protect its citizens and property from the effects of natural hazards by preparing and maintaining a local hazard mitigation plan; and

**WHEREAS**, it is also the intent of the Board of Aldermen 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 Town of Elon; and


**WHEREAS**, the Town of Elon, in coordination with all other participating jurisdictions of the Eno-Haw Region, has prepared a regional hazard mitigation plan with input from the appropriate local and state officials; and

**WHEREAS**, the North Carolina Division of Emergency Management and the Federal Emergency Management Agency will receive a draft of the Eno-Haw Regional Hazard Mitigation Plan to review for legislative compliance and approve pending the completion of local adoption procedures;

**NOW, THEREFORE, BE IT RESOLVED** that the Board of Aldermen of Elon hereby:

1. Adopts the Eno-Haw 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.

This the 11th day of August 2020.

  
Jerry Tolley, Mayor  
Town of Elon

ATTEST:  
  
DiAnne Enoch  
Town Clerk





## Town of

**MAYOR AND COUNCIL MEMBERS**  
Carissa Graves, MAYOR  
Theodore Howard, MAYOR PRO-TEMP  
Remonia Enoch, COUNCIL MEMBER  
Michael Trollinger, COUNCIL MEMBER  
Sandra McColtun, COUNCIL MEMBER



## Green Level

**OFFICE OF THE TOWN ADMINISTRATOR**  
Barrett Brown, TOWN ADMINISTRATOR  
Ida Kleiner, TOWN CLERK  
Eugene Russell, TOWN ATTORNEY

RESOLUTION # 0002

### ADOPTING THE ENO-HAW REGIONAL HAZARD MITIGATION PLAN

**WHEREAS**, the Town of Green Level is vulnerable to an array of natural hazards that can cause loss of life and damages to public and private property; and

**WHEREAS**, the Town of Green Level desires to seek ways to mitigate situations that may aggravate such circumstances; and

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

**WHEREAS**, it is the intent of the Town Council to protect its citizens and property from the effects of natural hazards by preparing and maintaining a local hazard mitigation plan; and

**WHEREAS**, it is also the intent of the Town Council 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 Town of Green Level; and

**WHEREAS**, the Town of Green Level, in coordination with all other participating jurisdictions of the Eno-Haw Region, has prepared a regional hazard mitigation plan with input from the appropriate local and state officials; and

**WHEREAS**, the North Carolina Division of Emergency Management and the Federal Emergency Management Agency will receive a draft of the Eno-Haw Regional Hazard Mitigation Plan to review for legislative compliance and approve pending the completion of local adoption procedures;

**NOW, THEREFORE, BE IT RESOLVED** that the Town Council of the Town of Green Level hereby:

1. Adopts the Eno-Haw 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.

Submitted this thirteenth of May, 2021.

## RESOLUTION ADOPTING THE ENO-HAW REGIONAL HAZARD MITIGATION PLAN

**WHEREAS,** Town of Haw River is vulnerable to an array of natural hazards that can cause loss of life and damages to public and private property; and

**WHEREAS,** the Town of Haw River desires to seek ways to mitigate situations that may aggravate such circumstances; and

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

**WHEREAS,** it is the intent of the Haw River Town Council to protect its citizens and property from the effects of natural hazards by preparing and maintaining a local hazard mitigation plan; and

**WHEREAS,** it is also the intent of the Haw River Town Council 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 Haw River; and

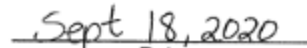
**WHEREAS,** the Town of Haw River, in coordination with all other participating jurisdictions of the Eno-Haw Region, has prepared a regional hazard mitigation plan with input from the appropriate local and state officials; and

**WHEREAS,** the North Carolina Division of Emergency Management and the Federal Emergency Management Agency will receive a draft of the Eno-Haw Regional Hazard Mitigation Plan to review for legislative compliance and approve pending the completion of local adoption procedures;

**NOW, THEREFORE, BE IT RESOLVED** that the Town Council of Haw River hereby:

1. Adopts the Eno-Haw 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.

  
Town of Haw River, Mayor

  
Date



# TOWN of OSSIPEE

2608 Ossipee Front St. P.O. Box 336 Elon, NC 27244  
Phone: 336-584-4258 Fax: 336-584-8512 Email: townofossipee@att.net

## RESOLUTION ADOPTING THE ENO-HAW REGIONAL HAZARD MITIGATION PLAN

**WHEREAS**, TOWN OF OSSIPEE is vulnerable to an array of natural hazards that can cause loss of life and damages to public and private property; and

**WHEREAS**, the TOWN OF OSSIPEE desires to seek ways to mitigate situations that may aggravate such circumstances; and

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

**WHEREAS**, it is the intent of the TOWN OF OSSIPEE to protect its citizens and property from the effects of natural hazards by preparing and maintaining a local hazard mitigation plan; and

**WHEREAS**, it is also the intent of the TOWN OF OSSIPEE COUNCIL 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 TOWN OF OSSIPEE; and

**WHEREAS**, the TOWN OF OSSIPEE, in coordination with all other participating jurisdictions of the Eno-Haw Region, has prepared a regional hazard mitigation plan with input from the appropriate local and state officials; and

**WHEREAS**, the North Carolina Division of Emergency Management and the Federal Emergency Management Agency will receive a draft of the Eno-Haw Regional Hazard Mitigation Plan to review for legislative compliance and approve pending the completion of local adoption procedures;

**NOW, THEREFORE, BE IT RESOLVED** that the Council of TOWN OF OSSIPEE, ELON NC hereby:

1. Adopts the Eno-Haw 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.

This the 28 day of June, 2021

Name: [Signature]  
Title: Mayor Pro Tem

ATTEST:

[Signature]  
Tabitha Whitman, Town Clerk

(SEAL)



RESOLUTION  
ADOPTING ENO-HAW REGIONAL  
HAZARD MITIGATION PLAN

WHEREAS, the citizens and property within Town of Swepsonville are subject to the effects of natural hazards that pose threats to lives and cause damage to property, and with the knowledge and experience that certain areas of the county are particularly vulnerable to drought, extreme heat, hailstorm, hurricane and tropical storm, lightning, thunderstorm wind/high wind, tornado, winter storm and freeze, flood, hazardous material incident, and wildfire; and

WHEREAS, the Town of Swepsonville desires to seek ways to mitigate the impact of identified hazard risks; and

WHEREAS, the Legislature of the State of North Carolina has in Part 6, Article 21 of Chapter 143; Parts 3, 5, and 8 of Article 19 of Chapter 160A; and Article 8 of Chapter 160A of the North Carolina General Statutes, delegated to local governmental units the responsibility to adopt regulations designed to promote the public health, safety, and general welfare of its citizenry; and

WHEREAS, the Legislature of the State of North Carolina has enacted General Statute Section 166A-19.41 (*State emergency assistance funds*) which provides that for a state of emergency declared pursuant to G.S. 166A-19.20(a) after the deadline established by the Federal Emergency Management Agency pursuant to the Disaster Mitigation Act of 2002, P.L. 106-390, the eligible entity shall have a hazard mitigation plan approved pursuant to the Stafford Act; and.

WHEREAS, Section 322 of the Federal Disaster Mitigation Act of 2000 states that local governments must develop an All-Hazards Mitigation Plan in order to be eligible to receive future Hazard Mitigation Grant Program Funds and other disaster-related assistance funding and that said Plan must be updated and adopted within a five year cycle; and

WHEREAS, the Town of Swepsonville has performed a comprehensive review and evaluation of each section of the previously approved Hazard Mitigation Plan and has updated the said plan as required under regulations at 44 CFR Part 201 and according to guidance issued by the Federal Emergency Management Agency and the North Carolina Division of Emergency Management.

WHEREAS, it is the intent of the Swepsonville Town Council to fulfill this obligation in order that the Town of Swepsonville will be eligible for federal and state assistance in the event that a state of disaster is declared for a hazard event affecting the Town;

NOW, THEREFORE, be it resolved that the Swepsonville Town Council hereby:


1. Adopts the Eno-Haw Regional Hazard Mitigation Plan.

2. Vests Town of Swepsonville with the responsibility, authority, and the means to:
  - (a) Inform all concerned parties of this action.
  - (b) Cooperate with Federal, State and local agencies and private firms which undertake to study, survey, map and identify floodplain areas, and cooperate with neighboring communities with respect to management of adjoining floodplain areas in order to prevent exacerbation of existing hazard impacts.
3. Appoints the Town of Swepsonville to assure that the Hazard Mitigation Plan is reviewed annually, and every five years as specified in the Plan to assure that the Plan is in compliance with all State and Federal regulations and that any needed revisions or amendments to the Plan are developed and presented to the Swepsonville Town Council for consideration.
4. Agrees to take such other official action as may be reasonably necessary to carry out the objectives of the Hazard Mitigation Plan.

Adopted this the 19<sup>th</sup> day of January, 2021.

  
Name, Mayor  
Town of Swepsonville

Attest:  
  
Name, Clerk  
Town of Swepsonville

Certified by:  (SEAL)  
Date: January 19<sup>th</sup>, 2021



**ALAMANCE COUNTY BOARD OF COMMISSIONERS**

**RESOLUTION OF ADOPTION  
ENO-HAW REGIONAL HAZARD MITIGATION PLAN**

**WHEREAS**, in October 2000, the President of the United States signed into law the "Disaster Mitigation Act of 2000" (PL 106-390) to amend the "Robert T. Stafford Disaster Relief and Emergency Act of 1988" which requires local governments to adopt a mitigation plan in order to be eligible for hazard mitigation funding; and

**WHEREAS**, Federal mitigation planning regulations require local mitigation plans to be updated and resubmitted to the Federal Emergency Management Agency for approval every five years in order to continue eligibility for Federal Emergency Management Agency hazard mitigation assistance programs; and

**WHEREAS**, North Carolina General Statute §166-A - 19.41, approved by the North Carolina General Assembly in June 2001 requires local governments to have a hazard mitigation plan approved in order to receive state public assistance funds; and

**WHEREAS**, County staff along with representatives from partnering jurisdictions in conjunction with contract services have performed a comprehensive review and evaluation of the newly created Eno-Haw Regional Hazard Mitigation Plan and have updated the plan as required under regulations at 44 CFR Part 201 and according to guidance issued by the North Carolina Division of Emergency Management; and

**WHEREAS**, the North Carolina Division of Emergency Management has deemed the Eno-Haw Regional Hazard Mitigation Plan compliant with Section 322 of the Disaster Mitigation Act of 2000, as well as with relevant state requirements; and

**WHEREAS**, the Eno-Haw Regional Hazard Mitigation Plan is currently under review for approval by the Federal Emergency Management Agency;

**NOW THEREFORE**, BE IT RESOLVED, that the Board of Alderman of the Village of Alamance County hereby adopt, by way of this resolution, the "Eno-Haw Regional Hazard Mitigation Plan" as approved by the North Carolina Division of Emergency Management.

This the 25<sup>th</sup> day of Jan, 2021.

  
Don Tichy, Mayor  
Village of Alamance

ATTEST:

  
Ben York  
Town Clerk



DURHAM BOARD OF COUNTY COMMISSIONERS

*Resolution*

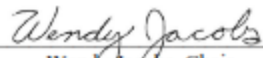
**RESOLUTION ADOPTING THE ENO-HAW REGIONAL HAZARD MITIGATION PLAN**

- WHEREAS,** Durham County is vulnerable to an array of natural, technological, and human-caused hazards that can cause loss of life and damages to public and private property; and
- WHEREAS,** Durham County 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 Durham County Board of Commissioners to protect its citizens and property from the effects of natural hazards by preparing and maintaining a local hazard mitigation plan; and
- WHEREAS,** it is also the intent of the Durham County Board of Commissioners 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 Durham County; and
- WHEREAS,** the Durham County, in coordination with all other participating jurisdictions of the Eno-Haw Region, has prepared a regional hazard mitigation plan with input from the appropriate local and state officials; and
- WHEREAS,** the North Carolina Division of Emergency Management has reviewed the Eno-Haw Regional Hazard Mitigation Plan for legislative compliance and has approved the plan pending the completion of local adoption procedures; and
- WHEREAS,** the Federal Emergency Management Agency has received a draft of the Eno-Haw Regional Hazard Mitigation Plan to review for legislative compliance and approve following the completion of local adoption procedures.

**NOW, THEREFORE, BE IT RESOLVED,** that the Durham County Board of Commissioners hereby:

1. Adopts the Eno-Haw 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.

This the 12<sup>th</sup> day of October, 2020.

  
Wendy Jacobs, Chair  
Board of County Commissioners

  
Monica Toomer, Clerk



Resolution 10191

## City of Durham

### RESOLUTION ADOPTING THE ENO-HAW REGIONAL HAZARD MITIGATION PLAN

**WHEREAS**, the City of Durham is vulnerable to an array of natural, technological, and human-caused hazards that can cause loss of life and damages to public and private property; and

**WHEREAS**, the City of Durham 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 Durham City Council to protect its citizens and property from the effects of natural hazards by preparing and maintaining a local hazard mitigation plan; and

**WHEREAS**, it is also the intent of the Durham City Council 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 City of Durham; and

**WHEREAS**, the City of Durham, in coordination with all other participating jurisdictions of the Eno-Haw Region, has prepared a regional hazard mitigation plan with input from the appropriate local and state officials; and

**WHEREAS**, the North Carolina Division of Emergency Management has reviewed the Eno-Haw Regional Hazard Mitigation Plan for legislative compliance and has approved the plan pending the completion of local adoption procedures;

**WHEREAS**, the Federal Emergency Management Agency has received a draft of the Eno-Haw Regional Hazard Mitigation Plan to review for legislative compliance and approve following the completion of local adoption procedures;

**NOW, THEREFORE, BE IT RESOLVED** that the Durham City Council hereby:

1. Adopts the Eno-Haw Regional Hazard Mitigation Plan; and

## SECTION 9: PLAN ADOPTION

2. Agrees to take such other official action as may be reasonably necessary to carry out the proposed actions of the Plan.



Steve Schewel, Mayor



Diana Schreder, Clerk



APPROVED BY  
CITY COUNCIL

NOV 2 2020

CITY CLERK

RES-2020-050

DAF 9/1/2020; 8:39  
4

**ORANGE COUNTY BOARD OF COMMISSIONERS**

**RESOLUTION OF ADOPTION  
2020 ENO-HAW REGIONAL HAZARD MITIGATION PLAN**

**WHEREAS**, in October 2000, the President of the United States signed into law the "Disaster Mitigation Act of 2000" (PL 106-390) to amend the "Robert T. Stafford Disaster Relief and Emergency Act of 1988" which requires local governments to adopt a mitigation plan in order to be eligible for hazard mitigation funding; and

**WHEREAS**, Federal mitigation planning regulations require local mitigation plans to be updated and resubmitted to the Federal Emergency Management Agency for approval every five years in order to continue eligibility for Federal Emergency Management Agency hazard mitigation assistance programs; and

**WHEREAS**, North Carolina General Statute §166-A - 19.41, approved by the North Carolina General Assembly in June 2001 requires local governments to have a hazard mitigation plan approved in order to receive state public assistance funds; and

**WHEREAS**, County staff along with representatives from partnering jurisdictions in conjunction with contract services have performed a comprehensive review and evaluation of the 2015 Eno-Haw Regional Hazard Mitigation Plan and have updated the plan as required under regulations at 44 CFR Part 201 and according to guidance issued by the North Carolina Division of Emergency Management; and

**WHEREAS**, the North Carolina Division of Emergency Management has deemed the Eno-Haw Regional Hazard Mitigation Plan compliant with Section 322 of the Disaster Mitigation Act of 2000, as well as with relevant state requirements; and


**WHEREAS**, the Federal Emergency Management Agency has received a draft of the 2020 Eno-Haw Regional Hazard Mitigation Plan and is currently reviewing;

**NOW THEREFORE, BE IT RESOLVED**, that the Board of County Commissioners of Orange County hereby adopts, by way of this resolution, the revised "Eno-Haw Regional Hazard Mitigation Plan" as approved by the North Carolina Division of Emergency Management.

This the 1<sup>st</sup> day of September, 2020.

  
Penny Rich, Chair  
Orange County Board of Commissioners

ATTEST:

  
David Hunt  
Deputy Clerk to the Board



**A motion was made by Council Member Foushee, seconded by Council Member Sells, to approve the following resolution:**

**RESOLUTION ADOPTING THE ENO-HAW REGIONAL HAZARD  
MITIGATION PLAN**

WHEREAS, the Town of Carrboro is vulnerable to an array of natural hazards that can cause loss of life and damages to public and private property; and

WHEREAS, the Town of Carrboro desires to seek ways to mitigate situations that may aggravate such circumstances; and

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

WHEREAS, it is the intent of the Carrboro Town Council to protect its citizens and property from the effects of natural hazards by preparing and maintaining a local hazard mitigation plan; and

WHEREAS, it is also the intent of the Carrboro Town Council 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 Town of Carrboro; and

WHEREAS, the Town of Carrboro, in coordination with all other participating jurisdictions of the Eno-Haw Region, has prepared a regional hazard mitigation plan with input from the appropriate local and state officials; and

WHEREAS, the North Carolina Division of Emergency Management and the Federal Emergency Management Agency will receive a draft of the Eno-Haw Regional Hazard Mitigation Plan to review for legislative compliance and approve pending the completion of local adoption procedures;

NOW, THEREFORE, BE IT RESOLVED that the Carrboro Town Council hereby:

1. Adopts the Eno-Haw 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.

This, the 16th day of June 2020.

**Ayes:** Mayor Lydia Lavelle, Council Member Barbara Foushee, Council Member Jacquelyn Gist, Council Member Randee Haven-O'Donnell, Council Member Susan Romaine, Council Member Damon Seils, Council Member Sammy Slade

I, Catherine Dorando, Town Clerk for the Town of Carrboro, NC do hereby certify that the foregoing is a true and correct copy of a resolution adopted by the Carrboro Board of Aldermen.

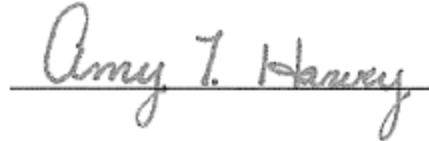


  
Town Clerk



**I, Amy T. Harvey, Deputy Town Clerk of the Town of Chapel Hill, North Carolina, hereby certify that the attached is a true and correct copy of (2021-03-10/R-2) adopted by the Chapel Hill Town Council on March 10, 2021.**

**This the 11<sup>th</sup> day of March, 2021.**



**Amy T. Harvey  
Deputy Town Clerk**



### **A RESOLUTION ADOPTING THE ENO-HAW REGIONAL HAZARD MITIGATION PLAN (2021-03-10/R-2)**

WHEREAS, the federal "Disaster Mitigation Act of 2000" (PL 106-390) requires local governments to adopt a mitigation plan in order to be eligible for hazard mitigation funding; and

WHEREAS, Federal mitigation planning regulations require local mitigation plans to be updated and resubmitted to the Federal Emergency Management Agency for approval every five years in order to continue eligibility for Federal Emergency Management Agency hazard mitigation assistance programs; and

WHEREAS, North Carolina General Statute §166A-19.41 requires local governments to have an approved hazard mitigation plan in order to receive state public assistance funds; and

WHEREAS, the Council of the Town of Chapel Hill desires to remain eligible for hazard mitigation funding and public assistance disaster relief funds; and

WHEREAS, Town staff along with representatives from partnering jurisdictions, in conjunction with contract services, have performed a comprehensive review and evaluation of the newly- created Eno-Haw Regional Hazard Mitigation Plan and have updated the plan as required under regulations at 44 CFR Part 201 and according to guidance issued by the North Carolina Division of Emergency Management; and

WHEREAS, the Eno-Haw Regional Hazard Mitigation plan formalizes the regional partnerships necessary to strategically and efficiently reduce and eliminate long-term risk to our citizens and their property from hazards; and

WHEREAS, the North Carolina Division of Emergency Management has deemed the Eno-Haw Regional Hazard Mitigation Plan compliant with Section 322 of the Disaster Mitigation Act of 2000, as well as with relevant state requirements; and

WHEREAS, the Federal Emergency Management Agency has deemed the Eno-Haw Regional Hazard Mitigation Plan compliant with Section 322 of the Disaster Mitigation Act of 2000.

NOW, THEREFORE, BE IT RESOLVED by the Council of the Town of Chapel Hill that the Council hereby adopts, by way of this resolution, the "Eno-Haw Regional Hazard Mitigation Plan" as approved by the North Carolina Division of Emergency Management and the Federal Emergency Management Agency.

This the 10th day of March, 2021.

Resolution #20200526-3.C

TOWN OF HILLSBOROUGH

**TOWN OF HILLSBOROUGH BOARD OF COMMISSIONERS RESOLUTION  
ADOPTING THE "ENO-HAW REGIONAL HAZARD MITIGATION PLAN"**

**WHEREAS**, in October 2000, the President of the United States signed into law the "Disaster Mitigation Act of 2000" (PL 106-390) to amend the "Robert T. Stafford Disaster Relief and Emergency Act of 1988" which requires local governments to adopt a mitigation plan in order to be eligible for hazard mitigation funding; and

**WHEREAS**, Federal mitigation planning regulations require local mitigation plans to be updated and resubmitted to the Federal Emergency Management Agency for approval every five years in order to continue eligibility for Federal Emergency Management Agency hazard mitigation assistance programs; and

**WHEREAS**, North Carolina General Statute §166-A - 19.41, approved by the North Carolina General Assembly in June 2001 requires local governments to have a hazard mitigation plan approved in order to receive state public assistance funds; and

**WHEREAS**, Town staff along with representatives from partnering jurisdictions in conjunction with contract services have performed a comprehensive review and evaluation of the Eno-Haw Regional Hazard Mitigation Plan and have updated the plan as required under regulations at 44 CFR Part 201 and according to guidance issued by the North Carolina Division of Emergency Management; and

**WHEREAS**, the North Carolina Division of Emergency Management has deemed the Eno-Haw Regional Hazard Mitigation Plan compliant with Section 322 of the Disaster Mitigation Act of 2000, as well as with relevant state requirements; and

**WHEREAS**, the Federal Emergency Management Agency has received a draft of the Eno-Haw Regional Hazard Mitigation Plan and is currently reviewing;

**NOW THEREFORE, BE IT RESOLVED**, that the Board of Commissioners of the Town of Hillsborough hereby adopts, by way of this resolution, the "Eno-Haw Regional Hazard Mitigation Plan" as approved by the North Carolina Division of Emergency Management.

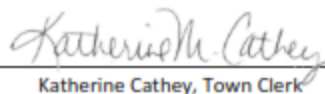
The foregoing resolution was put to a vote of the Town of Hillsborough Board of Commissioners, the results of which vote are as follows:

Ayes: 5

Noes: 0

Absent or Excused: 0

Dated: 5/26/2020

  
Katherine Cathey, Town Clerk

PERSON COUNTY

**A RESOLUTION ADOPTING THE ENO-HAW REGIONAL MULTI-JURISDICTION  
HAZARD MITIGATION PLAN**

**WHEREAS**, the residents, visitors and property owners of Person County are subject to death, personal injury, damage to property and disruption of activities and personal pursuits as a result of natural or man-made hazards; and

**WHEREAS**, Person County desires to seek ways to mitigate the effects and impacts of such hazards; and

**WHEREAS**, North Carolina state law in General Statutes Chapters 153A and 166A authorizes Counties to prepare plans and implement such plans for mitigation of hazards and to do so in cooperation with other counties and cities; and

**WHEREAS**, Person County has heretofore prepared a Person County specific hazard mitigation plan, but now finds it desirable to prepare and adopt a plan in concert with the City of Roxboro and the counties of Alamance, Orange, and Durham and the municipalities in those counties, which such plan is to be designated the Eno-Haw Regional Multi-Jurisdiction Hazard Mitigation Plan; and

**WHEREAS**, the Robert T. Stafford Disaster Relief and Emergency Assistance Act and the Disaster Mitigation Act of 2000 require the adoption by local governments of an All Hazards Mitigation Plan as a condition of receipt of federal funds in connection with a disaster; and

**WHEREAS**, Person County through its designated agents, officials and employees has pursuant to state and federal guidelines performed a comprehensive review and examination of potential risks, exposures and hazards and actions necessary and/or desirable to mitigate the effects of such risks, exposures and hazards and has done so in concert and cooperation with the other governmental units in the Eno-Haw region.

**NOW THEREFORE BE IT RESOLVED** by the Person County Board of Commissioners that:

1. The attached Eno-Haw Regional Multi-Jurisdiction Hazard Mitigation Plan is hereby adopted,
2. Person County agrees to take such further action as is reasonably necessary to carry out and implement the Eno-Haw Regional Multi-Jurisdiction Hazard Mitigation Plan, and
3. The Person County Emergency Management Director is designated as the responsible official to inform State and Federal officials of Person County's action and to carry out the emergency management duties under the Plan including ensuring that the County is compliant with state and federal rules, informing the County Manager and the Board of Commissioners of any necessary adjustments and amendments to the Plan.

Adopted this 17<sup>th</sup> day of August 2020.



  
B. Ray Jeffers, Chairman  
Person County Board of Commissioners

Attest:

  
Brenda B. Reaves, NCMCC, MMC  
Clerk to the Board of Commissioners

**RESOLUTION OF ADOPTION**  
**City of Roxboro Hazard Mitigation Plan**

- WHEREAS,** the citizens and property within the City of Roxboro are subject to the effects of natural hazards and man-made hazard events that pose threats to lives and cause damages to property, and with the knowledge and experience that certain areas, i.e., flood hazard areas, are particularly susceptible to flood hazard events; and
- WHEREAS,** the City desires to seek ways to mitigate situations that may aggravate such circumstances; and
- WHEREAS,** the General Assembly of the State of North Carolina has in Part 6, Article 21 of Chapter 143; Articles 7, 9 and 11 and sections 160D-403 and 160D-404 of Chapter 160D; and Article 8 of Chapter 160A of the North Carolina General Statutes, delegated to local governmental units the responsibility to adopt regulations designed to promote the public health, safety, and general welfare of its citizenry; and
- WHEREAS,** the General Assembly of the State of North Carolina has in North Carolina General Statutes section 166A-19.41 (b) (2) a. enacted the following: "For a state of emergency declared pursuant to G.S. 166A-19.20(a) after the deadline established by the Federal Emergency Management Agency pursuant to the Disaster Mitigation Act of 2002, P.L. 106-390, the eligible entity shall have a hazard mitigation plan approved pursuant to the Stafford Act"; and
- WHEREAS,** Section 322 of the Federal Disaster Mitigation Act of 2000 (42 U.S.C. 5165) states that local government must develop an all-hazards Mitigation Plan in order to receive future Hazard Mitigation Grant Program Funds, and
- WHEREAS,** it is the intent of the Roxboro City Council to fulfill this obligation in order that the City will be eligible for state assistance in the event that a state of disaster is declared for a hazard event affecting the City;

**NOW, therefore, be it resolved that the Roxboro City Council hereby:**

1. Adopts the Eno-Haw Regional Hazard Mitigation Plan; and
2. Vests the City Manager with the responsibility, authority, and the means to:
  - (a) Inform all concerned parties of this action.
  - (b) Cooperate with Federal, State and local agencies and private firms which undertake to study, survey, map, and identify floodplain or flood-related erosion areas, and cooperate with neighboring communities with respect to management of adjoining floodplain and/or flood-related erosion areas in order to prevent aggravation of existing hazards.
  - (c) Adjust the boundaries of municipal planning jurisdictions whenever a municipal annexation or extraterritorial jurisdiction revision results in a change whereby a municipality assumes or relinquishes the authority to adopt and enforce floodplain management regulations for a particular area in order that all Flood Hazard Boundary Maps (FHBMs) and Flood Insurance Rate Maps (FIRMs) accurately represent the planning jurisdiction boundaries. Provide notification of boundary revisions along with a map suitable for reproduction, clearly delineating municipal corporate limits and extraterritorial jurisdiction boundaries to all concerned parties.

## SECTION 9: PLAN ADOPTION

3. Appoints the City Manager to assure that the Hazard Mitigation Plan is reviewed annually and in greater detail at least once every five years to assure that the Plan is in compliance with all State and Federal regulations and that any needed revisions or amendments to the Plan are developed and presented to the Roxboro City Council for consideration.
4. Agrees to take such other official action as may be reasonably necessary to carry out the objectives of the Hazard Mitigation Plan.

Adopted by the City of Roxboro on 8/11/2020. Adoption to be within one calendar year after FEMA approval.

  
Marilyn Newell, Mayor  
City of Roxboro

Attest:  City Clerk



  
Trevie Adams, City Council Clerk



## Annex A Alamance County

### A.1 PLANNING PROCESS

The table below lists the HMPC members who represented Alamance County unincorporated areas.

**Table A.1 – HMPC Members**

Representative	Position or Title
Debbie Hatfield	EM Coordinator
Yancy King	Asst. EM Coordinator
Brad Bailey	Bat. Chief/City of Burlington
Alan Byrd	First Call

### A.2 COMMUNITY PROFILE

#### Geography

Alamance County is located in the western portion of the Piedmont of North Carolina. It is bordered by Caswell County to the north, Orange County to the east, Chatham County to the south, and Guilford and Randolph Counties to the west. It comprises the Burlington, NC Metropolitan Statistical Area, which falls within the larger Greensboro-Winston-Salem-High Point, NC Combined Statistical Area. The County comprises a total area of 423.3 square miles.

Alamance County was named after Great Alamance Creek, site of the Battle of Alamance (May 16, 1771), a pre-Revolutionary War battle in which militia under the command of Governor William Tryon crushed the Regulator movement. Great Alamance Creek, and in turn Little Alamance Creek, according to legend, were named after a local Native American word to describe the blue mud that was found at the bottom of the creeks. Other legends say that the name came from another local Native American word meaning "noisy river," or for the Alamanni region of Rhineland, Germany, where many of the early settlers would have come from.

#### Population and Demographics

Table A.2 provides population counts and growth estimates for the County's unincorporated areas as compared to the county and region overall.

**Table A.2 – Population Counts, Unincorporated Alamance County, 2010-2018**

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
Unincorporated Alamance County	53,846	54,859	59,106	4,247	7.7%
<b>Alamance County total</b>	<b>130,800</b>	<b>146,902</b>	<b>160,576</b>	<b>13,674</b>	<b>9.3%</b>
<b>Region Total</b>	<b>507,964</b>	<b>567,634</b>	<b>649,276</b>	<b>81,642</b>	<b>14.4%</b>

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

Note: Unincorporated areas statistics calculated by subtracting jurisdiction counts from the county total. The total populations of Burlington and Mebane include population residing in adjacent counties.

#### Housing

Table A.3 details housing unit counts for Alamance County unincorporated areas as compared to the county overall. Overall, housing unit estimates decreased slightly in unincorporated Alamance County.

#### Eno-Haw

However, these counts are calculated by subtracting the estimates of all incorporated areas from the county total estimate, which may skew these numbers.

**Table A.3 – Housing Statistics, Unincorporated Alamance County, 2010-2018**

Housing Characteristics	Alamance County	Unincorporated Alamance County
Housing Units (2010)	66,576	25,345
Housing Units (2018)	69,749	25,213
Housing Units Percent Change (2010-2018)	4.8%	-0.5%

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2014-2018 5-Year Estimates

### A.3 RISK ASSESSMENT

This section contains a summary of the County’s asset inventory as well as hazard profile and vulnerability assessment for those hazards that are spatially defined and have variations in risk that could be evaluated quantitatively on a jurisdictional level. The hazards included in this section are: Dam Failure, Flood and Wildfire.

#### Asset Inventory

The following tables summarize the asset inventory for Alamance County unincorporated areas in order to estimate the total physical exposure to hazards in this area. The locations of critical facilities are shown in Figure A.1. Critical facilities are a subset of identified assets from the Critical Infrastructure & Key Resources (CIKR) dataset. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted and displayed.

Building counts are provided based on data from the NCEM IRISK database, and supplemental parcel exposure is based on November 2019 county parcel data.

**Table A.4 – Critical Infrastructure & Key Resources by Type**

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	Defense	Government Facilities	Healthcare	IT	National Monuments and Icons	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Unincorporated Alamance County	2,325	0	0	783	0	273	0	89	14	0	0	0	0	211	6	12	25	3,738

Source: NCEM Risk Management Tool

**Table A.5 – High Potential Loss Facilities by Use**

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Unincorporated Alamance	6	58	28	25	0	28	20	165

Source: NCEM Risk Management Tool

**Table A.6 – IRISK Inventory of Building Counts and Values**

<b>Jurisdiction</b>	<b>Building Count</b>	<b>Building Value</b>
Unincorporated Alamance County	29,650	\$3,375,672,801

Source: NCEM Risk Management Tool

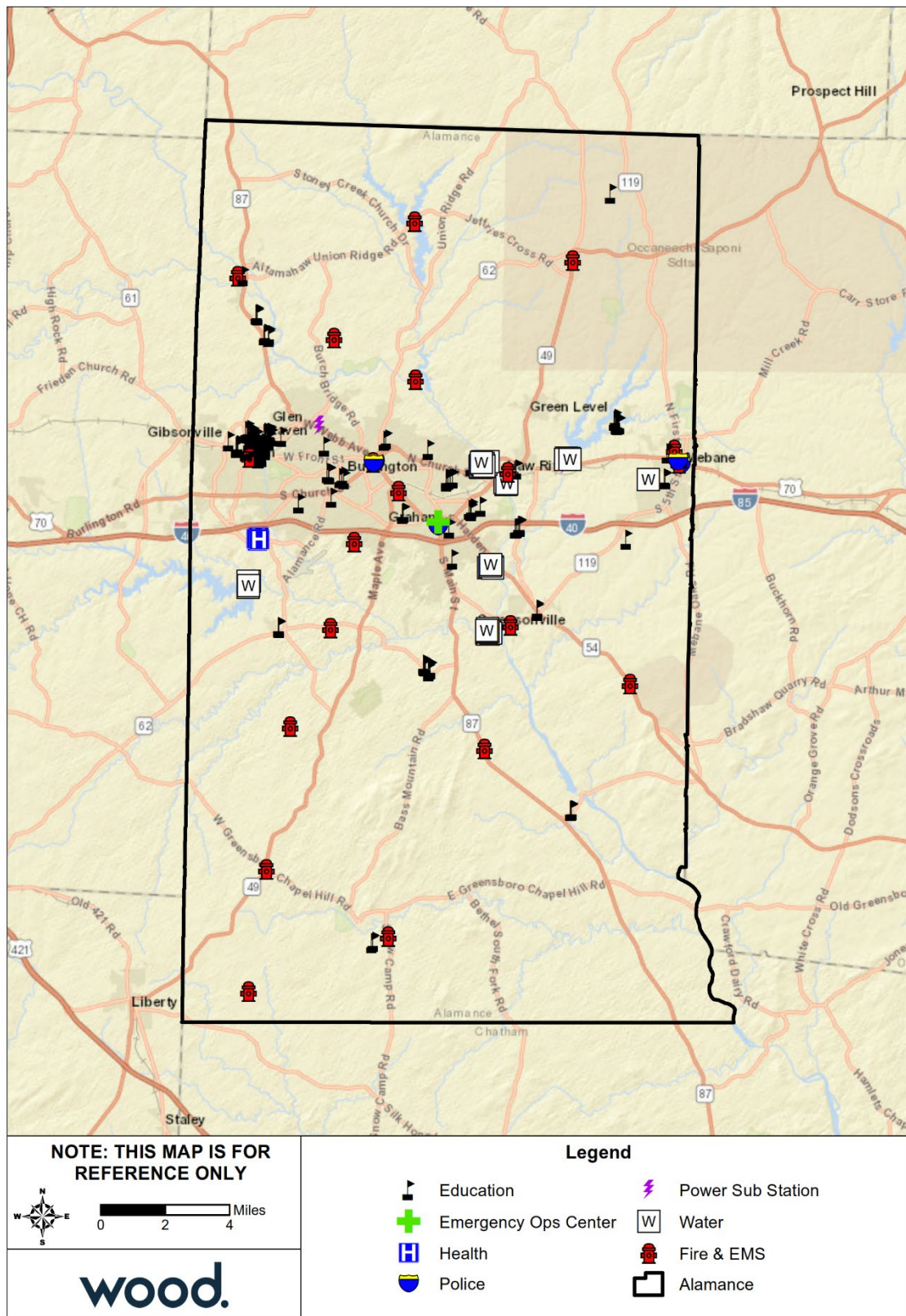
To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Eno-Haw Region, current parcel data was evaluated to identify recent development that was not included in NCEM's IRISK database. The building footprint layer from IRISK was compared to current parcel data; any parcels with an improved value that did not already have a building in IRISK were summarized in the table below. This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

**Table A.7 – Parcels Development Not Included in IRISK, November 2019**

<b>Jurisdiction</b>	<b>Improved Parcel Count</b>	<b>Total Improved Value</b>
Unincorporated Alamance County	3,588	\$552,421,404

Source: County parcel data, retrieved November 2019; IRISK database building footprints

Figure A.1 – Critical Facilities, Unincorporated Alamance County



Source: NCEM IRISK Database, GIS Analysis

Eno-Haw

Regional Hazard Mitigation Plan  
2020

### A.3.1 Dam Failure

Table A.8 lists all high hazard dams identified by the North Carolina Dam Inventory as of July 2018. Dam locations throughout Alamance County are shown in Figure A.2.

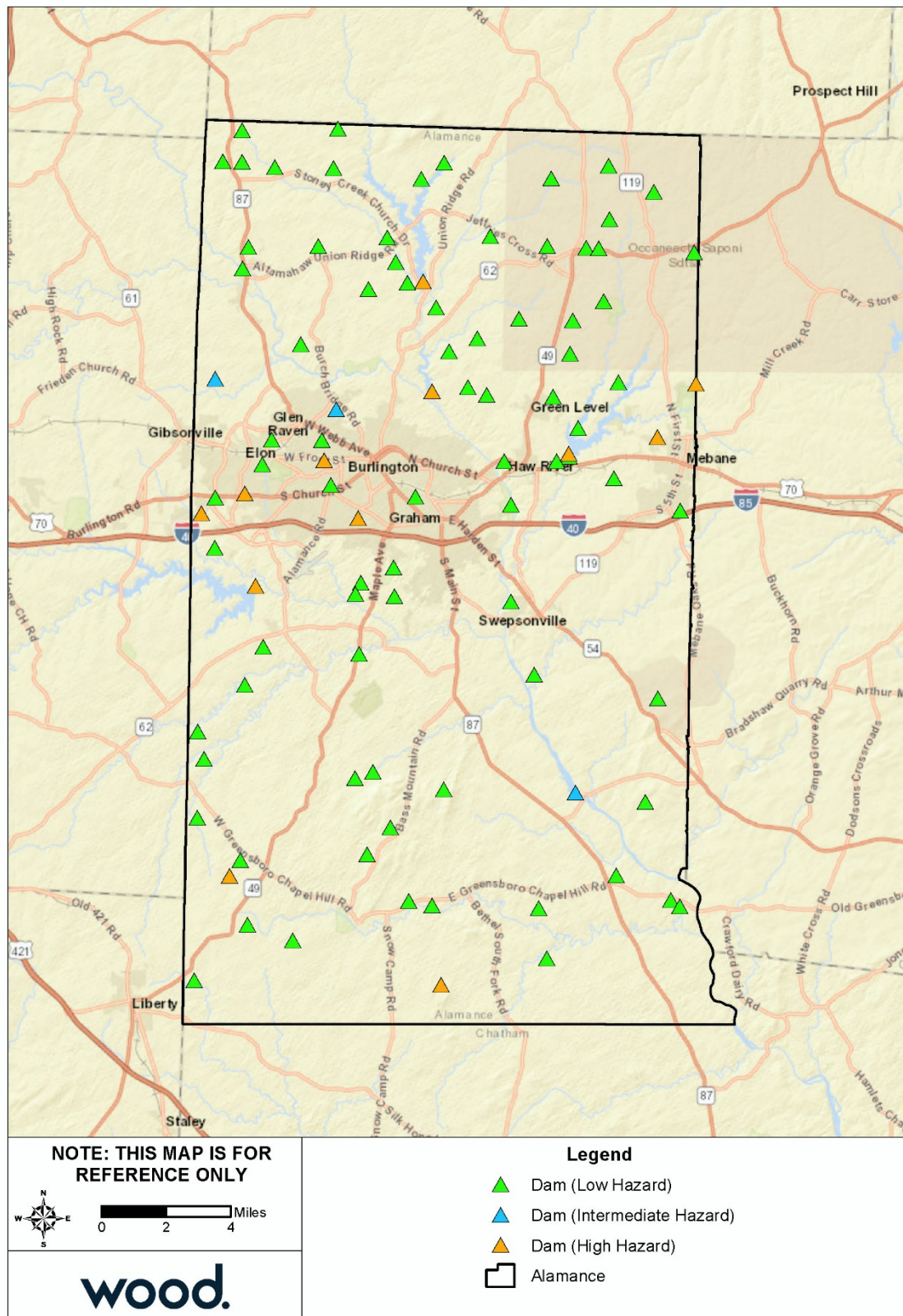
**Table A.8 – High Hazard Dams in Unincorporated Alamance County**

Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
Lake Cammack Dam	NC00739	Fair	36,000	Carolina
Forest Lake Dam	NC00748	Poor	235	Haw River
Timber Ridge Lake Dam	NC00742	Fair	288	Saxapahaw
Old Stony Creek Dam	NC00762	Poor	3,600	Hopedale
Tredmont Lake Dam	NC01732	Poor	331	-
Back Creek Reservoir	NC04873	Fair	10,645	Haw River

Source: NC Dam Inventory, July 2018



Figure A.2 – Dam Locations, Unincorporated Alamance County



Source: NC Dam Inventory, July 2018

Eno-Haw

Regional Hazard Mitigation Plan  
2020



### A.3.2 Flood

Table A.9 details the acreage of unincorporated Alamance County's total area by flood zone on the effective DFIRM. Per this assessment, nearly 7 percent of the unincorporated area in the County falls within the mapped 1%-annual-chance floodplains.

**Table A.9 – Flood Zone Acreage in Unincorporated Alamance County**

Flood Zone	Acreage	Percent of Total (%)
Zone AE	19,215.4	6.9
Zone X (500-year)	1,201.0	0.4
Zone X Unshaded	257,650.2	92.7
<b>Total</b>	<b>278,066.6</b>	<b>--</b>

Source: FEMA Effective DFIRM

Figure A.3 reflects the effective mapped flood hazard zones for Alamance County, and Figure A.4 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the region, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below and compared to total recent development counts and values. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. Additionally, this assessment does not evaluate flood impacts or provide damage estimates. According to this assessment, 8.5 percent of recent development in unincorporated Alamance County is located in or near the SFHA.

**Table A.10 – Recent Development at Risk to Flood, Unincorporated Alamance County**

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
305	\$59,467,089	8.5%	10.8%

Source: Parcel data retrieved November 2019; FEMA Effective DFIRM

Table A.11 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector and flood event in unincorporated Alamance County. Table A.12 summarizes high potential loss property vulnerability by sector and flood event.

**Table A.11 – Critical Facilities Exposed to Flooding, Unincorporated Alamance County**

Sector	Event	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	10 Year	1	\$1,483
	25 Year	1	\$33,299
	50 Year	1	\$42,773
	100 Year	2	\$132,207
	500 Year	4	\$2,082,214
Critical Manufacturing	50 Year	1	\$2,985
	100 Year	2	\$97,239
	500 Year	4	\$278,665
Food and Agriculture	100 Year	2	\$1,235
	500 Year	5	\$19,234
Water	500 Year	1	\$5,803

## ANNEX A: ALAMANCE COUNTY UNINCORPORATED AREAS

Sector	Event	Number of Buildings at Risk	Estimated Damages
All Categories	10 Year	1	\$1,483
	25 Year	1	\$33,299
	50 Year	2	\$45,758
	100 Year	6	\$230,681
	500 Year	14	\$2,385,916

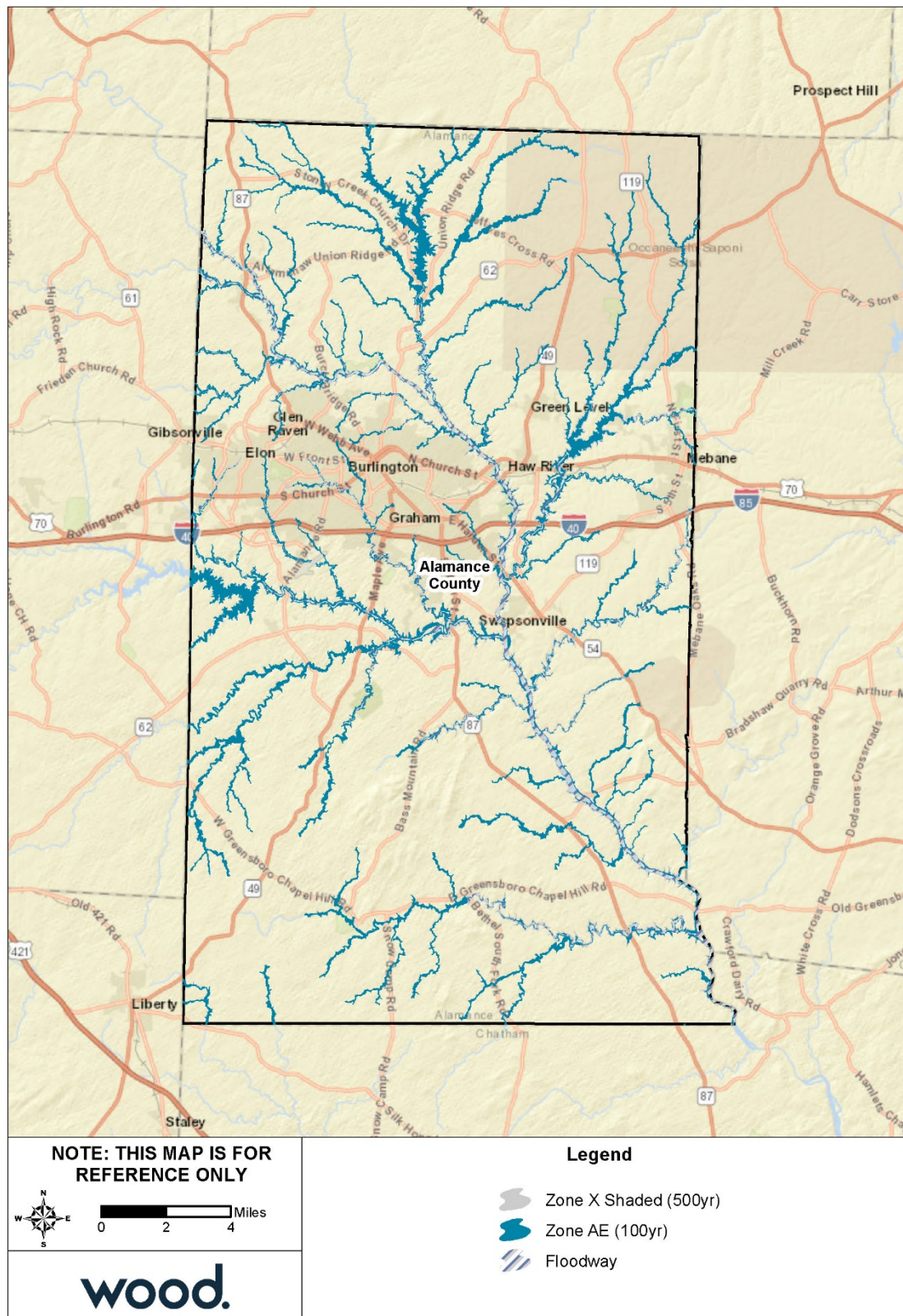
Source: NCEM Risk Management Tool

**Table A.12 – High Potential Loss Properties Exposed to Flooding, Unincorporated Alamance County**

Category	Event	Number of Buildings at Risk	Estimated Damages
Commercial	100 Year	1	\$77,874
	500 Year	1	\$1,953,027
Industrial	50 Year	1	\$2,985
	100 Year	1	\$97,235
	500 Year	1	\$178,118
Religious	500 Year	1	\$60,089
All Categories	50 Year	1	\$2,985
	100 Year	2	\$175,109
	500 Year	3	\$2,191,234

Source: NCEM Risk Management Tool

Figure A.3 – FEMA Flood Hazard Areas, Unincorporated Alamance County



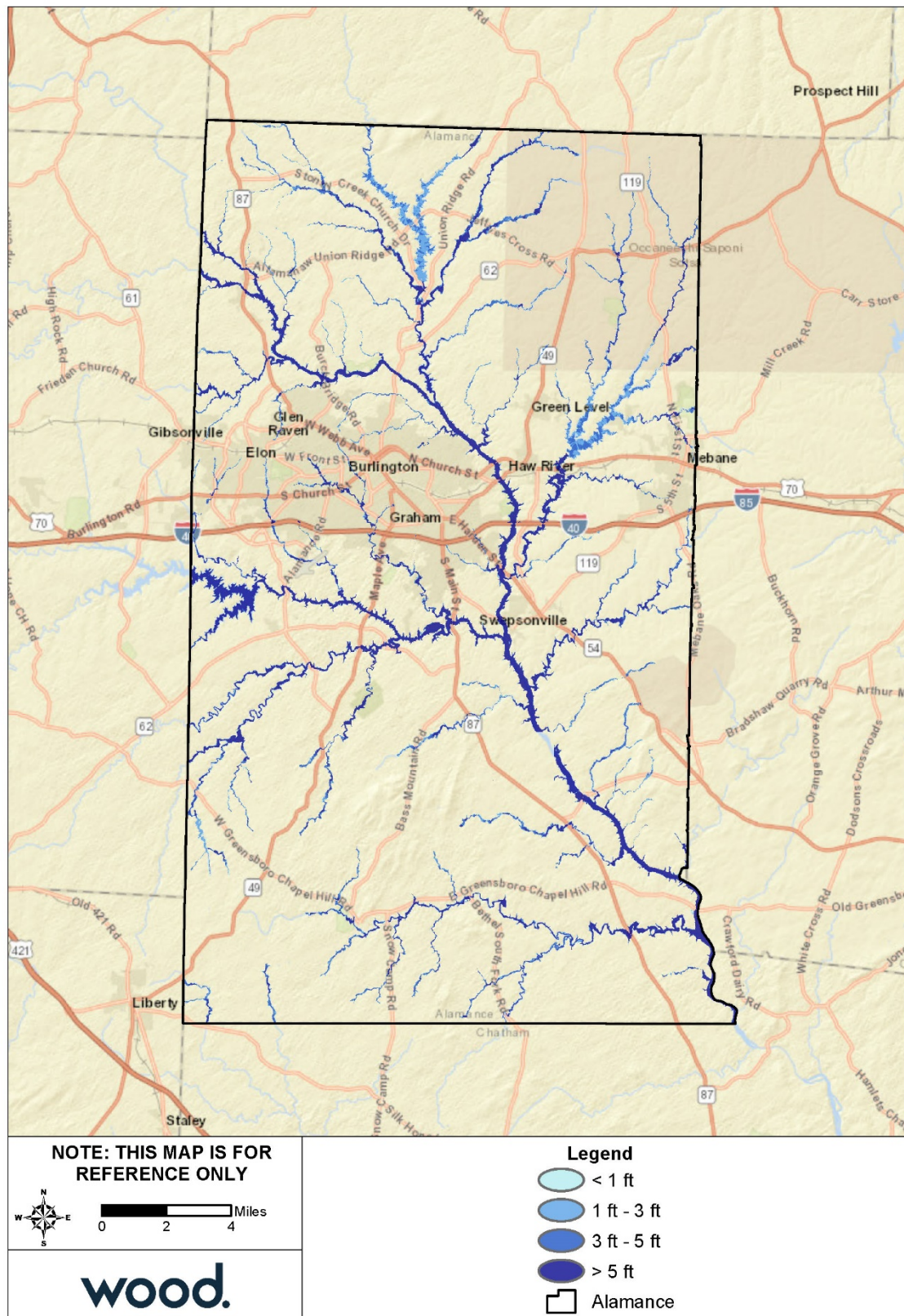
Source: FEMA Effective DFIRM

Eno-Haw

Regional Hazard Mitigation Plan  
2020



Figure A.4 – Flood Depth, 1%-Annual-Chance Floodplain, Unincorporated Alamance County



Source: FEMA Effective DFIRM

Eno-Haw

Regional Hazard Mitigation Plan  
2020

### A.3.3 Wildfire

Table A.13 summarizes the acreage in Alamance County that falls within the Wildland Urban Interface (WUI), categorized by housing density. Areas in the WUI are those where development may intermix with flammable vegetation. Nearly 40 percent of unincorporated Alamance County is not included in the WUI.

**Table A.13 – Wildland Urban Interface Acreage, Alamance County**

	Housing Density	Total Acreage	Percent of Total Acreage
	<i>Not in WUI</i>	94,933.66	39.5%
	LT 1hs/40ac	31,521.27	13.1%
	1hs/40ac to 1hs/20ac	18,695.89	7.8%
	1hs/20ac to 1hs/10ac	27,333.31	11.4%
	1hs/10ac to 1hs/5ac	27,020.33	11.2%
	1hs/5ac to 1hs/2ac	26,835.69	11.2%
	1hs/2ac to 3hs/1ac	13,796.86	5.7%
	GT 3hs/1ac	346.27	0.1%
	<b>Total</b>	<b>240,483.28</b>	

Source: Southern Wildfire Risk Assessment

Figure A.5 depicts the WUI for Alamance County, including incorporated areas. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure A.6 depicts Burn Probability based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Fire Intensity Scale, which indicates the potential severity of fire based on fuel loads, topography, and other factors, is depicted for Alamance County in Section 4 of this plan and detailed by jurisdiction in each community's annex.

WUI areas are distributed throughout the county with limited gaps. Burn probability is low throughout most of the county with clusters of moderate burn probability in southern Alamance County. A small portion of Alamance County, approximately 2.1 percent, may experience a Class 4 Fire Intensity, which poses significant harm or damage to life and property. Another 17 percent of the County may experience Class 3 Fire Intensity, which has potential for harm to life and property but is easier to suppress with dozer and plows. The remainder of the county is either non-burnable (18.8%) or would face a Class 1 or Class 2 Fire Intensity, which are easily suppressed.

Table A.14 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table A.15 provides counts and estimated damages for High Potential Loss Properties in unincorporated Alamance County.

**Table A.14 – Critical Facilities Exposed to Wildfire, Unincorporated Alamance County**

Sector	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	684	\$296,442,581
Critical Manufacturing	236	\$126,061,196
Emergency Services	10	\$4,478,978
Energy	5	\$29,647,708
Food and Agriculture	2,241	\$136,441,590
Government Facilities	80	\$86,387,428
Healthcare and Public Health	14	\$6,933,323
Transportation Systems	194	\$116,042,931
Water	18	\$49,956,475
<b>All Categories</b>	<b>3,482</b>	<b>\$852,392,210</b>

Source: NCEM Risk Management Tool

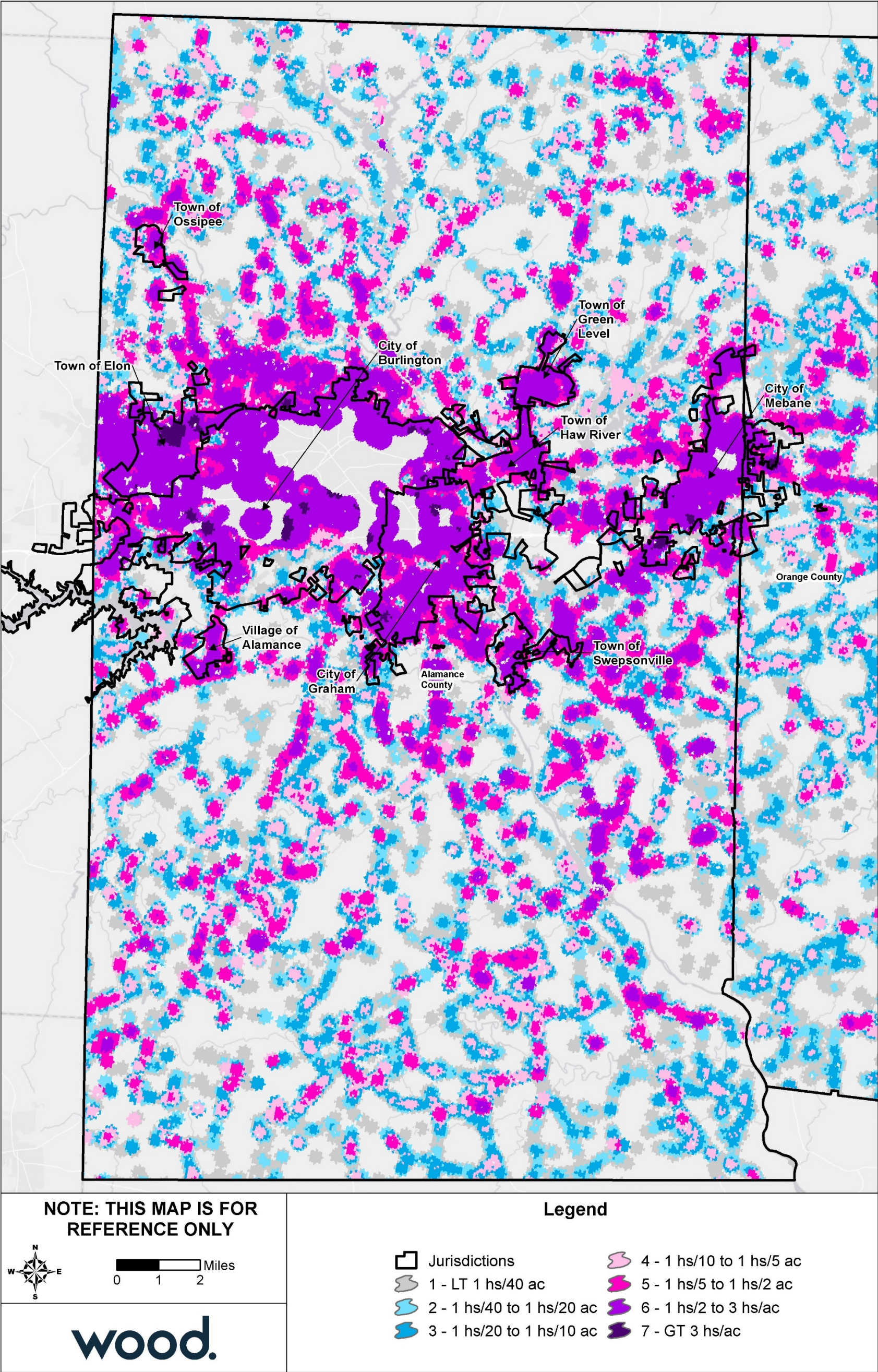
Table A.15 – High Potential Loss Properties Exposed to Wildfire, Unincorporated Alamance County

Category	Number of Buildings at Risk	Estimated Damages
Commercial	52	\$126,974,044
Government	22	\$68,872,536
Industrial	23	\$57,486,028
Religious	24	\$36,265,935
Residential	6	\$10,193,744
Utilities	16	\$76,993,676
<b>All Categories</b>	<b>143</b>	<b>\$376,785,963</b>

Source: NCEM Risk Management Tool



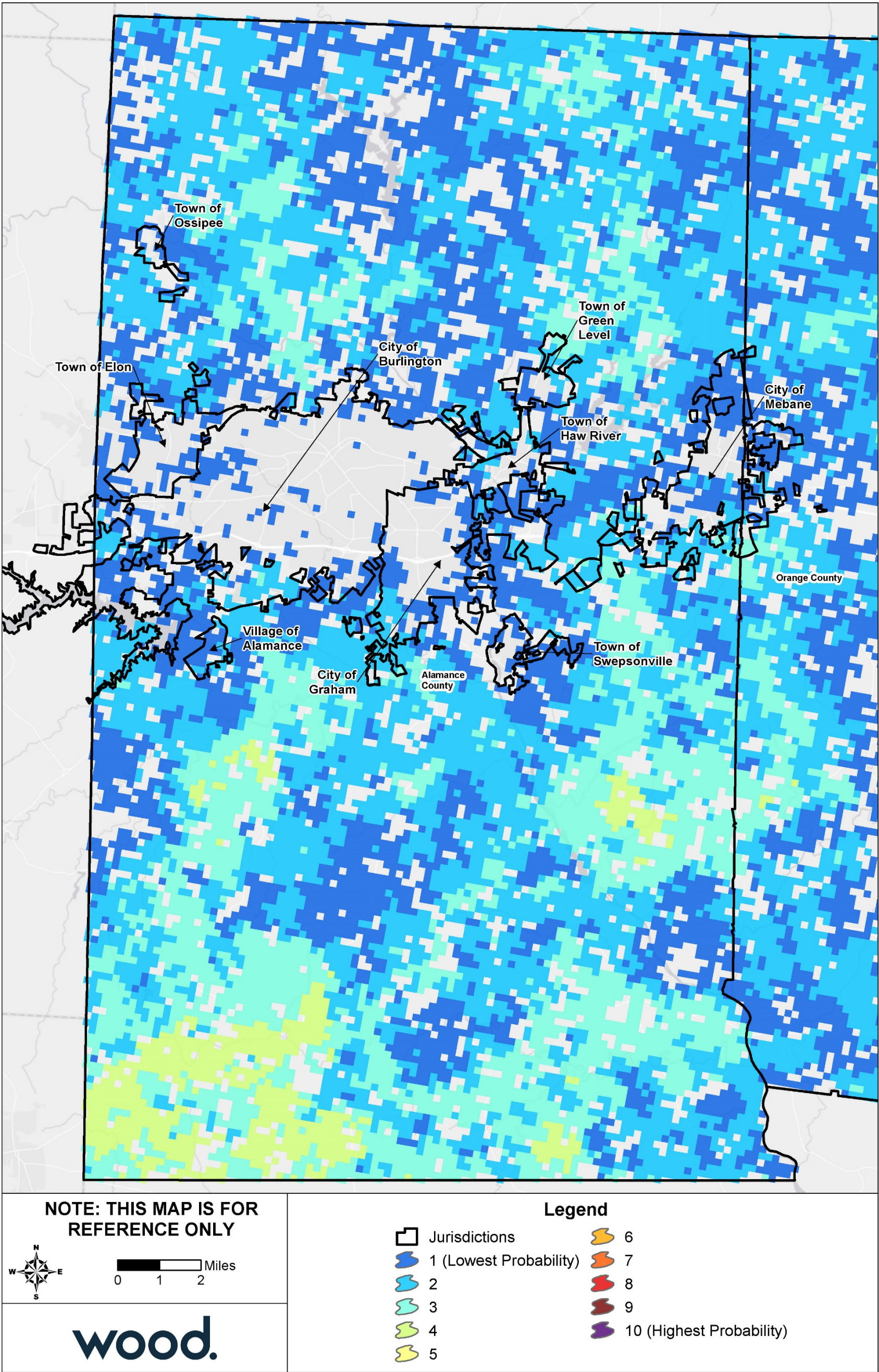
Figure A.5 – Wildland Urban Interface, Alamance County



Source: Southern Wildfire Risk Assessment



Figure A.6 – Burn Probability, Alamance County



Source: Southern Wildfire Risk Assessment



## A.4 CAPABILITY ASSESSMENT

### A.4.1 Overall Capability

Details on the tools and resources in place and available to Alamance County were provided by the County's HMPC representatives and are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Alamance County has a high capability rating overall. The County could improve regulatory capability by developing a Post-Disaster Redevelopment Ordinance to plan and set mitigation requirements for post-disaster reconstruction. The County has strong administrative, fiscal, and outreach capability but limited structural mitigation experience.

### A.4.2 Floodplain Management

Alamance County joined the NFIP emergency program in 1975 and has been a regular participant in the NFIP since December 1981. The following tables reflect NFIP policy and claims data for the County categorized by structure type, flood zone, Pre-FIRM and Post-FIRM.

**Table A.16 – NFIP Policy and Claims Data by Structure Type**

Structure Type	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
Single Family	35	\$26,324	\$9,280,900	33	\$454,947.05
2-4 Family	2	\$2,652	\$600,000	0	\$0.00
Non Residential	2	\$3,802	\$1,025,000	6	\$396,687.30
<b>Total</b>	<b>39</b>	<b>\$32,778</b>	<b>\$10,905,900</b>	<b>39</b>	<b>\$851,634.35</b>

Source: FEMA Community Information System, accessed May 2020

**Table A.17 – NFIP Policy and Claims Data by Flood Zone**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	12	\$17,625	\$2,288,000	31	\$743,069.66
A Zones	2	\$1,878	\$135,000	2	\$100,061.71
B, C & X Zone					
Standard	4	\$5,130	\$1,762,900	2	\$3,235.64
Preferred	21	\$8,145	\$6,720,000	1	\$0.00
<b>Total</b>	<b>39</b>	<b>\$32,778</b>	<b>\$10,905,900</b>	<b>36</b>	<b>\$846,367.01</b>

Source: FEMA Community Information System, accessed May 2020

**Table A.18 – NFIP Policy and Claims Data Pre-FIRM**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	7	\$13,036	\$1,295,200	28	\$692,586.50
A Zones	0	\$0	\$0	1	\$73,761.71
B, C & X Zone	9	\$4,284	\$2,582,900	2	\$3,235.64
Standard	3	\$2,081	\$762,900	2	\$3,235.64
Preferred	6	\$2,203	\$1,820,000	0	\$0.00
<b>Total</b>	<b>16</b>	<b>\$17,320</b>	<b>\$3,878,100</b>	<b>31</b>	<b>\$769,583.85</b>

Source: FEMA Community Information System, accessed May 2020

Table A.19 – NFIP Policy and Claims Data Post-FIRM

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	5	\$4,589	\$992,800	3	\$50,483.16
A Zones	2	\$1,878	\$135,000	1	\$26,300.00
B, C & X Zone	16	\$8,991	\$5,900,000	1	\$0.00
Standard	1	\$3,049	\$1,000,000	0	\$0.00
Preferred	15	\$5,942	\$4,900,000	1	\$0.00
<b>Total</b>	<b>23</b>	<b>\$15,458</b>	<b>\$7,027,800</b>	<b>5</b>	<b>\$76,783.16</b>

Source: FEMA Community Information System, accessed May 2020

A.5 MITIGATION STRATEGY

Action #	Action Description	Applicable Jurisdictions	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention										
P-1	Direct each County office of agency to assess how it can better incorporate hazard mitigation goals into its planning and implementation of its duties	Alamance County	All Hazards	1.2	Moderate	Alamance County Emergency Management	County	2020-2025	Carry forward	Each department is working on a COOP plan and they will address hazard mitigation goals and planning into their duties.
P-2	Maintain shelter agreements with the American Red Cross	Alamance County	All Hazards	2.2	Moderate	Alamance County Emergency Management	County	2020-2025	Carry forward	Alamance County has taken on the responsibilities of opening and maintaining shelters on their own. ARC will be used as a backup if need.
P-3	Review methods of school construction to ensure that all new schools are constructed to the maximum cost feasible standards of wind resistance, flood resistance, and access so that they can be used as shelters for evacuees during and after natural hazard events.	Alamance County	All Hazards	1.2	Moderate	Alamance County Inspections Department	General Fund	2020-2025	Carry forward	No progress made due to administrative limitations. Our Inspections department will follow all guidelines on new projects.
P-4	Review the subdivision regulations and make appropriate changes to encourage alternatives to placing lots in flood-prone areas and to minimize impervious surface coverings, if necessary.	Alamance County	Flood	1.2	Moderate	Alamance County Planning Department	General Fund	2020-2025	Carry forward	Planning is still working on this. No progress has been made due to limited staff resources.
P-5	Propose a policy to the Board of Commissioners prohibiting the development of critical public facilities in the 100-year floodplain in cases where viable alternatives exist. Presently, most critical facilities located in the floodplain are waste pump stations because they must be located at low elevations because the handle gravity flowing sewage.	Alamance County, Town of Green Level, Town of Swepsonville	Flood	1.2	Moderate	Alamance County Planning Department	General Fund	2020-2025	Carry forward	Planning is still working on this. No progress has been made due to limited staff reszources.
P-6	Develop specific regulations that prohibit dumping in the county's watersheds	Alamance County	Flood	1.1	Moderate	Alamance County Planning Department	Staff time	2020-2025	Carry forward	Planning is still working on this. No progress has been made due to limited staff resources.
P-7	When the county land use plan is complete, create a land use map with an overlay of flood hazards and any other natural hazards that can be mapped.	Alamance County	All Hazards	1.2	Moderate	Alamance County Emergency Management, Alamance County GIS Department	County	2020-2025	Carry forward	Land use study is still in progress. GIS planner will create this overlay when the land use study is completed. Where possible, local community land use mapping should be incorporated.
Property Protection										
PP-1	Look for opportunities to acquire or relocate structures vulnerable to floods	Alamance County	Flood	4.2	Low	Alamance County Emergency Management, Alamance County Planning Department	General Fund	2020-2025	New	EM monitors flood prone areas.
PP-2	Monitor structures affected by flood and track damages and repair costs. If damages and repair costs are high relative to the value of the structure, consider mitigation including elevation, acquisition, or floodproofing.	Alamance County	Flood	4.2	High	Alamance County Emergency Management, Alamance County Planning Department	General Fund	2020-2025	Carry forward	No progress was made on this project. The County will continue to monitor the county properties which are or may be impacted by flooding events.

ANNEX A: ALAMANCE COUNTY UNINCORPORATED AREAS

Action #	Action Description	Applicable Jurisdictions	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
PP-3	Monitor recreational facilities located in the floodplain and evaluate flood resistance of county structures.	Alamance County	Flood	4.2	Moderate	Alamance County Planning Department	General Fund	2020-2025	Carry forward	No progress was made on this project. The County will monitor the county properties which are or may be impacted by flooding events.
PP-4	Monitor reservoirs for potential flooding problems and note any unexpected flooding issues.	Alamance County	Flood	4.2	High	Alamance County Emergency Management	N/A	2020-2025	Carry forward	No progress was made on this project. The County will coordinate with Municipal watershed owners and operators to monitor levels and control of the dams and gates for flooding.
Structural Projects										
SP-1	Seek funding to the retrofit of critical facilities and County-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	Alamance County	All Hazards	4.2	Moderate	Alamance County Buildings and Inspections Department, Alamance County Planning Department, Alamance County Emergency Management	State grants, UHMA grants, other federal grants	2020-2025	Carry forward	No progress was made on this project due to limited funding. Will evaluate resilience needs and look for grants and resource funding to retrofit county facilities.
SP-2	Seek funding for the installation of backup generators or quick connect hook ups for mobile generators on any newly constructed and existing county critical facilities.	Alamance County	All Hazards	4.2	Moderate	Alamance County Buildings and Inspections Department, Alamance County Planning Department, Alamance County Emergency Management	Local, State grants, UHMA grants, other federal grants	2020-2025	New	Work to install a spare transfer switch to one of our local shelters.
Emergency Services										
ES-1	Coordinate with the North Carolina Department of Transportation (NCDOT) to maintain adequate and effective snow and ice removal plans by the towns/cities and NCDOT. "Adequate" means that all major thoroughfares are cleared and remain clear within 12 hours of last snowfall.	Alamance County, Town of Green Level, Town of Haw River, Town of Swepsonville	Severe Winter Weather	2.2	Moderate	Alamance County Emergency Management	Staff time	2020-2025	Carry forward	Attended local area DOT meetings and gathered updates on their snow and ice removal plans to ensure that they can adequately treat and plow roads.
Public Education & Awareness										
PEA-1	Encourage builders, developers, and architects to become familiar with the National Flood Insurance Program (NFIP) land use and building standards by attending annual workshops presented by the North Carolina Division of Emergency Management (NCEM). This can be accomplished by creating a mailing list and providing it to NCEM to use for its announcements. This task can be further supported by distributing copies of NCEM's announcements from the Alamance County Inspections Department when builders and developers apply for permits.	Alamance County, Town of Green Level, Town of Haw River, Town of Swepsonville	Flood	2.1	Moderate	Alamance County Emergency Management	General Fund	2020-2025	Carry forward	No progress was made on this project due to limited staff resources.



ANNEX A: ALAMANCE COUNTY UNINCORPORATED AREAS

Action #	Action Description	Applicable Jurisdictions	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
PEA-2	Encourage citizens and businesses/industries to develop emergency preparedness plans.	Alamance County, Town of Green Level	All Hazards	2.1	Moderate	Alamance County Emergency Management; Alamance County LEPC	LEPC	2020-2025	Carry forward	County EM has been working directly with local chemical facilities on developing Emergency Response Plans for 1st responder response.
PEA-3	Encourage homeowners to review insurance policies as part of an overall family disaster plan.	Alamance County	All Hazards	2.1	Moderate	Alamance County Emergency Management	N/A	2020-2025	Carry forward	No progress made on this project due to limited staff. Plan to add this to the Emergency Management website
PEA-4	Increase awareness of the natural hazards potential to local officials, the general public, and private industry.	Alamance County	All Hazards	2.1	Moderate	Alamance County Emergency Management	N/A	2020-2025	Carry forward	We have shared information via our website pertaining to preparation and planning for disasters.
PEA-5	Discourage the public and developers from developing property in flood zones.	Alamance County	Flood	1.2	Moderate	Alamance County Planning Department	General Fund	2020-2025	Carry forward	No progress made on this project due to limited staff.
PEA-6	Maintain documents about flood insurance, flood protections, floodplain management, and natural and beneficial functions of floodplains at the local libraries and government offices.	Alamance County	Flood	2.1	Moderate	Alamance County Planning Department	General Fund	2020-2025	Carry forward	No progress made on this project due to limited staff.
PEA-7	Maintain GIS system at <a href="http://www.alamance-nc.com">www.alamance-nc.com</a> . From this site anyone from a private citizen, builder, insurance company, etc. can see if a property is located in the 1-percent-annual-chance (100-year) floodplain.	Alamance County, Town of Haw River, Town of Ossipee, Town of Swepsonville, Village of Alamance	Flood	2.1	Moderate	Alamance County GIS Department	General Fund	2020-2025	Carry forward	The County Land Use plan is in progress and a land-use GIS layer is expected as a deliverable once the plan is complete.
PEA-8	Provide local real estate agents with handouts that will advise potential buyers to investigate the flood hazard for the property they are considering purchasing.	Alamance County,	Flood	2.1	Moderate	Alamance County Planning Department	Unknown	2020-2025	Carry forward	In Progress. Implementation delayed due to limited staff resources.
PEA-9	Educate citizens to listen for the watches and warnings issued by the National Weather Service	Alamance County, Town of Green Level, Town of Haw River, Town of Ossipee, Village of Alamance	All Hazards	2.2	Moderate	Alamance County Emergency Management	County	2020-2025	Carry forward	The County has utilized our website and social media outlets to share information to the public and local municipalities on listening to and having a warning system in the home. The County is now working with hearing impaired and distributing hearing impaired weather alert radios devices to those who request them.
PEA-10	Maintain Alamance County Communications' capability to monitor weather conditions and advise all emergency services regarding watches and warnings.	Alamance County,	Flood	2.2	Moderate	Alamance County Emergency Management	County	2020-2025	Carry forward	We have updated our Nixle alert system and are promoting personnel to sign up for the service. Will continue to monitor and push weather information to PSAP's and other Emergency Services in the county to keep them aware of impending weather.

## Annex B City of Burlington

### B.1 PLANNING PROCESS

The table below lists the HMPC members who represented the City of Burlington.

**Table B.1 – HMPC Members**

Representative	Position or Title
Roger Manuel	EM Coordinator
Mike Nunn	Planning Director

### B.2 COMMUNITY PROFILE

#### Geography

The City of Burlington is located in western Alamance County. A small portion of the city extends west into Guilford County, however all data presented here is representative of the entire city. The City is neighbored by Elon to the northwest, and Haw River and Graham to the east. Burlington is the principal city of the Burlington, NC Metropolitan Statistical Area, which falls within the larger Greensboro-Winston-Salem-High Point, NC Combined Statistical Area. Burlington comprises a total area of 25.4 square miles.

#### Population and Demographics

Table B.2 provides population counts and growth estimates for the City of Burlington as compared to Alamance County and the Eno Haw region. Table B.3 provides demographic information for Burlington as compared to the county and the state.

**Table B.2 – Population Counts, Burlington, 2010-2018**

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
City of Burlington	44,917	50,042	52,524	2,482	5.0%
<b>Alamance County</b>	<b>130,800</b>	<b>146,902</b>	<b>160,576</b>	<b>13,674</b>	<b>9.3%</b>
<b>Region Total</b>	<b>507,964</b>	<b>567,634</b>	<b>649,276</b>	<b>81,642</b>	<b>14.4%</b>

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

Note: The total population of Burlington includes population residing in Guilford County.

**Table B.3 – Demographics and Social Characteristics, Burlington, 2018**

Demographic & Social Characteristics	Burlington	Alamance County	North Carolina
Median Age	39.9	39.5	38.6
% of Population Under 5 years old	5.9	5.8	5.9
% of population Over 65 years old	17.9	16.4	15.5
% of Population Over 25 with high school diploma	81.0%	85.5%	87.4%
% of Population Over 25 with bachelor's degree or higher	24.3%	24.0%	30.5%
% with Disability	15.0%	14.3	13.6
% Speak English less than "very well"	8.8%	5.5	4.6

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

## Housing

The table below details key housing statistics for Burlington as compared to the county overall.

**Table B.4 – Housing Statistics, Burlington, 2010-2018**

Housing Characteristics	Burlington	Alamance County
Housing Units (2010)	23,459	66,576
Housing Units (2018)	24,580	69,749
Housing Units Percent Change (2010-2018)	4.8%	4.8%
Housing Occupancy Rate	90.4%	91.8%
% Owner-Occupied	51.1	65.0%
Average Household Size	2.32	2.43
% of Housing Units with no Vehicles Available	8.3	5.3%
% of Housing Units that are mobile homes	3.2	12.0%
Median Home Value	\$126,300	\$147,800

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2014-2018 5-Year Estimates

## Economy

The following tables present key economic statistics for Burlington as compared to the county and the state.

**Table B.5 – Economic Statistics, Burlington, 2018**

Demographic & Social Characteristics	Burlington	Alamance County	North Carolina
Median Household Income	40,061	\$45,735	\$52,413
Per Capita Income	25,614	\$26,215	\$29,456
Unemployment Rate	7.1%	5.7%	6.3%
% of Individuals Below Poverty Level	20.7	16.8	15.4
% Without Health Insurance	14.5	11.9	11.1

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

## B.3 RISK ASSESSMENT

This section contains a summary of the City's asset inventory as well as hazard profile and vulnerability assessment for those hazards that are spatially defined and have variations in risk that could be evaluated quantitatively on a jurisdictional level. The hazards included in this section are: Dam Failure, Flood, and Wildfire.

### Asset Inventory

The following tables summarize the asset inventory for Burlington in order to estimate the total physical exposure to hazards in this area. The locations of critical facilities are shown in Figure B.1. Critical facilities are a subset of identified assets from the Critical Infrastructure & Key Resources (CIKR) dataset. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted and displayed.

Building counts are provided based on data from the NCEM IRISK database, and supplemental parcel exposure is based on November 2019 county parcel data.

Table B.6 – Critical Infrastructure &amp; Key Resources by Type

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	Defense	Government Facilities	Healthcare	IT	National Monuments and Icons	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Burlington	45	43	0	1,453	2	448	1	119	112	0	0	2	0	486	23	5	40	2,779

Source: NCEM Risk Management Tool

Table B.7 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Burlington	72	288	144	42	0	54	42	642

Source: NCEM Risk Management Tool

Table B.8 – IRISK Inventory of Building Counts and Values

Jurisdiction	Building Count	Building Value
City of Burlington	24,403	\$5,515,560,224

Source: NCEM Risk Management Tool

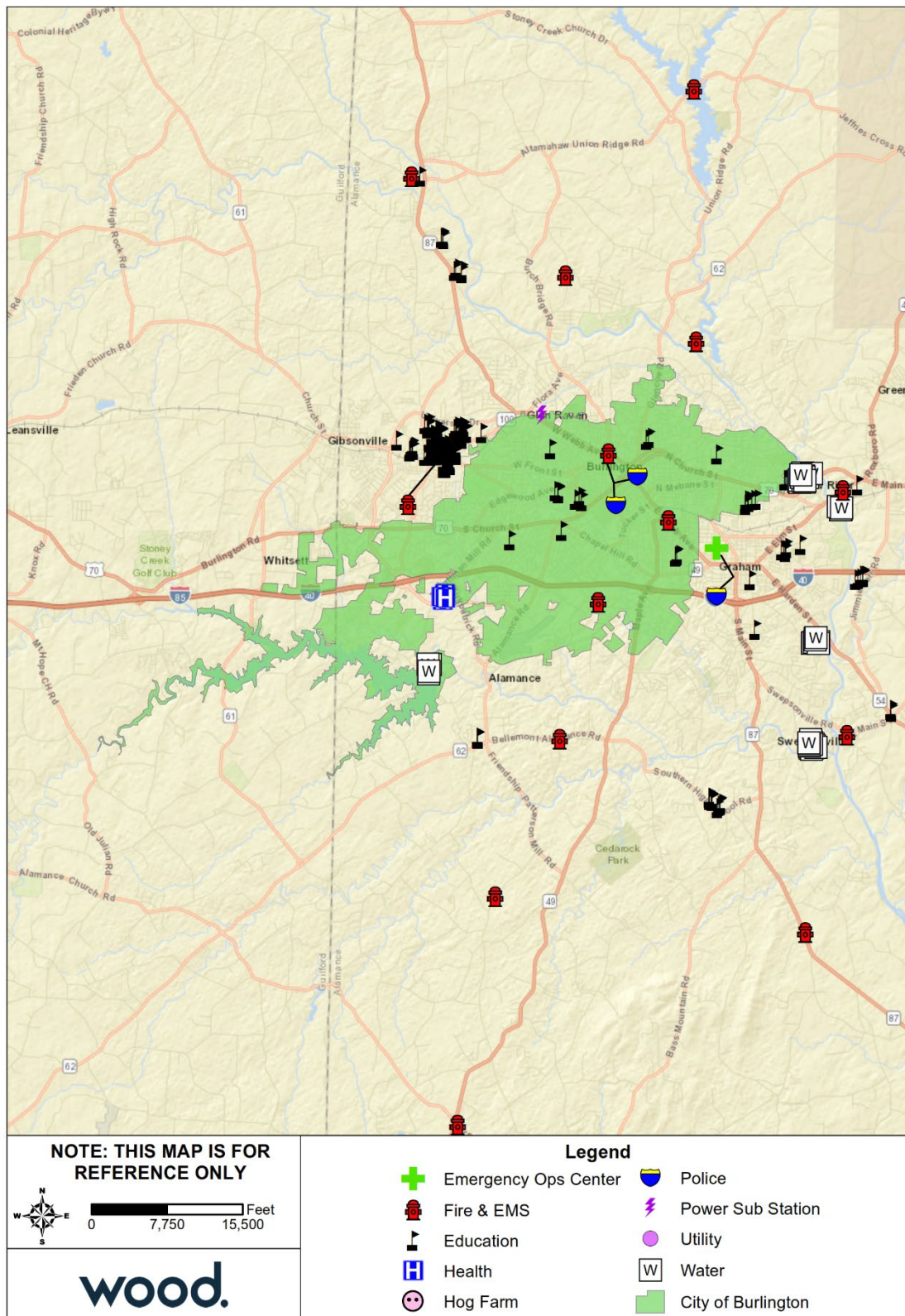
To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Eno-Haw Region, current parcel data was evaluated to identify recent development that was not included in NCEM's IRISK database. The building footprint layer from IRISK was compared to current parcel data; any parcels with an improved value that did not already have a building in IRISK were summarized in the table below. This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

Table B.9 – Parcels Development Not Included in IRISK, November 2019

Jurisdiction	Improved Parcel Count	Total Improved Value
Burlington	1,926	\$538,509,617

Source: County parcel data, retrieved November 2019; IRISK database building footprints

Figure B.1 – Critical Facilities, City of Burlington



Source: NCEM IRISK Database, GIS Analysis

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2020

### B.3.1 Dam Failure

Table B.10 lists the high hazard dams in the City of Burlington identified by the North Carolina Dam Inventory as of July 2018. All dam locations throughout Burlington are shown in Figure B.2. Additionally, Burlington is the nearest downstream city to the Somerton Lake Dam in Elon, which was rated as being in poor condition at the time of its last inspection.

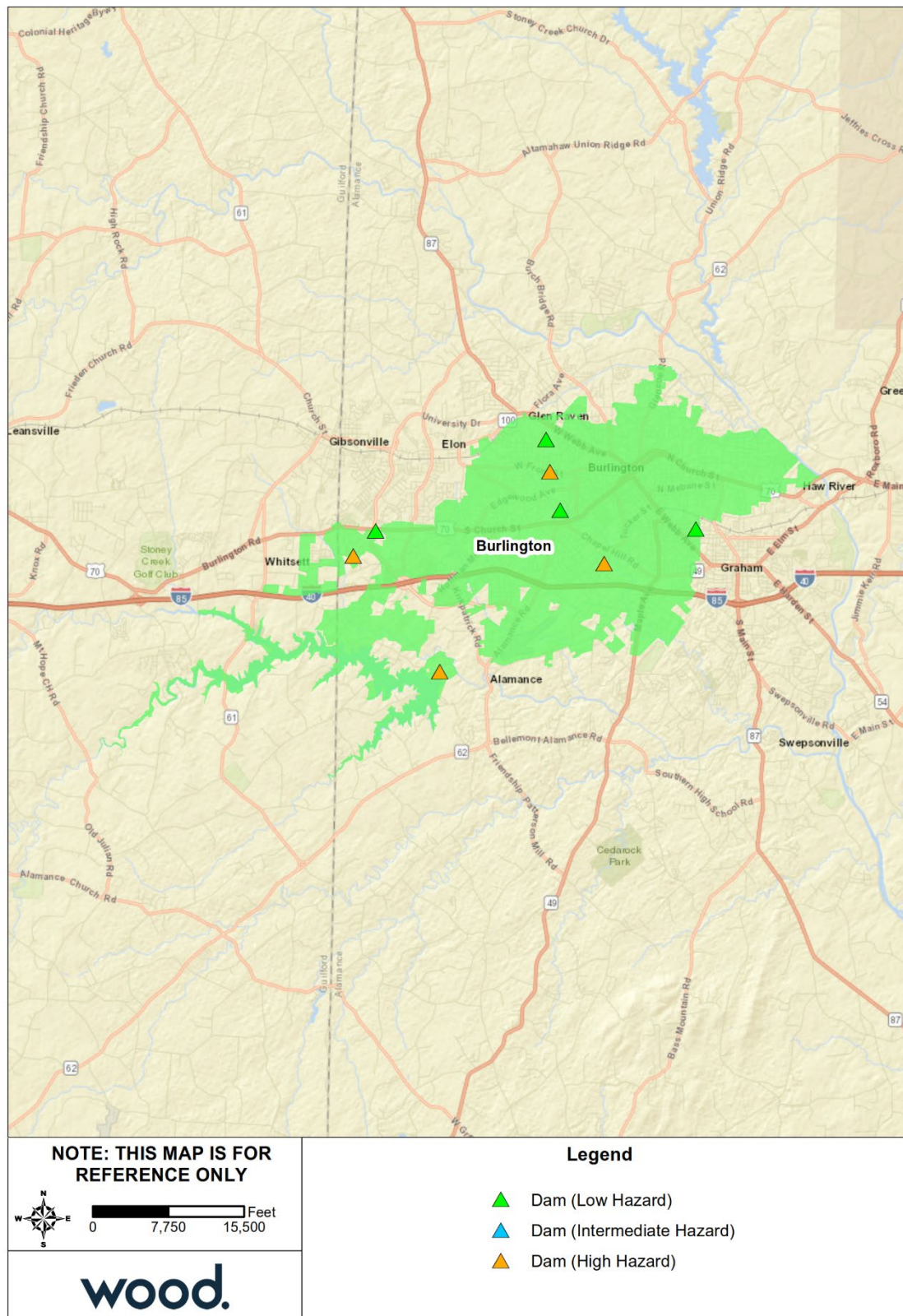
**Table B.10 – High Hazard Dams in City of Burlington**

Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
McEwen Estate Dam	NC01734	Fair	142	Alamance
Tate Dam	NC01737	Fair	56	Burlington
Lake Mackintosh Dam	NC04954	Fair	30,825	Alamance
Hudgins Dam	NC05541	Unsatisfactory	10	

Source: NC Dam Inventory, July 2018



Figure B.2 – Dam Locations, City of Burlington



Source: NC Dam Inventory, July 2018

### B.3.2 Flood

Table B.11 details the acreage of the City of Burlington's total area by flood zone on the effective DFIRM. Per this assessment, over 11 percent of the unincorporated area in the County falls within the mapped 1%-annual-chance floodplains.

**Table B.11 – Flood Zone Acreage in the City of Burlington**

Flood Zone	Acreage	Percent of Total (%)
Zone AE	2,243.0	11.3
Zone X (500-year)	100.4	0.5
Zone X Unshaded	17,492.1	88.2
<b>Total</b>	<b>19,835.4</b>	<b>--</b>

Source: FEMA Effective DFIRM

Figure B.3 reflects the effective mapped flood hazard zones for the City of Burlington, and Figure B.4 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the region, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below and compared to total recent development counts and values. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. Additionally, this assessment does not evaluate flood impacts or provide damage estimates. According to this assessment, 3.8 percent of recent development in Burlington is located in or near the SFHA.

**Table B.12 – Recent Development at Risk to Flood, City of Burlington**

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
74	\$29,376,335	3.8%	5.5%

Source: Parcel data retrieved November 2019; FEMA Effective DFIRM

Table B.13 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector and flood event in the City of Burlington. There are no high potential loss facilities with estimated flood damages in Burlington.

**Table B.13 – Critical Facilities Exposed to Flooding, City of Burlington**

Sector	Event	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	10 Year	5	\$22,900
	25 Year	10	\$65,705
	50 Year	11	\$92,754
	100 Year	12	\$120,189
	500 Year	19	\$183,961
Critical Manufacturing	10 Year	2	\$13,964
	25 Year	3	\$47,142
	50 Year	3	\$53,979
	100 Year	4	\$62,585
	500 Year	5	\$129,458
Food and Agriculture	500 Year	1	\$38

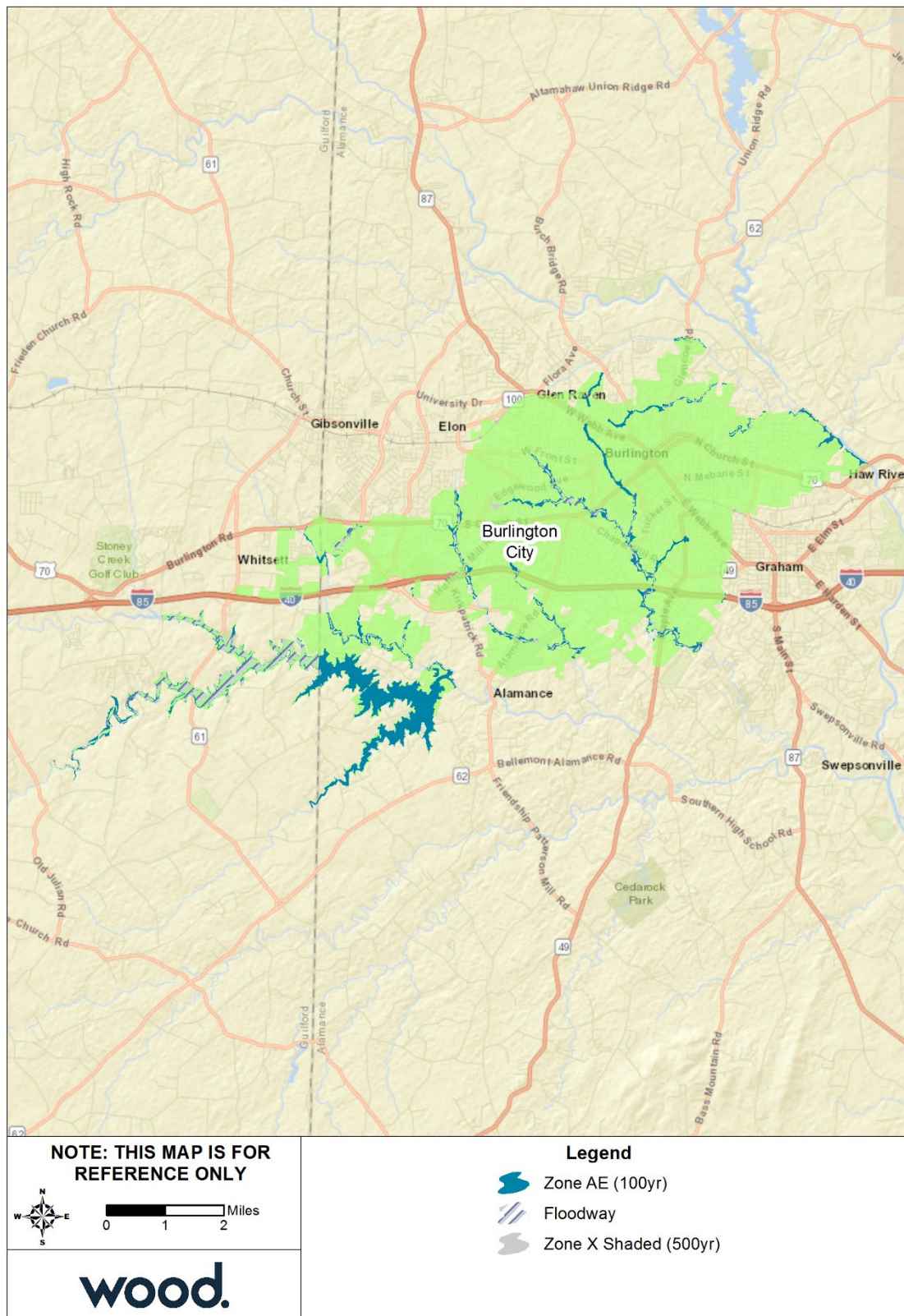
## ANNEX B: CITY OF BURLINGTON

Sector	Event	Number of Buildings at Risk	Estimated Damages
Healthcare and Public Health	100 Year	1	\$3,117
	500 Year	1	\$41,608
Water	50 Year	1	\$19,950
	100 Year	2	\$67,602
	500 Year	2	\$186,564
All Categories	10 Year	7	\$36,864
	25 Year	13	\$112,847
	50 Year	15	\$166,683
	100 Year	19	\$253,493
	500 Year	28	\$541,629

Source: NCEM Risk Management Tool



Figure B.3 – FEMA Flood Hazard Areas, City of Burlington

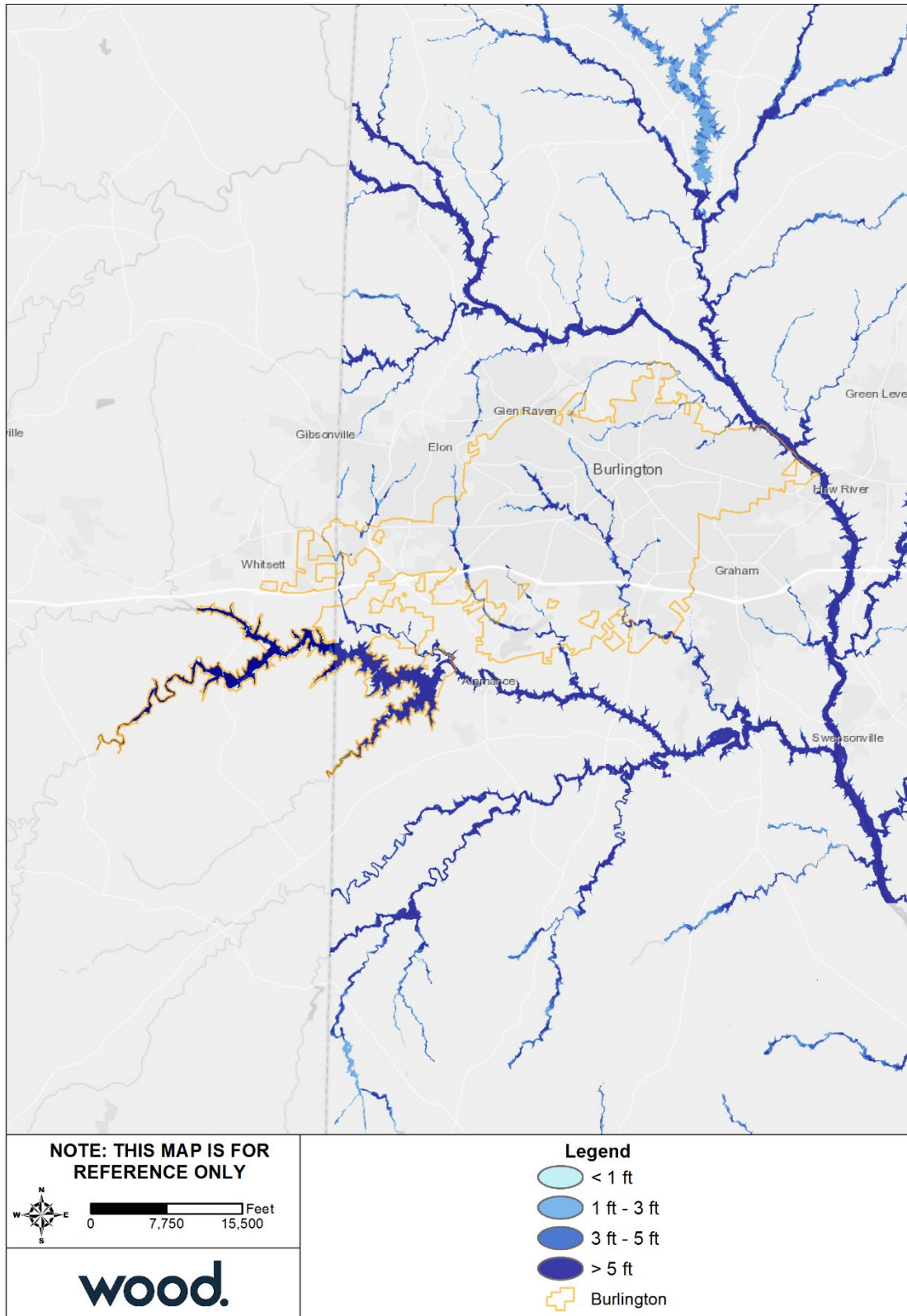


Source: FEMA Effective DFIRM

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Figure B.4 – Flood Depth, 1%-Annual Chance Floodplain, City of Burlington



Source: FEMA Effective DFIRM



### B.3.3 Wildfire

Table B.14 summarizes the acreage in the City of Burlington that falls within the Wildland Urban Interface (WUI), categorized by housing density. Areas in the WUI are those where development may intermix with flammable vegetation. Over 30 percent of the City of Burlington is not included in the WUI.

**Table B.14 – Wildland Urban Interface Acreage, City of Burlington**

	Housing Density	Total Acreage	Percent of Total Acreage
	<i>Not in WUI</i>	5,543.45	30.3%
	LT 1hs/40ac	630.42	3.4%
	1hs/40ac to 1hs/20ac	315.39	1.7%
	1hs/20ac to 1hs/10ac	634.35	3.5%
	1hs/10ac to 1hs/5ac	933.62	5.1%
	1hs/5ac to 1hs/2ac	1,727.55	9.4%
	1hs/2ac to 3hs/1ac	8,167.84	44.6%
	GT 3hs/1ac	365.74	2.0%
	<b>Total</b>	<b>18,318.35</b>	

Source: Southern Wildfire Risk Assessment

Figure A.5 depicts the WUI for all incorporated areas in Alamance County, including the City of Burlington. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure A.6 depicts Burn Probability based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Figure B.5 depicts the Fire Intensity Scale; which indicates the potential severity of fire based on fuel loads, topography, and other factors; in order to detail potential wildfire extent in the City of Burlington. Much of the City is non-burnable, however there are some small clusters of moderate potential fire intensity in the western portion of Burlington. Overall, less than one percent of the City has a potential fire intensity of Class 4.

Table B.15 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table B.16 provides counts and estimated damages for High Potential Loss Properties in the City of Burlington.

**Table B.15 – Critical Facilities Exposed to Wildfire, City of Burlington**

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	5	\$2,112,286
Commercial Facilities	182	\$262,199,194
Communications	1	\$452,852
Critical Manufacturing	114	\$182,162,978
Defense Industrial Base	1	\$8,801,607
Energy	2	\$110,000,000
Food and Agriculture	36	\$1,378,039
Government Facilities	33	\$65,226,946
Healthcare and Public Health	11	\$12,159,502
Transportation Systems	70	\$83,698,083
Water	13	\$119,790,631
<b>All Categories</b>	<b>468</b>	<b>\$847,982,118</b>

Source: NCEM Risk Management Tool

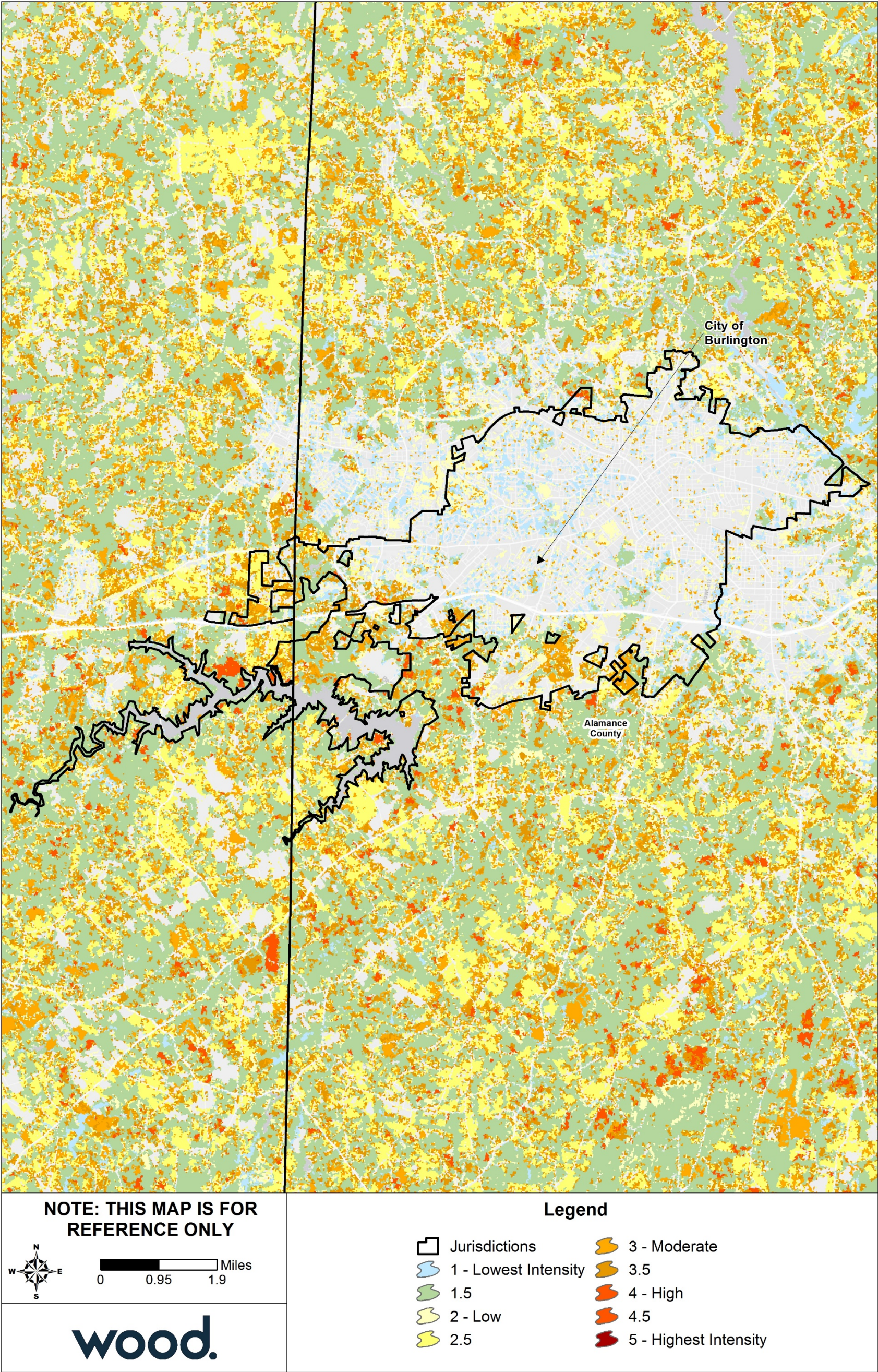
Table B.16 – High Potential Loss Properties Exposed to Wildfire, City of Burlington

Category	Number of Buildings at Risk	Estimated Damages
Commercial	66	\$223,044,646
Government	13	\$59,132,550
Industrial	48	\$225,053,312
Religious	8	\$17,577,830
Residential	1	\$1,185,923
Utilities	11	\$227,945,105
<b>All Categories</b>	<b>147</b>	<b>\$753,939,366</b>

Source: NCEM Risk Management Tool



Figure B.5 – Fire Intensity Scale, City of Burlington



Source: Southern Wildfire Risk Assessment



## B.4 CAPABILITY ASSESSMENT

### B.4.1 Overall Capability

Details on the tools and resources in place and available to the City of Burlington were provided by the City's HMPC representatives and are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, the City has a high overall capability rating. The City could improve regulatory capability by developing a Post-Disaster Redevelopment Ordinance to plan and set mitigation requirements for post-disaster reconstruction and/or an Evacuation Plan to increase emergency preparedness. The City has strong administrative, fiscal, and outreach capability but limited structural mitigation experience.

### B.4.2 Floodplain Management

The City of Burlington joined the NFIP emergency program in 1975 and has been a regular participant in the NFIP since April 1981. The following tables reflect NFIP policy and claims data for the City categorized by structure type, flood zone, Pre-FIRM and Post-FIRM.

**Table B.17 – NFIP Policy and Claims Data by Structure Type**

Structure Type	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
Single Family	139	\$103,769	\$31,727,200	46	\$383,520.86
2-4 Family	2	\$432	\$358,000	0	\$0.00
All Other Residential	14	\$3,269	\$2,317,000	2	\$0.00
Non Residential	12	\$43,458	\$3,800,200	2	\$37,235.61
<b>Total</b>	<b>167</b>	<b>\$150,928</b>	<b>\$38,202,400</b>	<b>50</b>	<b>\$420,756.47</b>

Source: FEMA Community Information System, accessed May 2020

**Table B.18 – NFIP Policy and Claims Data by Flood Zone**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	75	\$104,629	\$13,030,200	33	\$377,297.21
A Zones	0	\$0	\$0	4	\$13,208.70
B, C & X Zone					
Standard	21	\$18,363	\$5,546,200	3	\$4,081.34
Preferred	71	\$27,936	\$19,626,000	7	\$25,303.35
<b>Total</b>	<b>167</b>	<b>\$150,928</b>	<b>\$38,202,400</b>	<b>47</b>	<b>\$419,890.60</b>

Source: FEMA Community Information System, accessed May 2020

**Table B.19 – NFIP Policy and Claims Data Pre-FIRM**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	51	\$97,557	\$9,065,700	33	\$377,297.21
A Zones	0	\$0	\$0	4	\$13,208.70
B, C & X Zone	44	\$28,325	\$12,181,200	9	\$29,384.69
Standard	14	\$15,567	\$4,270,200	3	\$4,081.34
Preferred	30	\$12,758	\$7,911,000	6	\$25,303.35
<b>Total</b>	<b>95</b>	<b>\$125,882</b>	<b>\$21,246,900</b>	<b>46</b>	<b>\$419,890.60</b>

Source: FEMA Community Information System, accessed May 2020

Table B.20 – NFIP Policy and Claims Data Post-FIRM

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	24	\$7,072	\$3,964,500	0	\$0.00
A Zones	0	\$0	\$0	0	\$0.00
B, C & X Zone	48	\$17,974	\$12,991,000	1	\$0.00
Standard	7	\$2,796	\$1,276,000	0	\$0.00
Preferred	41	\$15,178	\$11,715,000	1	\$0.00
<b>Total</b>	<b>72</b>	<b>\$25,046</b>	<b>\$16,955,500</b>	<b>1</b>	<b>\$0.00</b>

Source: FEMA Community Information System, accessed May 2020



B.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Discourage the public and developers from developing property in flood zones.	Flood	1.2	Moderate	City of Burlington Building and Inspections	General fund	2020-2025	Carried Forward	The City works with developers and property owners on a case-by-case basis.
P-2	Adopt policy prohibiting the development of critical public facilities in the 100-year floodplain in cases where viable alternatives exist.	Flood	1.2	Moderate	City of Burlington Building and Inspections	General fund	2020-2025	Carried Forward	This activity is ongoing. This is not an adopted policy, but the City of Burlington Floodplain Manager oversees construction and acquisition of property in flood-prone areas. It is not the policy of the City to place critical systems in areas subject to flooding.
P-3	Expand the City’s Geographic Information System (GIS) capabilities to include more hazard specific information.	All Hazards	1.2	Moderate	City of Burlington GIS Division	Staff time	2020-2025	Carried Forward	This activity is ongoing and continually evaluated for effectiveness and modified as needed. Current capability includes the ability to define hazard areas from historical data as well as the ability to project potential areas of concern. The City will also continue to monitor opportunities to enhance GIS technologies and appropriate datasets for hazard mitigation planning.
P-4	Continue the City’s participation in the National Flood Insurance Program (NFIP) so citizens are eligible for flood insurance.	Flood	1.2	Moderate	City of Burlington Building and Inspections	General fund	2020-2025	Carried Forward	The City maintained active participation in the NFIP.
P-5	Request that each City department/office assess how it can better incorporate hazard mitigation goals into its separate planning processes and/or implementation of its duties.	All Hazards	1.2	Moderate	City of Burlington Office of Emergency Management	City funds	2020-2025	Carried Forward	Informal assessments completed. No formal documentation developed yet due to limited administrative resources.
P-6	Review all fire districts coverage to ensure that there are adequate quantities of water for firefighting purposes and that all water points are maintained on a regular basis.	Wildfire	2.2	Moderate	City of Burlington Fire Department, City of Burlington Water Department	Staff time	2020-2025	Carried Forward	This activity is ongoing based on regular maintenance schedules and is continually evaluated for effectiveness and modified as needed.
P-7	Develop a detailed hazard assessment for dams in Alamance County and add to county hazard mitigation plan.	Dam Failure	3.2	Moderate	City of Burlington Office of Emergency Management	Local, County	2020-2025	Carried Forward	Dam failure is included in this plan update and will continue to be evaluated in future updates.
Property Protection									
PP-1	Monitor structures affected by flood and track damages and repair costs. If damages and repair costs are high relative to the value of the structure, consider mitigation including elevation, acquisition, or floodproofing.	Flood	4.2	High	City of Burlington Office of Emergency Management, City Planning Department	General fund	2020-2025	Carried Forward	This activity was implemented as needed following hazard events. The City has the capability to conduct damage assessments with assistance from the County and the State.
PP-2	Monitor recreational facilities located in the floodplain and evaluate flood resistance of city structures.	Flood	4.2	Moderate	City of Burlington, City Planning Department	General fund	2020-2025	Carried Forward	No progress made due to limited administrative resources.
PP-3	Monitor reservoirs, lakes, and streams for potential flooding problems and note any unexpected flooding issues.	Flood	1.1	High	City of Burlington	N/A	2020-2025	Carried Forward	All reservoirs and water sources located throughout the city have been processed by various companies (i.e. dam review, etc.). City of Burlington reservoirs are assessed each year for potential problems as well as security issues.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Structural Projects									
SP-1	Retrofit critical facilities and City-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, 320 or 361 compliant safe rooms, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	4.2	Moderate	City of Burlington Building and Inspections, Office of Emergency Management, City Planning Department	Internal staff time	2020-2025	Carried Forward	No progress made due to fiscal limitations.
SP-2	Install backup generators or quick connect hook ups for mobile generators on any newly constructed county/town critical facilities.	All Hazards	4.2	Moderate	City of Burlington Building and Inspections, Office of Emergency Management, City Planning Department	Local, State grants, UHMA grants, other federal grants	2020-2025	Carried Forward	No progress made due to fiscal limitations. The City will continue to seek funding to install backup generators as needed for new facilities.
Emergency Services									
ES-1	Meet annually with State Forester for Alamance County to improve coordination of wildfire control and response.	Wildfire	3.2	Moderate	City of Burlington Fire Department	Staff time	2020-2025	Carried Forward	This activity is implemented annually.
Public Education & Awareness									
PEA-1	Encourage builders, developers, and architects to become familiar with the National Flood Insurance Program (NFIP) land use and building standards by attending annual workshops presented by the North Carolina Division of Emergency Management (NCEM).	Flood	1.2	Moderate	City of Burlington Building and Inspections, City of Burlington Office of Emergency Management	General fund	2020-2025	Carried Forward	No progress made due to limited staff resources.
PEA-2	Encourage homeowners to review insurance policies as part of an overall family disaster plan.	All Hazards	2.1	Moderate	City of Burlington Office of Emergency Management	Staff time	2020-2025	Carried Forward	In Progress. The City gives presentations to HOAs and neighborhood groups and distributes literature.
PEA-3	Increase awareness of the natural hazards potential to local officials, the general public, and private industry.	All Hazards	2.1	Moderate	City of Burlington Office of Emergency Management, Burlington Office of Public Information	Staff time	2020-2025	Carried Forward	This activity is ongoing and continually evaluated for effectiveness and modified as needed. Recent outreach methods include giving presentations and maintaining a presence at public events.
PEA-4	Maintain documents about flood insurance, flood protection, floodplain management, and natural and beneficial functions of floodplains at the local libraries and government offices.	Flood	2.1	Low	City of Burlington, Alamance County Planning Department	N/A	2020-2025	Carried Forward	This activity is ongoing. The City will continue to support maintaining these materials at local libraries and government offices.
PEA-5	Provide local real estate agents with handouts that will advise potential buyers to investigate the flood hazard for the property they are considering purchasing.	Flood	2.1	Low	City of Burlington, City Planning Department	Unknown	2020-2025	Carried Forward	No new resources were developed due to limited staff and fiscal resources.
PEA-6	Educate citizens to listen for the watches and warnings issued by the National Weather Service.	All Hazards	2.2	Moderate	City of Burlington Office of Emergency Management	County	2020-2025	Carried Forward	The City of Burlington Office of Emergency Management conducted annual presentations to Burlington Housing authority, Burlington Senior center, and Burlington Community network and has maintained a presence at local community events such as the annual Carousel Festival. Presentations include NWS information as well as inclement and hazardous weather planning/preparation.

## Annex C City of Graham

### C.1 PLANNING PROCESS

The table below lists the HMPC members who represented the City of Graham.

**Table C.1 – HMPC Members**

Representative	Position or Title
Tommy Cole	Fire Chief
Nathan Page	Planning Director

### C.2 COMMUNITY PROFILE

#### Geography

The City of Graham is located in central Alamance County and is neighbored by Burlington to the west and Haw River to the northeast. The City is part of the Burlington, NC Metropolitan Statistical Area. Graham comprises a total area of 9.7 square miles.

#### Population and Demographics

Table C.2 provides population counts and growth estimates for the City of Graham as compared to Alamance County and the Eno-Haw region overall. Table C.3 provides demographic information for Graham as compared to the county and the state.

**Table C.2 – Population Counts, Graham, 2010-2018**

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
City of Graham	12,833	14,153	14,670	517	3.7%
<b>Alamance County</b>	<b>130,800</b>	<b>146,902</b>	<b>160,576</b>	<b>13,674</b>	<b>9.3%</b>
<b>Region Total</b>	<b>507,964</b>	<b>567,634</b>	<b>649,276</b>	<b>81,642</b>	<b>14.4%</b>

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

**Table C.3 – Demographic and Social Characteristics, Graham, 2018**

Demographic & Social Characteristics	Graham	Alamance County	North Carolina
Median Age	38.4	39.5	38.6
% of Population Under 5 years old	7.7	5.8	5.9
% of population Over 65 years old	15.9	16.4	15.5
% of Population Over 25 with high school diploma	82.6%	85.5%	87.4%
% of Population Over 25 with bachelor's degree or higher	19.1%	24.0%	30.5%
% with Disability	16.3%	14.3	13.6
% Speak English less than "very well"	6.2%	5.5	4.6

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

#### Housing

The table below details key housing statistics for Graham as compared to the County overall.

**Table C.4 – Housing Statistics, Graham, 2010-2018**

Housing Characteristics	Graham	Alamance County
Housing Units (2010)	6,523	66,576
Housing Units (2018)	6,668	69,749
Housing Units Percent Change (2010-2018)	2.2%	4.8%
Housing Occupancy Rate	94.1%	91.8%
% Owner-Occupied	58.3	65.0%
Average Household Size	2.31	2.43
% of Housing Units with no Vehicles Available	5.0	5.3%
% of Housing Units that are mobile homes	9.0	12.0%
Median Home Value	\$129,400	\$147,800

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2014-2018 5-Year Estimates

### Economy

The following tables present key economic statistics for Graham as compared to the county and the state.

**Table C.5 – Economic Statistics, Graham, 2018**

Demographic & Social Characteristics	Graham	Alamance County	North Carolina
Median Household Income	35,152	\$45,735	\$52,413
Per Capita Income	21,808	\$26,215	\$29,456
Unemployment Rate	5.0%	5.7%	6.3%
% of Individuals Below Poverty Level	27.1	16.8	15.4
% Without Health Insurance	14.7	11.9	11.1

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

## C.3 RISK ASSESSMENT

This section contains a summary of the City's asset inventory as well as hazard profile and vulnerability assessment for those hazards that are spatially defined and have variations in risk that could be evaluated quantitatively on a jurisdictional level. The hazards included in this section are: Flood and Wildfire.

### Asset Inventory

The following tables summarize the asset inventory for the City of Graham in order to estimate the total physical exposure to hazards in this area. The locations of critical facilities are shown in Figure C.1. Critical facilities are a subset of identified assets from the Critical Infrastructure & Key Resources (CIKR) dataset. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted and displayed.

Building counts are provided based on data from the NCEM IRISK database, and supplemental parcel exposure is based on November 2019 county parcel data.

Table C.6 – Critical Infrastructure &amp; Key Resources by Type

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	Defense	Government Facilities	Healthcare	IT	National Monuments and Icons	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Graham	27	13	0	331	0	92	1	99	18	0	0	2	0	102	2	1	7	695

Source: NCEM Risk Management Tool

Table C.7 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Graham	14	55	39	28	0	12	8	156

Source: NCEM Risk Management Tool

Table C.8 – IRISK Inventory of Building Counts and Values

Jurisdiction	Building Count	Building Value
City of Graham	7,269	\$1,316,164,837

Source: NCEM Risk Management Tool

To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Eno-Haw Region, current parcel data was evaluated to identify recent development that was not included in NCEM's IRISK database. The building footprint layer from IRISK was compared to current parcel data; any parcels with an improved value that did not already have a building in IRISK were summarized in the table below. This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

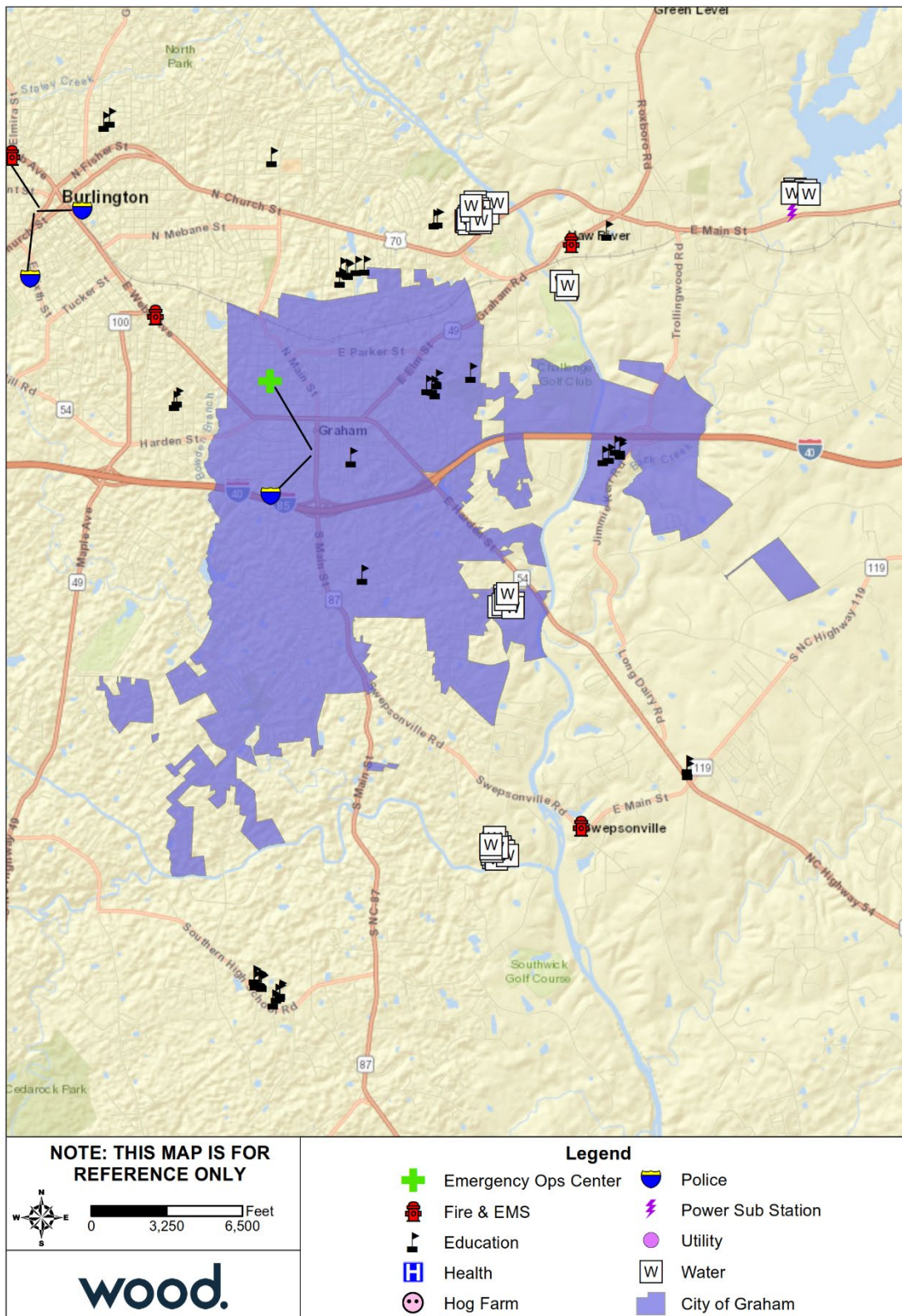
Table C.9 – Parcels Development Not Included in IRISK, November 2019

Jurisdiction	Improved Parcel Count	Total Improved Value
Graham	699	\$181,053,856

Source: County parcel data, retrieved November 2019; IRISK database building footprints



Figure C.1 – Critical Facilities, City of Graham



Source: NCEM IRISK Database, GIS Analysis

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### C.3.1 Flood

Table C.10 details the acreage of the City of Graham total area by flood zone on the effective DFIRM. Per this assessment, over 7 percent of Graham falls within the mapped 1%-annual-chance floodplains.

**Table C.10 – Flood Zone Acreage in the City of Graham**

Flood Zone	Acreage	Percent of Total (%)
Zone AE	458.5	7.40
Zone X (500-year)	79.4	1.3
Zone X Unshaded	5,679.1	91.3
<b>Total</b>	<b>6,217.0</b>	<b>--</b>

Source: FEMA Effective DFIRM

Figure C.2 reflects the effective mapped flood hazard zones for the City of Graham, and Figure C.3 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the region, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below and compared to total recent development counts and values. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. Additionally, this assessment does not evaluate flood impacts or provide damage estimates. According to this assessment, 2.7 percent of recent development in Graham is located in or near the SFHA.

**Table C.11 – Recent Development at Risk to Flood, City of Graham**

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
19	\$3,172,625	2.7%	1.8%

Source: Parcel data retrieved November 2019; FEMA Effective DFIRM

Table C.12 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector and flood event in the City of Graham. Table C.13 provides counts and estimated damages for High Potential Loss Properties.

**Table C.12 – Critical Facilities Exposed to Flooding, City of Graham**

Sector	Event	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	25 Year	1	\$600
	50 Year	1	\$945
	100 Year	1	\$1,246
	500 Year	2	\$89,887
Transportation Systems	500 Year	1	\$603,428
Water	100 Year	1	\$94,101
	500 Year	1	\$253,665
All Categories	25 Year	1	\$600
	50 Year	1	\$945
	100 Year	2	\$95,347
	500 Year	4	\$946,980

Source: NCEM Risk Management Tool

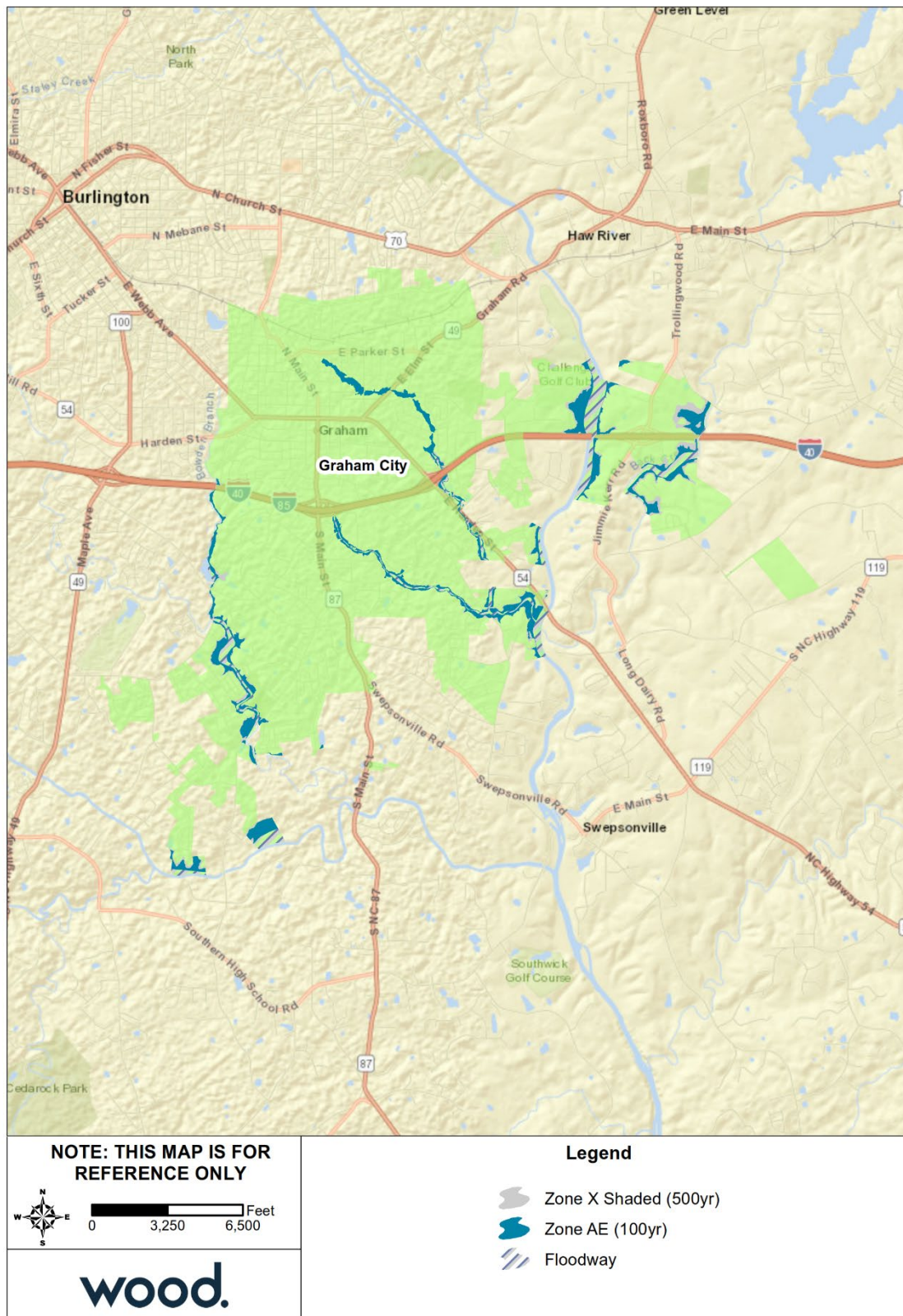
Table C.13 – High Potential Loss Properties Exposed to Flooding, City of Graham

Category	Event	Number of Buildings at Risk	Estimated Damages
Commercial	500 Year	2	\$688,399
Utilities	100 Year	1	\$94,101
	500 Year	1	\$253,665
All Categories	500 Year	3	\$942,064
	100 Year	1	\$94,101

Source: NCEM Risk Management Tool



Figure C.2 – FEMA Flood Hazard Areas, City of Graham

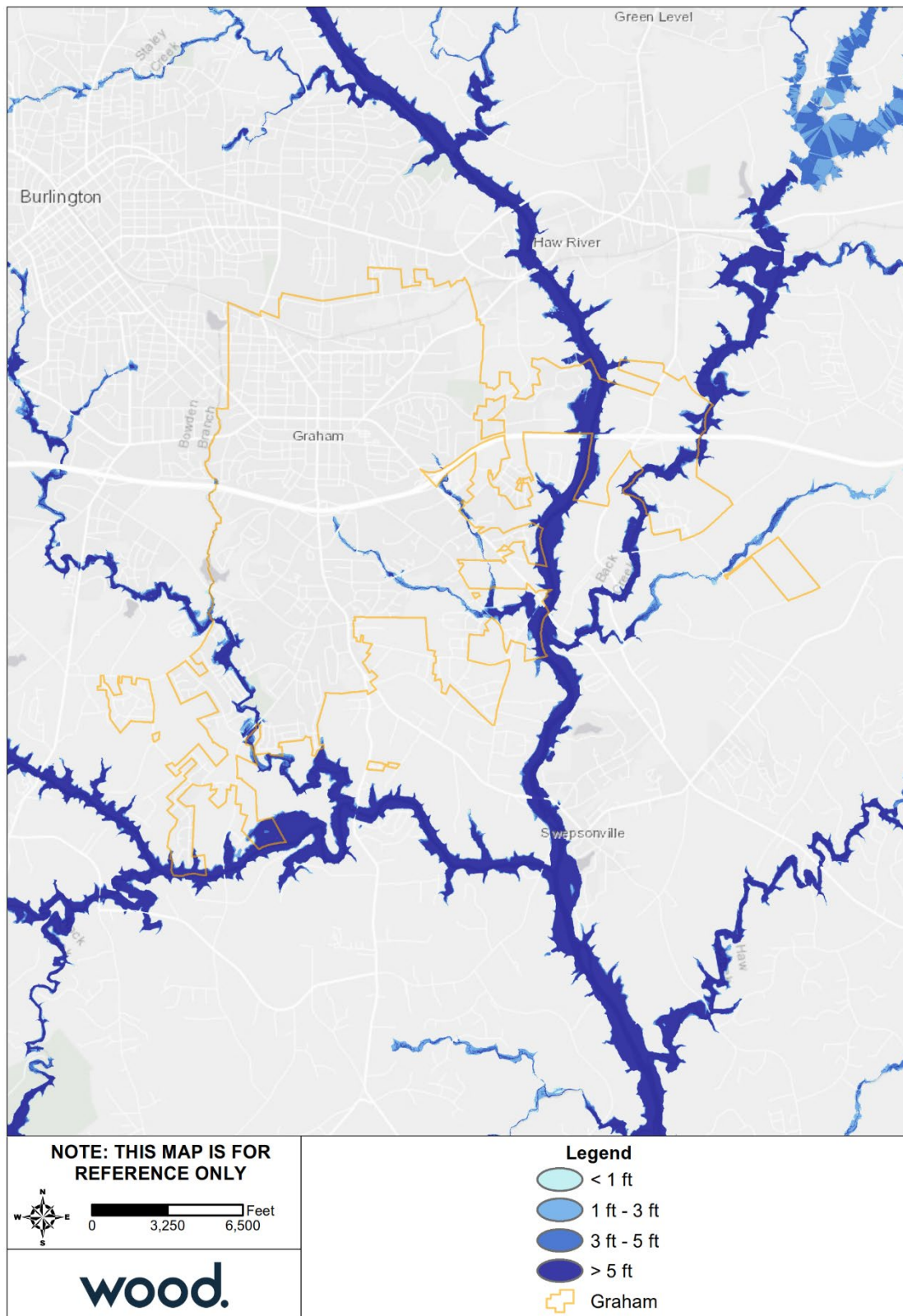


Source: FEMA Effective DFIRM

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2020

Figure C.3 – Flood Depth, 1%-Annual-Chance Floodplain, City of Graham



Source: FEMA Effective DFIRM

Eno-Haw

Regional Hazard Mitigation Plan  
2020



### C.3.2 Wildfire

Table C.14 summarizes the acreage in the City of Graham that falls within the Wildland Urban Interface (WUI), categorized by housing density. Areas in the WUI are those where development may intermix with flammable vegetation. Over 18 percent the City of Graham is not included in the WUI.

**Table C.14 – Wildland Urban Interface Acreage, City of Graham**

	Housing Density	Total Acreage	Percent of Total Acreage
	<i>Not in WUI</i>	1,129.76	18.2%
	LT 1hs/40ac	264.13	4.2%
	1hs/40ac to 1hs/20ac	146.61	2.4%
	1hs/20ac to 1hs/10ac	256.61	4.1%
	1hs/10ac to 1hs/5ac	334.24	5.4%
	1hs/5ac to 1hs/2ac	776.14	12.5%
	1hs/2ac to 3hs/1ac	3,224.82	51.9%
	GT 3hs/1ac	84.73	1.4%
	<b>Total</b>	<b>6,217.03</b>	

Source: Southern Wildfire Risk Assessment

Figure A.5 depicts the WUI for all incorporated areas in Alamance County, including the City of Graham. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure A.6 depicts Burn Probability for all of Alamance County based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Figure C.4 depicts the Fire Intensity Scale; which indicates the potential severity of fire based on fuel loads, topography, and other factors; in order to detail potential wildfire extent in the City of Graham. There are clusters of moderate and high potential fire intensity in eastern and southeastern Graham. Overall, less than one percent of the City has a Class 4 fire intensity and only 13 percent has a Class 3 fire intensity. Therefore, in most of the City a fire would be easily suppressed.

Table C.15 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table C.16 provides counts and estimated damages for High Potential Loss Properties in the City of Graham.

**Table C.15 – Critical Facilities Exposed to Wildfire, City of Graham**

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	1	\$281,223
Commercial Facilities	71	\$58,067,568
Critical Manufacturing	35	\$56,321,917
Defense Industrial Base	1	\$9,458,118
Energy	2	\$10,089,208
Food and Agriculture	18	\$905,905
Government Facilities	22	\$53,400,100
Healthcare and Public Health	2	\$3,405,469
Nuclear Reactors, Materials and Waste	1	\$50,000
Transportation Systems	20	\$20,752,401
Water	7	\$56,418,052
<b>All Categories</b>	<b>180</b>	<b>\$269,149,961</b>

Source: NCEM Risk Management Tool

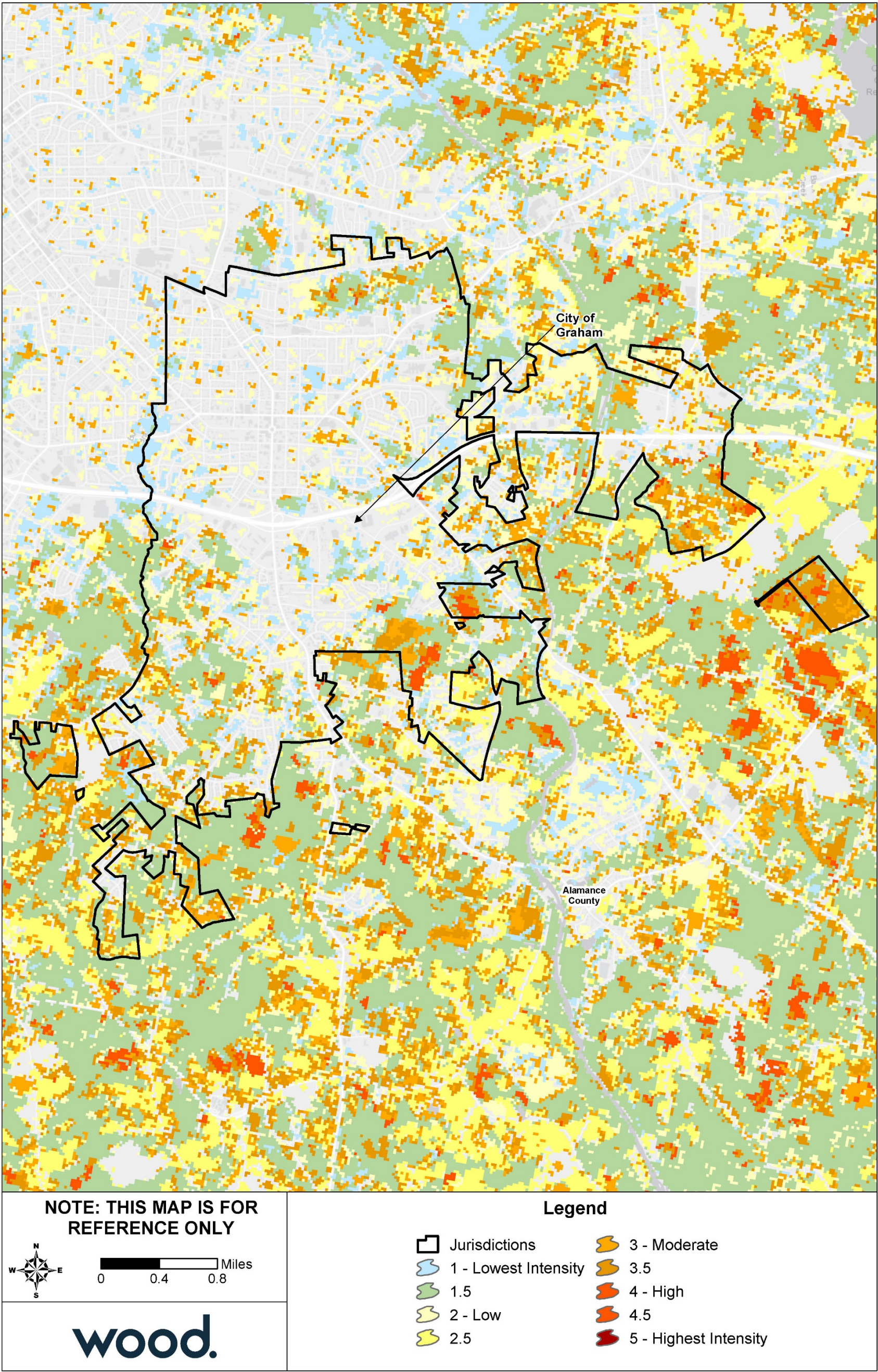
**Table C.16 – High Potential Loss Properties Exposed to Wildfire, City of Graham**

Category	Number of Buildings at Risk	Estimated Damages
Commercial	19	\$46,523,332
Government	13	\$51,787,393
Industrial	17	\$65,673,059
Religious	3	\$5,645,093
Residential	9	\$10,038,648
Utilities	8	\$66,418,052
<b>All Categories</b>	<b>69</b>	<b>\$246,085,577</b>

Source: NCEM Risk Management Tool



Figure C.4 – Fire Intensity Scale, City of Graham



Source: Southern Wildfire Risk Assessment



## C.4 CAPABILITY ASSESSMENT

### C.4.1 Overall Capability

Details on the tools and resources in place and available to the City of Graham are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, the City has a moderate overall capability rating. The City could improve regulatory capability by developing a Post-Disaster Redevelopment Ordinance to plan and set mitigation requirements for post-disaster reconstruction. The City has strong administrative capability, but its fiscal and outreach capabilities are limited. The City does not have structural mitigation experience.

### C.4.2 Floodplain Management

The City of Graham joined the NFIP through emergency entry in June 1976 and has been a regular participant since November 1980. The following tables reflect NFIP policy and claims data for the City categorized by structure type, flood zone, Pre-FIRM and Post-FIRM.

**Table C.17 – NFIP Policy and Claims Data by Structure Type**

Structure Type	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
Single Family	58	\$33,272	\$13,056,900	10	\$63,752.71
2-4 Family	1	\$402	\$350,000	0	\$0.00
All Other Residential	0	\$0	\$0	0	\$0.00
Non Residential	3	\$7,155	\$1,069,500	0	\$0.00
<b>Total</b>	<b>62</b>	<b>\$40,829</b>	<b>\$14,476,400</b>	<b>10</b>	<b>\$63,752.71</b>

Source: FEMA Community Information System, accessed May 2020

**Table C.18 – NFIP Policy and Claims Data by Flood Zone**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
<b>A01-30 &amp; AE Zones</b>	33	\$23,890	\$6,924,500	8	\$50,031.61
<b>B, C &amp; X Zone</b>					
<b>Standard</b>	13	\$11,387	\$3,246,900	0	\$0.00
<b>Preferred</b>	16	\$5,552	\$4,305,000	2	\$13,721.10
<b>Total</b>	<b>62</b>	<b>\$40,829</b>	<b>\$14,476,400</b>	<b>10</b>	<b>\$63,752.71</b>

Source: FEMA Community Information System, accessed May 2020

**Table C.19 – NFIP Policy and Claims Data Pre-FIRM**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
<b>A01-30 &amp; AE Zones</b>	4	\$7,899	\$658,200	8	\$50,031.61
<b>B, C &amp; X Zone</b>	9	\$3,025	\$1,820,000	2	\$13,721.10
<b>Standard</b>	4	\$1,318	\$560,000	0	\$0.00
<b>Preferred</b>	5	\$1,707	\$1,260,000	2	\$13,721.10
<b>Total</b>	<b>13</b>	<b>\$10,924</b>	<b>\$2,478,200</b>	<b>10</b>	<b>\$63,752.71</b>

Source: FEMA Community Information System, accessed May 2020

Table C.20 – NFIP Policy and Claims Data Post-FIRM

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	29	\$15,991	\$6,266,300	0	\$0.00
B, C & X Zone	20	\$13,914	\$5,731,900	0	\$0.00
Standard	9	\$10,069	\$2,686,900	0	\$0.00
Preferred	11	\$3,845	\$3,045,000	0	\$0.00
<b>Grand Total</b>	49	\$29,905	\$11,998,200	0	\$0.00

Source: FEMA Community Information System, accessed May 2020



C.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Review methods of school construction to ensure that all new schools are constructed to the maximum cost feasible standards of wind resistance, flood resistance, and access so that they can be used as shelters for evacuees during and after natural hazard events.	Flood	1.2	Moderate	City of Graham	General fund	2022	Carried forward	The City of Graham Planning Department reviews plans for all new and existing structures for this. The City of Graham currently has one charter school under construction and will reach out to them regarding use as a shelter.
P-2	Propose a policy prohibiting the development of critical public facilities in the 100-year floodplain in cases where viable alternatives exist. Presently, most critical facilities located in the floodplain are waste pump stations because they must be located at low elevations because the handle gravity flowing sewage.	Flood	1.2	Moderate	City of Graham Public Works Department	General fund	2024	Carried forward	The City is currently moving our most at-risk pump station (Boyd Creek) out of the floodplain.
P-3	Consider expanding the County's Geographic Information System (GIS) capabilities to include maintaining Elevation Certificates in a computer database.	Flood	1.2	Moderate	Alamance County GIS Department	Staff time, General fund	2023	Carried forward	Graham has centralized our Floodplain permitting and Elevation Certificates such that they are ready when requested.
P-4	Continue City of Graham's participation in the National Flood Insurance Program (NFIP) so citizens are eligible for flood insurance.	Flood	1.2	Moderate	City of Graham	General fund	2020	Carried forward	Graham complied with the most recent update of the regulations and maps and will adopt language to allow for the 'most current map' to rule as part of our 160D update.
P-5	Review all fire districts coverage to ensure that there are adequate quantities of water for firefighting purposes and that all water points are maintained on a regular basis.	Wildfire	2.2	Moderate	City of Graham Fire Department	Staff time	2025	Carried forward	No progress reported due to administrative barriers. Timeline based on Rating Schedule dictated by Office of State Fire Marshal.
Property Protection									
PP-1	Monitor recreational facilities located in the floodplain and evaluate flood resistance of county structures.	Flood	4.2	Moderate	City of Graham Public Works Department	Staff time	2022	Carried forward	Graham will continue to monitor. A new route to the Wastewater Treatment Plant was installed in 2019 to provide access outside of the floodplain.
PP-2	Monitor reservoirs, lakes, and streams for potential flooding problems and note any unexpected flooding issues.	Flood	4.2	Moderate	City of Graham/ Alamance County EM	General fund	2025	Carried forward	Dam repairs were completed at reservoir in 2020. Graham will continue to monitor.
Structural Projects									
SP-1	Seek funding to the retrofit of critical facilities and Town-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	4.2	Moderate	City Buildings and Inspections Department, City Planning Department, City Emergency Services	Local, State grants, federal grants	2025	Carried forward	The City of Graham has begun to use smart meters to detect leaks throughout the city and re-ran electrical lines underground to City Hall to increase reliability.
SP-2	Seek funding for the installation of backup generators or quick connect hook ups for mobile generators on any newly constructed and existing county critical facilities.	All Hazards	4.2	Moderate	City Buildings and Inspections Department, City Planning Department, City Emergency Services	Local, State grants, federal grants	2020	Completed	City Hall, Police Department, Fire Department, Water Treatment, Wastewater Treatment, and our pump stations are now all covered by back-up generators. Additional facilities to be identified.
Emergency Services									

Action #	Action Description	Hazard(s) Addressed	Goal Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
ES-1	Meet annually with State Forester for Alamance County to improve coordination of wildfire control and response.	Wildfire	3.2	Moderate	City of Graham	General fund	2021	Carried forward	No progress due to staff limitations. New Fire Chief will reach back out to State Forester and reestablish this link.
ES-2	Coordinate with the North Carolina Department of Transportation (NCDOT) to maintain adequate and effective snow and ice removal plans by the towns/cities and NCDOT. "Adequate" means that all major thoroughfares are cleared and remain clear within 12 hours of last snowfall.	Severe Winter Weather	2.2	Moderate	City of Graham	General fund	2023	Carried forward	Limited progress due to administrative barriers. It has been difficult to get a response from NCDOT for snow clearing of specific routes. The City continues to reach out and attempt to take over some primary routes.
Public Education & Awareness									
PEA-1	Encourage builders, developers, and architects to become familiar with the National Flood Insurance Program (NFIP) land use and building standards by attending annual workshops presented by the North Carolina Division of Emergency Management (NCEM). This can be accomplished by creating a mailing list and providing it to NCEM to use for its announcements. This task can be further supported by distributing copies of NCEM's announcements from the Alamance County Inspections Department when builders and developers apply for permits.	Flood	2.1	Moderate	City of Graham	General fund	2025	Carried forward	The City of Graham works with Alamance County to ensure that developers are up-to-date when applying for permits and by attending workshops. City staff attends CFP trainings, and reviews all NFIP regulations.
PEA-2	Encourage citizens and businesses/industries to develop emergency preparedness plans.	All Hazards	2.1	Moderate	City of Graham	General fund	2023	Carried forward	No progress reported due to limited staff resources. The City will maintain an Emergency Preparedness page on the City website in conjunction with the County to help inform local residents.
PEA-3	Encourage homeowners to review insurance policies as part of an overall family disaster plan.	All Hazards	2.1	Moderate	City of Graham	General fund	2023	Carried forward	No progress reported due to limited staff resources. The City will maintain an Emergency Preparedness page on the City website in conjunction with the County to help inform local residents.
PEA-4	Increase awareness of the natural hazards potential to local officials, the general public, and private industry.	All Hazards	2.1	Moderate	City of Graham	General fund	2022	Carried forward	The usage of NIXLE has increased awareness of the frequency of hazards. The City will continue to push notifications regarding hazardous weather over this and other media.
PEA-5	Discourage the public and developers from developing property in flood zones.	All Hazards	1.2	Moderate	City of Graham	General fund	2025	Carried forward	Graham adopted a 2' above base flood elevation building requirement to decrease development potential of flood zones.
PEA-6	Maintain documents about flood insurance, flood protections, floodplain management, and natural and beneficial functions of floodplains at the local libraries and government offices.	Flood	2.1	Moderate	City of Graham	General fund	2025	Carried forward	Documents are made available at City Hall.

## Annex D City of Mebane

### D.1 PLANNING PROCESS

The table below lists the HMPC members who represented the City of Mebane.

**Table D.1 – HMPC Members**

Representative	Position or Title
Bob Louis	Fire Chief
Montrena W. Hadley	Planning Officer
Kyle Smith	Utilities Director

### D.2 COMMUNITY PROFILE

#### Geography

The City of Mebane is located in eastern Alamance County. The City extends partially into Orange County. The Alamance portion of the City is part of the Burlington, NC Metropolitan Statistical Area while the portion in Orange County is part of the Durham-Chapel Hill Metropolitan Statistical Area. Mebane comprises a total land area of 8.5 square miles.

#### Population and Demographics

Table D.2 provides population counts and growth estimates for the City of Mebane as compared to Alamance County and the Eno-Haw region overall. Table D.3 provides demographic information for Mebane as compared to the county and the state.

**Table D.2 – Population Counts, Mebane, 2010-2018**

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
City of Mebane	7,284	11,393	15,198	3,805	33.4%
<b>Alamance County</b>	<b>130,800</b>	<b>146,902</b>	<b>160,576</b>	<b>13,674</b>	<b>9.3%</b>
<b>Region Total</b>	<b>507,964</b>	<b>567,634</b>	<b>649,276</b>	<b>81,642</b>	<b>14.4%</b>

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

Note: The total population of Mebane includes population residing in Orange County.

**Table D.3 – Demographic and Social Characteristics, Mebane, 2018**

Demographic & Social Characteristics	Mebane	Alamance County	North Carolina
Median Age	34.2	39.5	38.6
% of Population Under 5 years old	7.9	5.8	5.9
% of population Over 65 years old	11.4	16.4	15.5
% of Population Over 25 with high school diploma	92.6%	85.5%	87.4%
% of Population Over 25 with bachelor's degree or higher	36.1%	24.0%	30.5%
% with Disability	12.2%	14.3	13.6
% Speak English less than "very well"	2.8%	5.5	4.6

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

## Housing

The table below details key housing statistics for Mebane as compared to the County overall.

**Table D.4 – Housing Statistics, Mebane, 2010-2018**

Housing Characteristics	Mebane	Alamance County
Housing Units (2010)	5,045	66,576
Housing Units (2018)	6,322	69,749
Housing Units Percent Change (2010-2018)	25.3%	4.8%
Housing Occupancy Rate	92.7%	91.8%
% Owner-Occupied	60.8	65.0%
Average Household Size	2.59	2.43
% of Housing Units with no Vehicles Available	2.3	5.3%
% of Housing Units that are mobile homes	0.9	12.0%
Median Home Value	\$185,700	\$147,800

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2014-2018 5-Year Estimates

## Economy

The following tables present key economic statistics for Mebane as compared to the county and the state.

**Table D.5 – Economic Statistics, Mebane, 2018**

Demographic & Social Characteristics	Mebane	Alamance County	North Carolina
Median Household Income	54,157	\$45,735	\$52,413
Per Capita Income	27,848	\$26,215	\$29,456
Unemployment Rate	6.3%	5.7%	6.3%
% of Individuals Below Poverty Level	13.1	16.8	15.4
% Without Health Insurance	5.4	11.9	11.1

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

### D.3 RISK ASSESSMENT

This section contains a summary of the City's asset inventory as well as hazard profile and vulnerability assessment for those hazards that are spatially defined and have variations in risk that could be evaluated quantitatively on a jurisdictional level. The hazards included in this section are: Dam Failure, Flood, and Wildfire.

#### Asset Inventory

The following tables summarize the asset inventory for the City of Mebane in order to estimate the total physical exposure to hazards in the jurisdiction. The locations of critical facilities are shown in Figure D.1. Critical facilities are a subset of identified assets from the Critical Infrastructure & Key Resources (CIKR) dataset. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted.

Building counts are provided based on data from the NCEM IRISK database, and supplemental parcel exposure is based on November 2019 county parcel data.

Table D.6 – Critical Infrastructure &amp; Key Resources by Type

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	Defense	Government Facilities	Healthcare	IT	National Monuments and Icons	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Mebane	32	10	0	265	0	108	1	15	14	0	0	0	0	76	2	4	2	529

Source: NCEM Risk Management Tool

Table D.7 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Mebane	35	42	31	7	0	9	2	126

Source: NCEM Risk Management Tool

Table D.8 – IRISK Inventory of Building Counts and Values

Jurisdiction	Building Count	Building Value
City of Mebane	5,835	\$1,292,288,024

Source: NCEM Risk Management Tool

To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Eno-Haw Region, current parcel data was evaluated to identify recent development that was not included in NCEM's IRISK database. The building footprint layer from IRISK was compared to current parcel data; any parcels with an improved value that did not already have a building in IRISK were summarized in the table below. This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

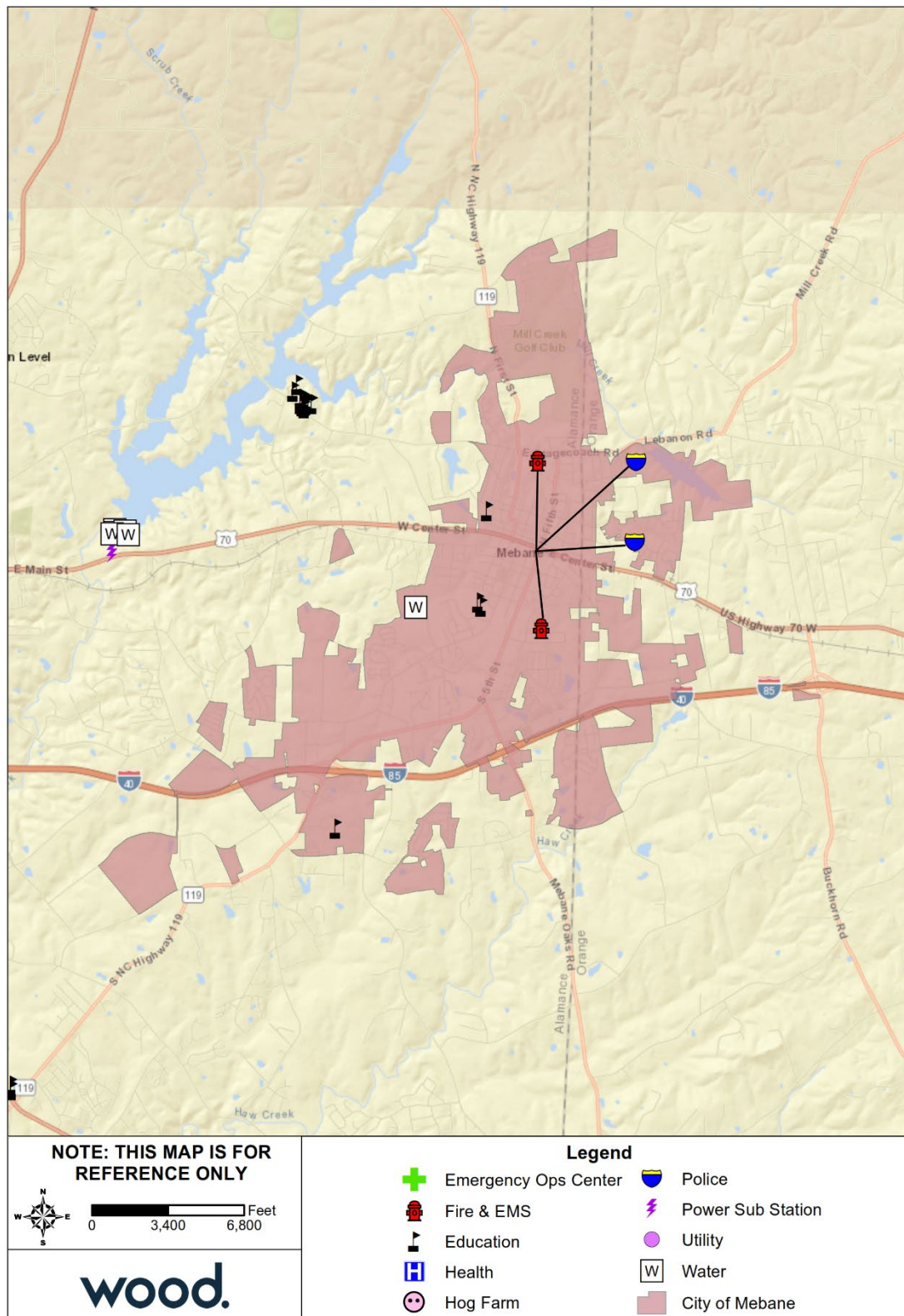
Table D.9 – Parcels Development Not Included in IRISK, November 2019

Jurisdiction	Improved Parcel Count	Total Improved Value
Mebane	1,310	\$495,097,215

Source: County parcel data, retrieved November 2019; IRISK database building footprints



Figure D.1 – Critical Facilities, City of Mebane



Source: NCEM IRISK Database, GIS Analysis

**D.3.1 Dam Failure**

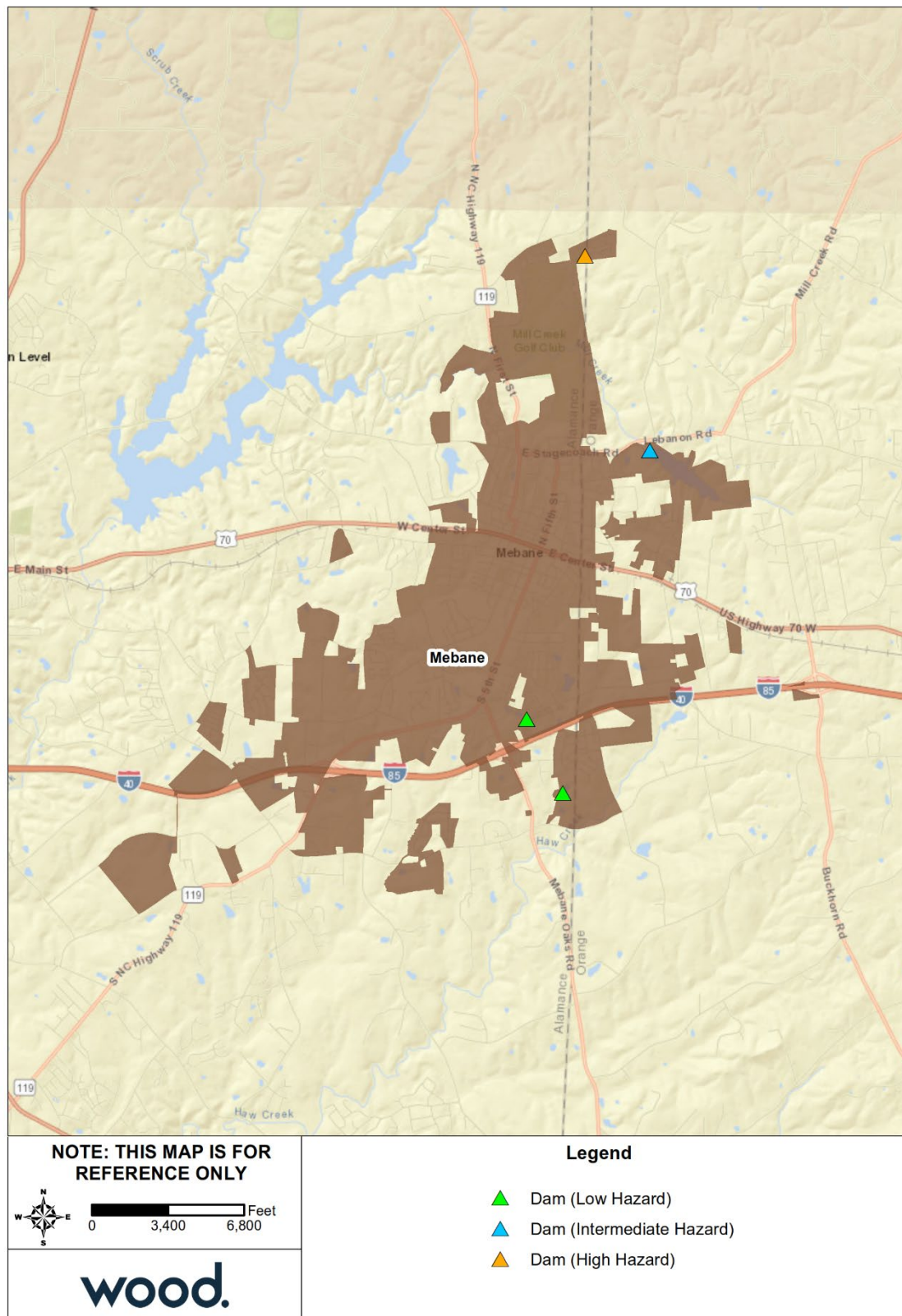
Table D.10 lists the high hazard dams in the City of Mebane identified by the North Carolina Dam Inventory as of July 2018. All dam locations throughout Mebane are shown in Figure D.2.

**Table D.10 – High Hazard Dams in City of Mebane**

<b>Dam Name</b>	<b>NID ID</b>	<b>Condition as of Last Inspection</b>	<b>Max Capacity (Ac-Ft)</b>	<b>Nearest Downstream Location</b>
Mill Creek Subdivision Dam	NC05718	Fair	7	Mebane

Source: NC Dam Inventory, July 2018

Figure D.2 – Dam Locations, City of Mebane



Source: NC Dam Inventory, July 2018

Eno-Haw

Regional Hazard Mitigation Plan  
2020

### D.3.2 Flood

Table D.11 details the acreage of the City of Mebane total area by flood zone on the effective DFIRM. Per this assessment, over 4 percent of the Mebane falls within the mapped 1%-annual-chance floodplains.

**Table D.11 – Flood Zone Acreage in the City of Mebane**

Flood Zone	Acreage	Percent of Total (%)
Zone AE	261.7	4.4
Zone X (500-year)	20.1	0.3
Zone X Unshaded	5,637.8	95.2
<b>Total</b>	<b>5,919.6</b>	<b>--</b>

Source: FEMA Effective DFIRM

Figure D.3 reflects the effective mapped flood hazard zones for the City of Mebane, and Figure D.4 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the region, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below and compared to total recent development counts and values. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. Additionally, this assessment does not evaluate flood impacts or provide damage estimates. According to this assessment, 2.0 percent of recent development in Mebane is located in or near the SFHA.

**Table D.12 – Recent Development at Risk to Flood, City of Mebane**

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
26	\$56,083,678	2.0%	11.3%

Source: Parcel data retrieved November 2019; FEMA Effective DFIRM

Table D.13 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector and flood event in the City of Mebane. There are no high potential loss facilities with estimated flood damages in Mebane.

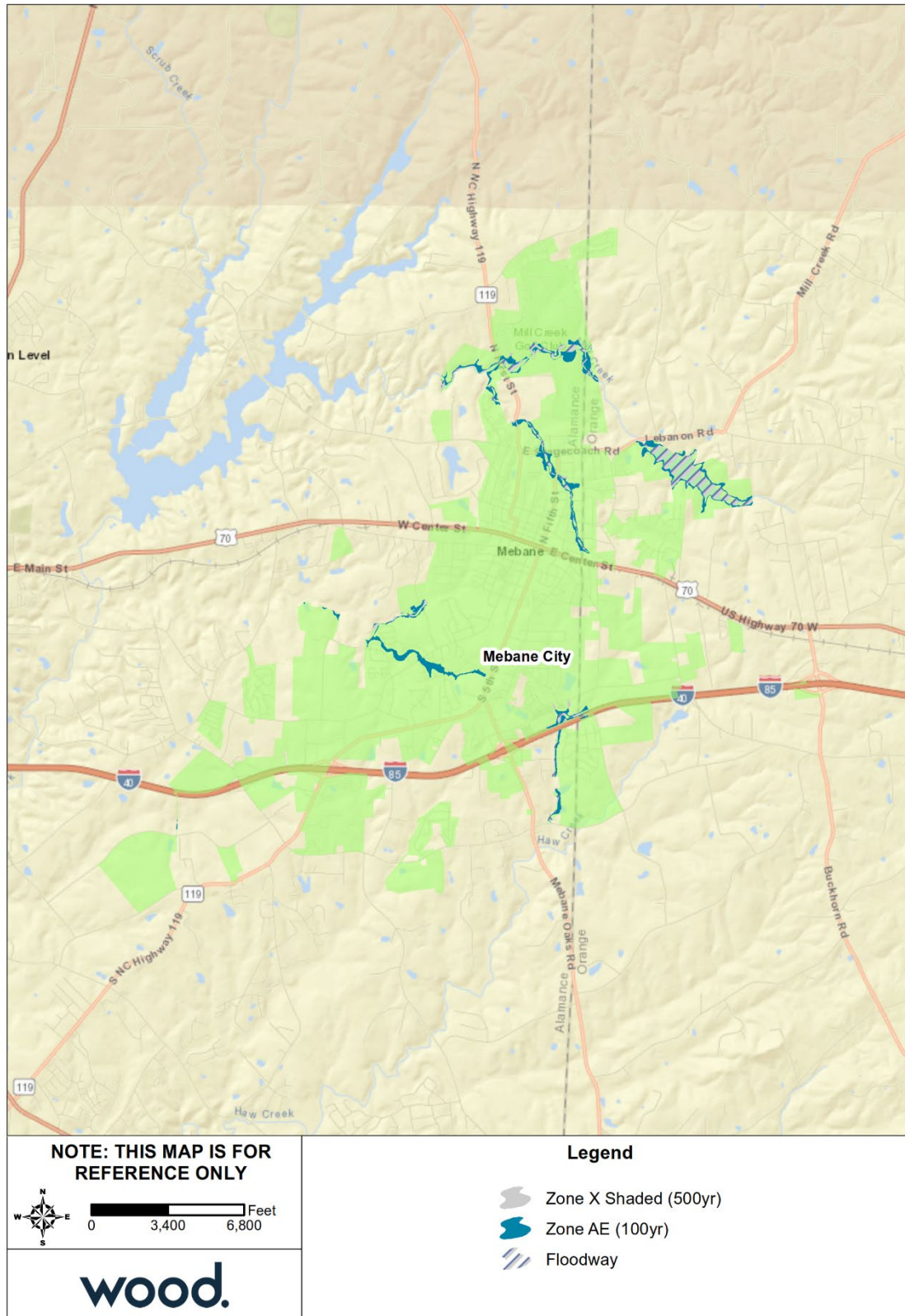
**Table D.13 – Critical Facilities Exposed to Flooding, City of Mebane**

Sector	Event	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	25 Year	1	\$277
	50 Year	1	\$1,108
	100 Year	1	\$1,960
	500 Year	1	\$18,092
Transportation Systems	500 Year	1	\$7,009
<b>All Categories</b>	<b>25 Year</b>	<b>1</b>	<b>\$277</b>
	<b>50 Year</b>	<b>1</b>	<b>\$1,108</b>
	<b>100 Year</b>	<b>1</b>	<b>\$1,960</b>
	<b>500 Year</b>	<b>2</b>	<b>\$25,101</b>

Source: NCEM Risk Management Tool



Figure D.3 – FEMA Flood Hazard Areas, City of Mebane



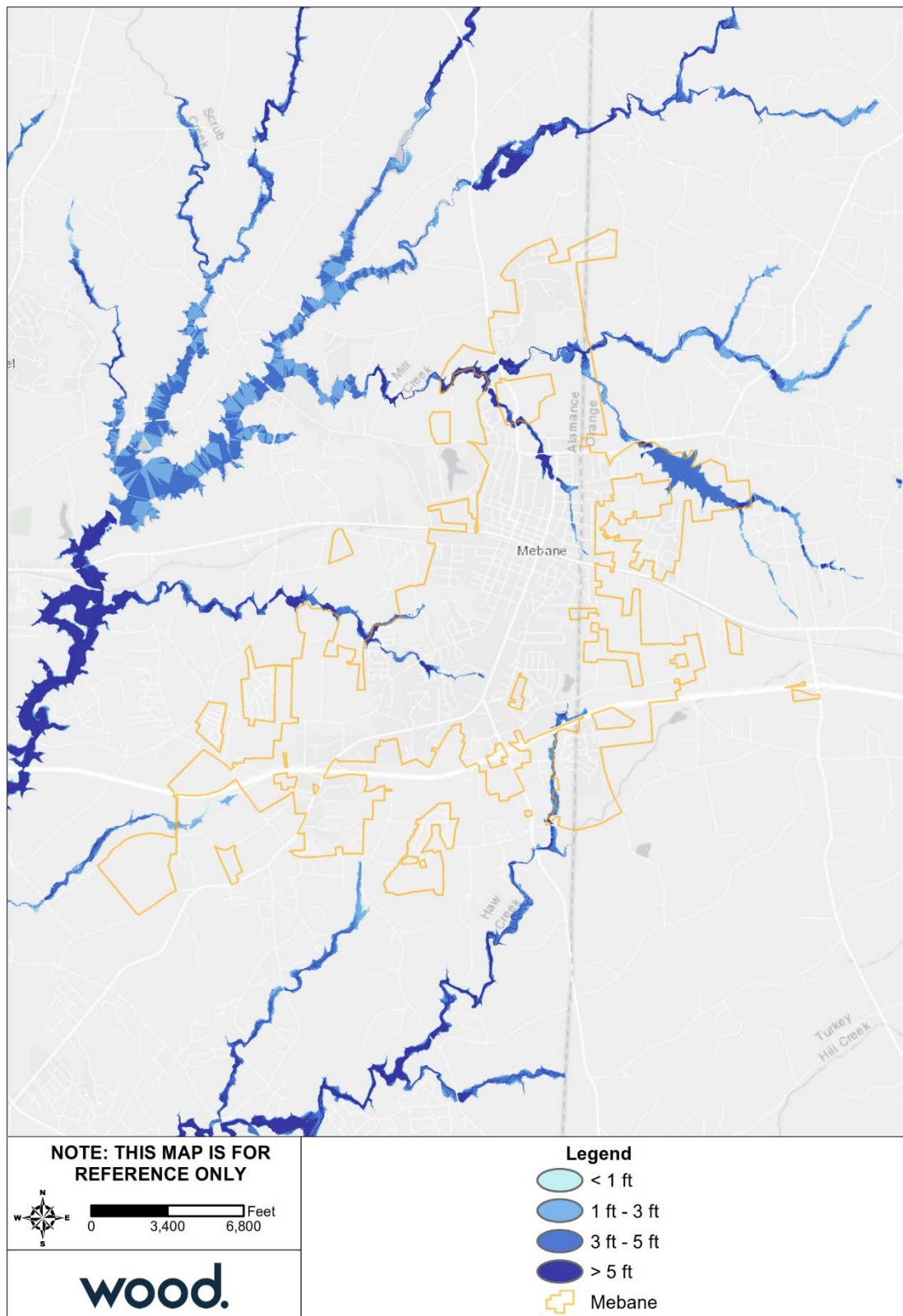
Source: FEMA Effective DFIRM

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Regional Hazard Mitigation Plan  
2020



Figure D.4 – Flood Depth, 1%-Annual-Chance Floodplain, City of Mebane



Source: FEMA Effective DFIRM

Eno-Haw

Regional Hazard Mitigation Plan  
2020

### D.3.3 Wildfire

Table D.14 summarizes the acreage in the City of Mebane that falls within the Wildland Urban Interface (WUI), categorized by housing density. Areas in the WUI are those where development may intermix with flammable vegetation. Over 17 percent of the City of Mebane is not included in the WUI.

**Table D.14 – Wildland Urban Interface Acreage, City of Mebane**

	Housing Density	Total Acreage	Percent of Total Acreage
	<i>Not in WUI</i>	1,048.27	17.7%
	LT 1hs/40ac	367.51	6.2%
	1hs/40ac to 1hs/20ac	196.80	3.3%
	1hs/20ac to 1hs/10ac	319.24	5.4%
	1hs/10ac to 1hs/5ac	361.48	6.1%
	1hs/5ac to 1hs/2ac	742.55	12.5%
	1hs/2ac to 3hs/1ac	2,785.34	47.1%
	GT 3hs/1ac	98.40	1.7%
	<b>Total</b>	<b>5,919.59</b>	

Source: Southern Wildfire Risk Assessment

Figure A.5 depicts the WUI for all incorporated areas in Alamance County, including the City of Mebane. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure A.6 depicts Burn Probability for all of Alamance County based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Figure D.5 depicts the Fire Intensity Scale; which indicates the potential severity of fire based on fuel loads, topography, and other factors; in order to detail potential wildfire extent in the City of Mebane. There are clusters of moderate potential fire intensity throughout Mebane, primarily in the southern edges of the City. Overall, roughly 14 percent of the City has a Class 3 fire intensity but less than one percent of the City has a Class 4 fire intensity. Therefore, in most of the City a fire would be easily suppressed.

Table D.15 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table D.16 provides counts and estimated damages for High Potential Loss Properties in the City of Mebane.

**Table D.15 – Critical Facilities Exposed to Wildfire, City of Mebane**

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	8	\$5,874,916
Commercial Facilities	156	\$191,124,437
Critical Manufacturing	61	\$242,766,439
Defense Industrial Base	1	\$12,913,162
Emergency Services	1	\$1,113,835
Energy	1	\$10,000,000
Food and Agriculture	27	\$2,063,366
Government Facilities	9	\$34,679,782
Healthcare and Public Health	11	\$14,178,595
Transportation Systems	40	\$14,192,096
Water	2	\$60,800,000
<b>All Categories</b>	<b>317</b>	<b>\$589,706,628</b>

Source: NCEM Risk Management Tool

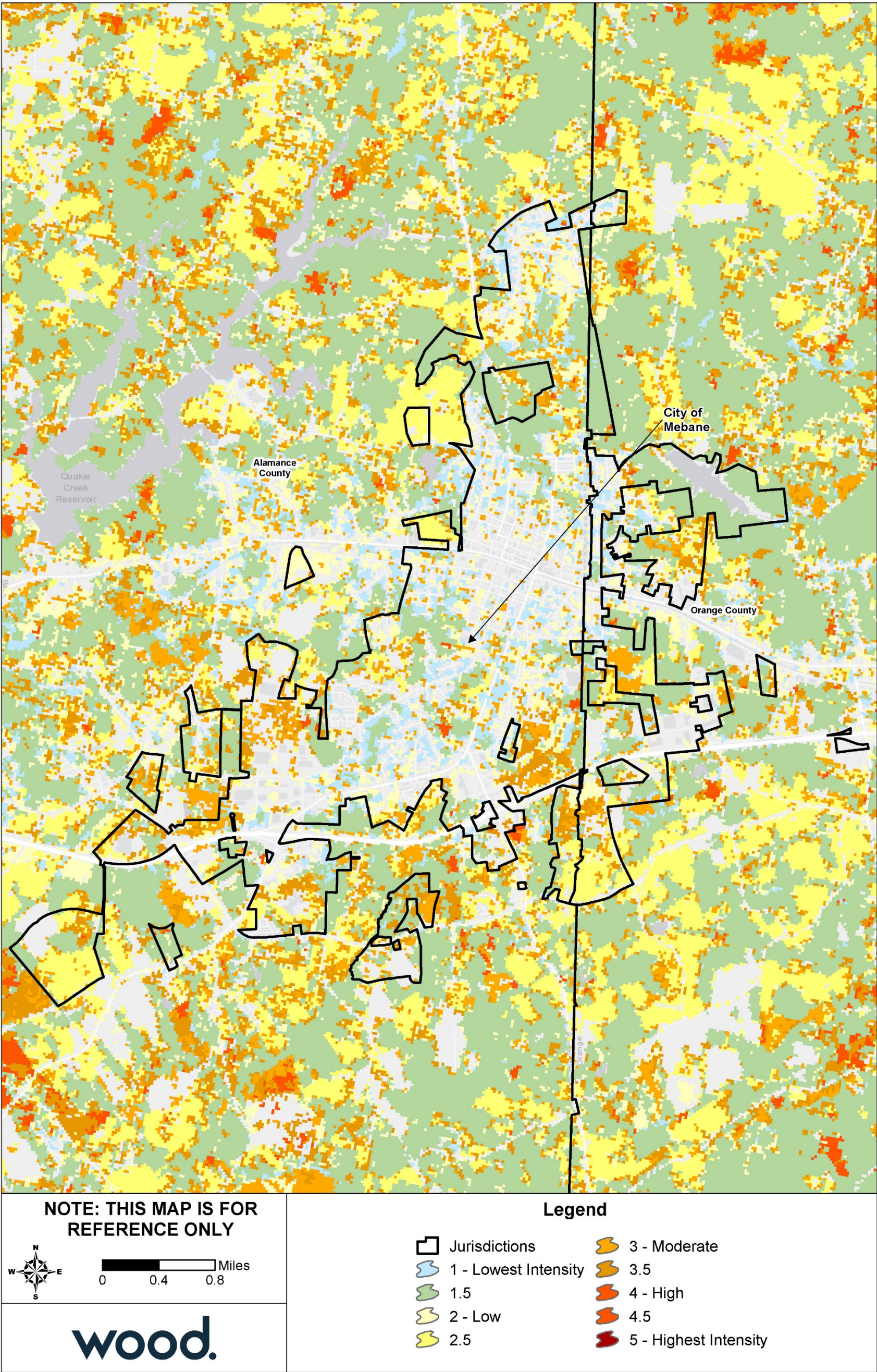
**Table D.16 – High Potential Loss Properties Exposed to Wildfire, City of Mebane**

Category	Number of Buildings at Risk	Estimated Damages
Commercial	34	\$145,066,400
Government	5	\$33,893,573
Industrial	25	\$232,531,056
Religious	5	\$12,739,636
Residential	33	\$63,672,939
Utilities	2	\$70,000,000
<b>All Categories</b>	<b>104</b>	<b>\$557,903,604</b>

Source: NCEM Risk Management Tool



Figure D.5 – Fire Intensity Scale, City of Mebane



Source: Southern Wildfire Risk Assessment



## D.4 CAPABILITY ASSESSMENT

### D.4.1 Overall Capability

Details on the tools and resources in place and available to the City of Mebane were provided by the City's HMPC representatives and are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, the City has a moderate overall capability rating. The City could improve regulatory capability by developing a Floodplain Management Plan, an Open Space Management Plan, or a Post-Disaster Redevelopment Ordinance. The City has strong administrative capability, moderate fiscal capability and limited outreach capability. The City does not have structural mitigation experience.

### D.4.2 Floodplain Management

The City of Mebane joined the NFIP through emergency entry in 1975 and has been a regular participant since November 1980. The following tables reflect NFIP policy and claims data for the City categorized by structure type, flood zone, Pre-FIRM and Post-FIRM.

**Table D.17 – NFIP Policy and Claims Data by Structure Type**

Structure Type	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
Single Family	48	\$21,349	\$13,150,700	3	\$4,622.05
2-4 Family	1	\$395	\$350,000	0	\$0.00
<b>Total</b>	<b>49</b>	<b>\$21,744</b>	<b>\$13,500,700</b>	<b>3</b>	<b>\$4,622.05</b>

Source: FEMA Community Information System, accessed May 2020

**Table D.18 – NFIP Policy and Claims Data by Flood Zone**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
<b>A01-30 &amp; AE Zones</b>	24	\$12,247	\$5,975,700	0	\$0.00
<b>B, C &amp; X Zone</b>					
Standard	3	\$1,350	\$910,000	0	\$0.00
Preferred	22	\$8,147	\$6,615,000	3	\$4,622.05
<b>Total</b>	<b>49</b>	<b>\$21,744</b>	<b>\$13,500,700</b>	<b>3</b>	<b>\$4,622.05</b>

Source: FEMA Community Information System, accessed May 2020

**Table D.19 – NFIP Policy and Claims Data Pre-FIRM**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	3	\$740	\$449,400	0	\$0.00
B, C & X Zone	6	\$2,324	\$1,715,000	2	\$3,090.26
Standard	2	\$918	\$700,000	0	\$0.00
Preferred	4	\$1,406	\$1,015,000	2	\$3,090.26
<b>Total</b>	<b>9</b>	<b>\$3,064</b>	<b>\$2,164,400</b>	<b>2</b>	<b>\$3,090.26</b>

Source: FEMA Community Information System, accessed May 2020



Table D.20 – NFIP Policy and Claims Data Post-FIRM

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
<b>A01-30 &amp; AE Zones</b>	21	\$11,507	\$5,526,300	0	\$0.00
<b>B, C &amp; X Zone</b>	19	\$7,173	\$5,810,000	1	\$1,531.79
<b>Standard</b>	1	\$432	\$210,000	0	\$0.00
<b>Preferred</b>	18	\$6,741	\$5,600,000	1	\$1,531.79
<b>Total</b>	<b>40</b>	<b>\$18,680</b>	<b>\$11,336,300</b>	<b>1</b>	<b>\$1,531.79</b>

Source: FEMA Community Information System, accessed May 2020

D.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Maintain Shelter Agreements with the American Red Cross	All Hazards	2.2	Moderate	Alamance County/ City	General Fund	2020-2025	Carried Forward	This is in the CIP for the shelter in Mebane.
P-2	Expand the County's GIS Capabilities to Include Maintaining Elevation Certificates	Flood	2.2	Moderate	Alamance County/ City	Staff Time	2020-2025	Carried Forward	County maintains GIS but City maintains elevation certificates available to county upon request.
P-3	Continue the City of Mebane’s participation in the National Flood Insurance Program	Flood	1.2	Moderate	City	Staff Time	2020-2025	Carried Forward	The City has maintained compliance with the NFIP and will continue to do so as part of plan review and permitting process.
P-4	Monitor Reservoirs, Lakes, and Streams for Potential Flooding Problems and Note any Unexpected Flooding Issues	Flood	1.2	Moderate	City	Staff Time	2020-2025	Carried Forward	City has checked culverts and streams along outfalls ahead of large predicted storm events and cleared debris as necessary to prevent flooding. No major issues beyond maintenance needs have been noted.
P-5	Review All Fire Districts Coverage to Ensure there are Adequate Quantities of Water for Fire Fighting Purposes and that all Water Points are Maintained on a Regular Basis	Wildfire	2.2	Moderate	City	Staff Time	2020-2025	Carried Forward	OSFM conducted ISO inspections in 2018. Will review with OSFM upon next inspection.
P-6	When County Land Use Plan is Complete, Create a Land Use Map with an Overlay for Flood Hazards and any Other Natural Hazards	All Hazards	1.2	Moderate	City	General Fund	2020-2022	Carried Forward	Land use plan completed locally. County has flood hazard on the County GIS. Will look to provide additional mapping as data becomes available.
Property Protection									
PP-1	Monitor Structures Affected by Flood and Track Damages and Repair Costs.	Flood	4.2	Low	City	Hazard Mitigation Grants	2020-2025	Carried Forward	No progress to report due to low priority. City owned structures will be monitored and tracked. Private structures will be tracked by building permits.
Structural Projects									
SP-1	Seek funding to retrofit critical facilities and Town-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, 320 or 361 compliant safe rooms, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	4.2	Moderate	City	State Grants, UHMA Grants, other federal grants	2020-2025	Carried Forward	As buildings are upgraded, we will look into retrofitting facilities with the latest technology. Many facilities have backup generators installed and low water consumption fixtures.
SP-2	Seek funding to install backup generators or quick connect hook ups for mobile generators on any newly constructed county/town critical facilities	All Hazards	4.2	Moderate	City	Local, State Grants, UHMA Grants, other federal grants	2020-2025	Carried Forward	Backup generators have now been installed at nearly all existing facilities. All new construction facilities will be evaluated as part of plan review.
Emergency Services									
ES-1	Meet Annually with State Forester for Alamance County to Improve Coordination of Wildfire Control and Response	Wildfire	3.2	Moderate	City	Staff Time	2020-2025	Carried Forward	No progress due to limited staff resources. Fire department to meet annually with State forester to coordinate Wildfire Control and Response.
ES-2	Coordinate with the NCDOT to Maintain Adequate and Effective Snow Removal Plans by Cities and NCDOT	Severe Winter Weather	3.1	Moderate	Public Works	General Fund	2020-2021	Carried Forward	In process with a municipal agreement with the NCDOT.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Public Education & Awareness									
PEA-1	Encourage Familiarity with National Flood Insurance Program (NFIP)	Flood	2.1	Moderate	Planning, Zoning and Inspections	Staff Time	2020-2025	Carried Forward	No new progress to report due to limited administrative resources. Will continue existing outreach as part of plan review and permitting process.
PEA-2	Encourage Citizens and Businesses to Develop Emergency Preparedness Plans	All Hazards	2.1	Moderate	City	Staff Time	2020-2025	Carried Forward	No progress made due to administrative limitations. Will place information on the website encouraging development of emergency preparedness plans.
PEA-3	Encourage Homeowners to Review Insurance Policies as Part of an Overall Family Disaster Plan	All Hazards	2.1	Moderate	City	Staff Time	2020-2025	Carried Forward	Educational material is posted on website/handouts
PEA-4	Increase Awareness of the Natural Hazards Potential to Officials, Public and Industry	All Hazards	2.1	Moderate	City	Staff Time	2020-2025	Carried Forward	Code Red information is placed on the City's website. Citizens are informed by Code Red notifications as hazards arise.
PEA-5	Provide Local Real Estate Agents with Handouts that Will Advise Potential Buyers to Investigate the Flood Hazards for the Property Under Consideration	Flood	2.1	Low	City	Staff Time	2020-2025	Carried Forward	Planning department provides information to agents and developers.

## Annex E Town of Elon

### E.1 PLANNING PROCESS

The table below lists the HMPC members who represented the Town of Elon.

**Table E.1 – HMPC Members**

Representative	Position or Title
Alva Sizemore	Fire Chief
Pamela Graham	Planning Director
Steve Floyd	Retired Fire Chief

### E.2 COMMUNITY PROFILE

#### Geography

The Town of Elon is located in western Alamance County. It is neighbored to the south and east by the City of Burlington. The Town is part of the Burlington, NC Metropolitan Statistical Area. Elon comprises a total area of 3.9 square miles.

#### Population and Demographics

Table E.2 provides population counts and growth estimates for the Town of Elon as compared to Alamance County and the Eno-Haw region. Table E.3 provides demographic information for Elon as compared to the county and the state.

**Table E.2 – Population Counts, Elon, 2010-2018**

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
Town of Elon	6,738	9,409	11,008	1,599	17.0%
<b>Alamance County</b>	<b>130,800</b>	<b>146,902</b>	<b>160,576</b>	<b>13,674</b>	<b>9.3%</b>
<b>Region Total</b>	<b>507,964</b>	<b>567,634</b>	<b>649,276</b>	<b>81,642</b>	<b>14.4%</b>

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

**Table E.3 – Demographic and Social Characteristics, Elon, 2018**

Demographic & Social Characteristics	Elon	Alamance County	North Carolina
Median Age	21.9	39.5	38.6
% of Population Under 5 years old	2.7	5.8	5.9
% of population Over 65 years old	17.9	16.4	15.5
% of Population Over 25 with high school diploma	96.3%	85.5%	87.4%
% of Population Over 25 with bachelor's degree or higher	52.1%	24.0%	30.5%
% with Disability	11.3%	14.3	13.6
% Speak English less than "very well"	2.8%	5.5	4.6

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

#### Housing

The table below details key housing statistics for Elon as compared to the County overall.

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Table E.4 – Housing Statistics, Elon, 2010-2018

Housing Characteristics	Elon	Alamance County
Housing Units (2010)	3,055	66,576
Housing Units (2018)	3,468	69,749
Housing Units Percent Change (2010-2018)	13.5%	4.8%
Housing Occupancy Rate	95.8%	91.8%
% Owner-Occupied	51.7	65.0%
Average Household Size	2.37	2.43
% of Housing Units with no Vehicles Available	6.1	5.3%
% of Housing Units that are mobile homes	2.1	12.0%
Median Home Value	\$246,900	\$147,800

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2014-2018 5-Year Estimates

### Economy

The following tables present key economic statistics for Elon as compared to the county and the state.

Table E.5 – Economic Statistics, Elon, 2018

Demographic & Social Characteristics	Elon	Alamance County	North Carolina
Median Household Income	59,962	\$45,735	\$52,413
Per Capita Income	23,008	\$26,215	\$29,456
Unemployment Rate	3.6%	5.7%	6.3%
% of Individuals Below Poverty Level	20.1	16.8	15.4
% Without Health Insurance	3.0	11.9	11.1

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

## E.3 RISK ASSESSMENT

This section contains a summary of the Town's asset inventory as well as hazard profile and vulnerability assessment for those hazards that are spatially defined and have variations in risk that could be evaluated quantitatively on a jurisdictional level. The hazards included in this section are: Dam Failure, Flood, and Wildfire.

### Asset Inventory

The following tables summarize the asset inventory for the Town of Elon in order to estimate the total physical exposure to hazards in this area. The locations of critical facilities are shown in Figure E.1. Critical facilities are a subset of identified assets from the Critical Infrastructure & Key Resources (CIKR) dataset. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted and displayed.

Building counts are provided based on data from the NCEM IRISK database, and supplemental parcel exposure is based on November 2019 county parcel data.



Table E.6 – Critical Infrastructure &amp; Key Resources by Type

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	Defense	Government Facilities	Healthcare	IT	National Monuments and Icons	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Elon	4	1	0	75	0	14	0	152	62	0	0	0	0	13	1	1	1	324

Source: NCEM Risk Management Tool

Table E.7 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Elon	12	44	5	51	0	9	1	122

Source: NCEM Risk Management Tool

Table E.8 – IRISK Inventory of Building Counts and Values

Jurisdiction	Building Count	Building Value
Town of Elon	2,760	\$719,062,825

Source: NCEM Risk Management Tool

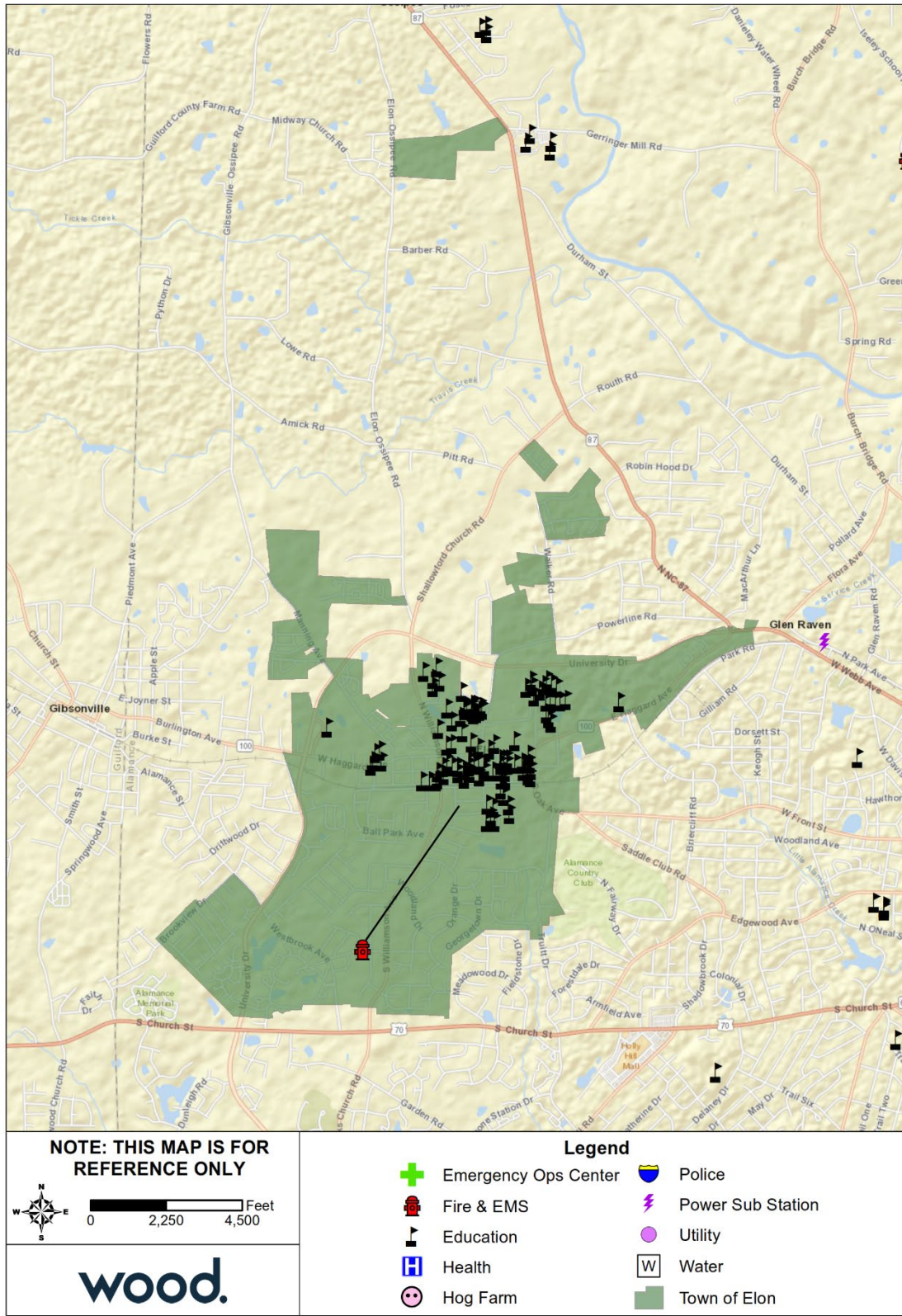
To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Eno-Haw Region, current parcel data was evaluated to identify recent development that was not included in NCEM's IRISK database. The building footprint layer from IRISK was compared to current parcel data; any parcels with an improved value that did not already have a building in IRISK were summarized in the table below. This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

Table E.9 – Parcels Development Not Included in IRISK, November 2019

Jurisdiction	Improved Parcel Count	Total Improved Value
Elon	375	\$104,400,254

Source: County parcel data, retrieved November 2019; IRISK database building footprints

Figure E.1 – Critical Facilities, Town of Elon



Source: NCEM IRISK Database, GIS Analysis

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### E.3.1 Dam Failure

Table E.10 lists the high hazard dams in the Town of Elon identified by the North Carolina Dam Inventory as of July 2018. All dam locations throughout Elon are shown in Figure E.2.

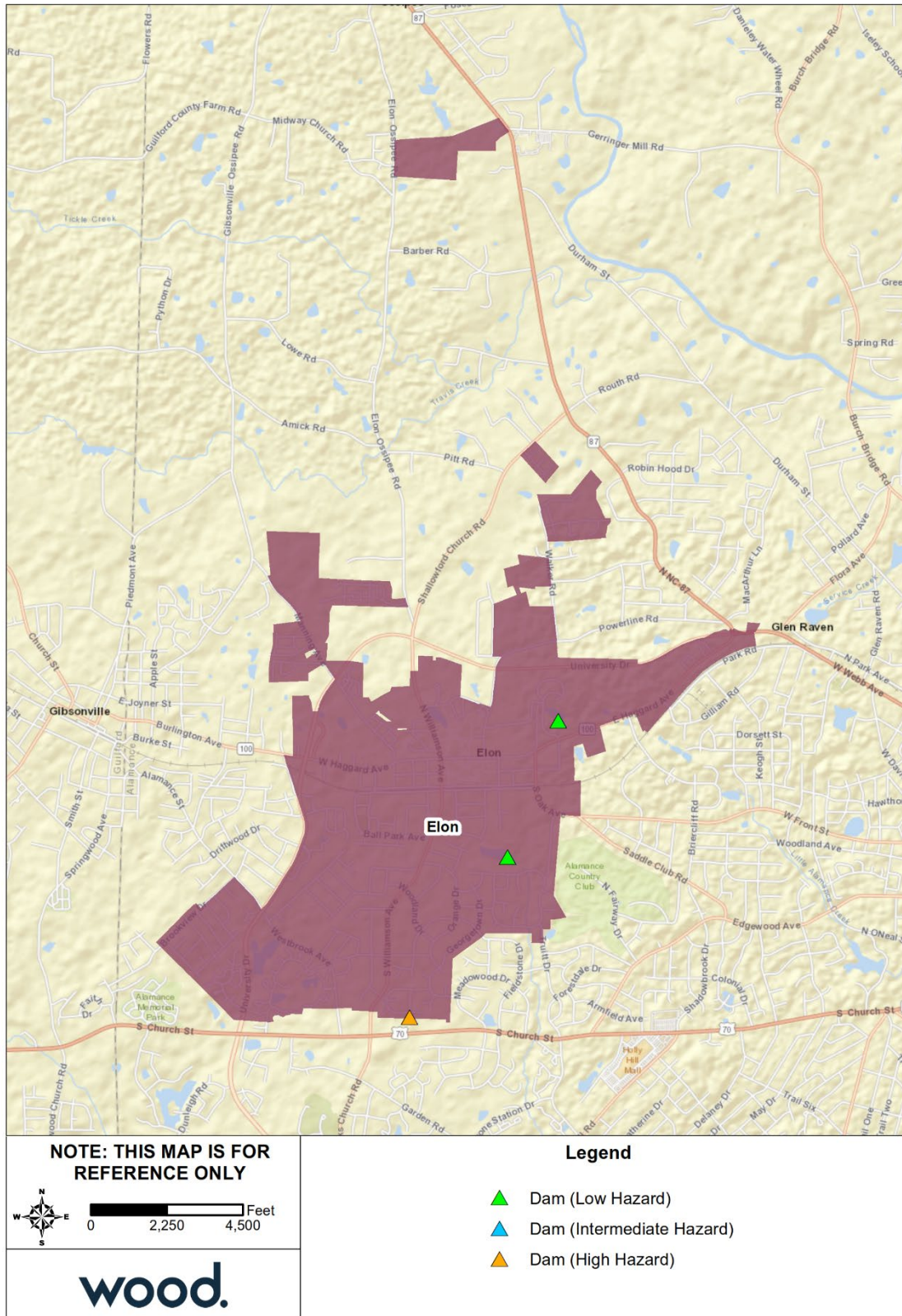
**Table E.10 – High Hazard Dams in Town of Elon**

Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
Somerton Lake Dam	NC05203	Poor	46.89	Burlington

Source: NC Dam Inventory, July 2018



Figure E.2 – Dam Locations, Town of Elon



Source: NC Dam Inventory, July 2018

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### E.3.2 Flood

Table E.11 details the acreage of the Town of Elon by flood zone on the effective DFIRM. Per this assessment, over 4 percent of the Elon falls within the mapped 1%-annual-chance floodplains.

**Table E.11 – Flood Zone Acreage in the Town of Elon**

Flood Zone	Acreage	Percent of Total (%)
Zone AE	105.8	4.1
Zone X (500-year)	6.2	0.2
Zone X Unshaded	2,461.7	95.6
<b>Total</b>	<b>2,573.7</b>	<b>--</b>

Source: FEMA Effective DFIRM

Figure E.3 reflects the effective mapped flood hazard zones for the Town of Elon, and Figure E.4 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the region, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below and compared to total recent development counts and values. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. Additionally, this assessment does not evaluate flood impacts or provide damage estimates. According to this assessment, 4.3 percent of recent development in Elon is located in or near the SFHA.

**Table E.12 – Recent Development at Risk to Flood, Town of Elon**

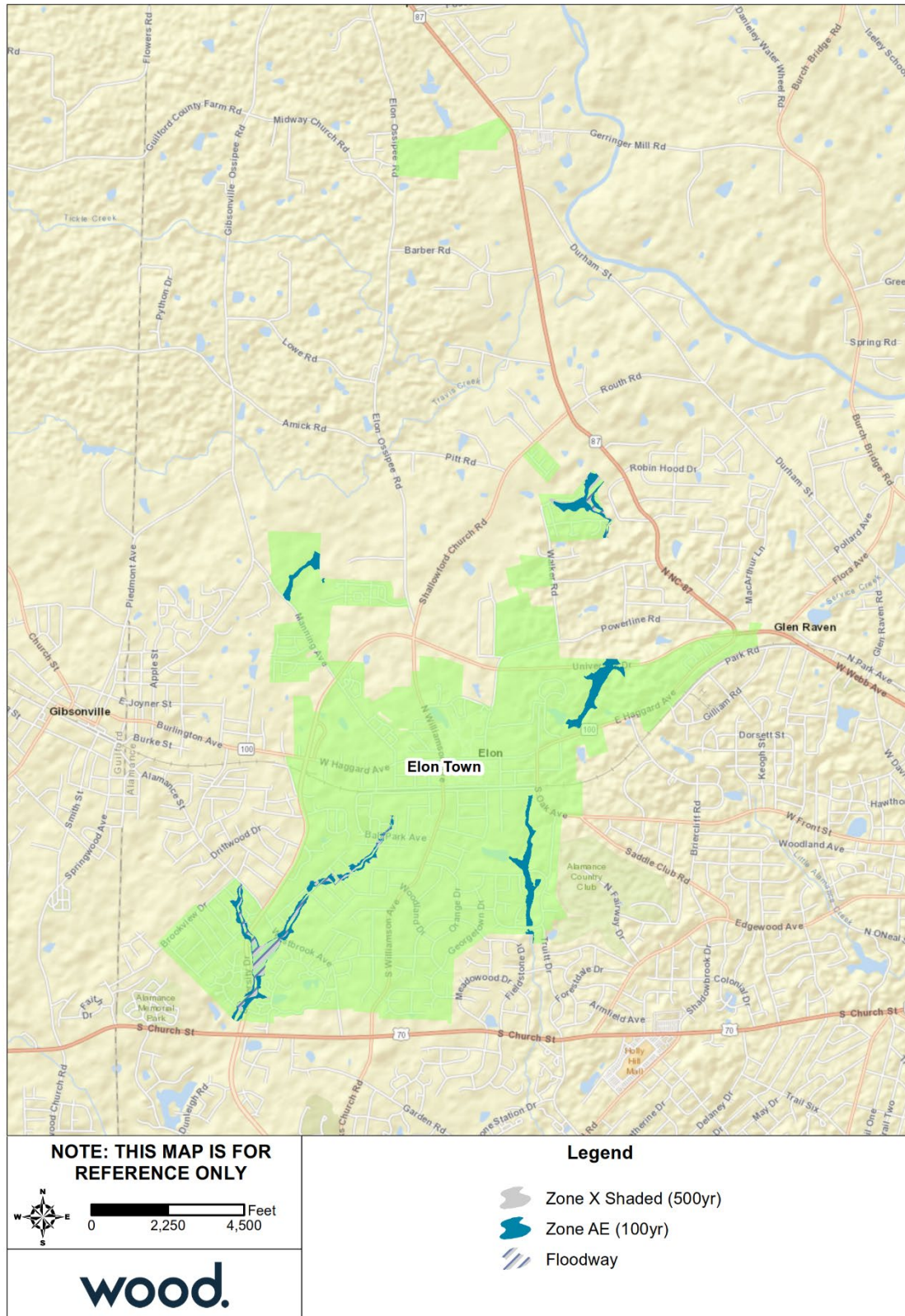
Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
16	\$5,585,563	4.3%	5.4%

Source: Parcel data retrieved November 2019; FEMA Effective DFIRM

There are no critical facilities or high potential loss properties with estimated flood damages in the Town of Elon.



Figure E.3 – FEMA Flood Hazard Areas, Town of Elon

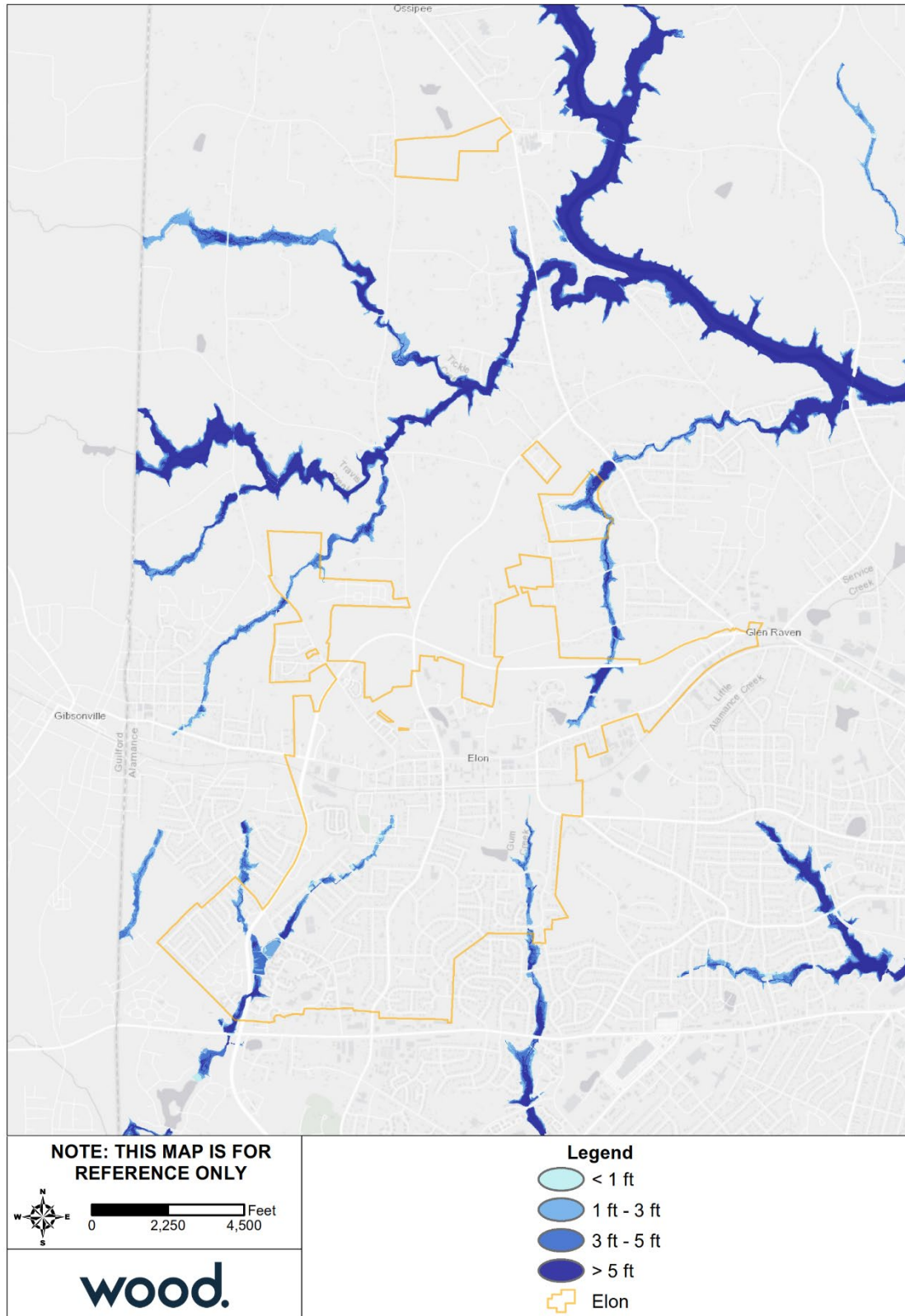


Source: FEMA Effective DFIRM

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2020

Figure E.4 – Flood Depth, 1%-Annual-Chance Floodplain, Town of Elon



Source: FEMA Effective DFIRM

### E.3.3 Wildfire

Table E.13 summarizes the acreage in the Town of Elon that falls within the Wildland Urban Interface (WUI), categorized by housing density. Areas in the WUI are those where development may intermix with flammable vegetation. Over 7 percent of the Town of Elon is not included in the WUI.

**Table E.13 – Wildland Urban Interface Acreage, Town of Elon**

	Housing Density	Total Acreage	Percent of Total Acreage
	<i>Not in WUI</i>	188.36	7.3%
	LT 1hs/40ac	35.62	1.4%
	1hs/40ac to 1hs/20ac	24.64	1.0%
	1hs/20ac to 1hs/10ac	62.64	2.4%
	1hs/10ac to 1hs/5ac	76.45	3.0%
	1hs/5ac to 1hs/2ac	224.99	8.7%
	1hs/2ac to 3hs/1ac	1,720.93	66.9%
	GT 3hs/1ac	240.05	9.3%
	<b>Total</b>	<b>2,573.67</b>	

Source: Southern Wildfire Risk Assessment

Figure A.5 depicts the WUI for all incorporated areas in Alamance County, including the Town of Elon. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure A.6 depicts Burn Probability for all of Alamance County based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Figure E.5 depicts the Fire Intensity Scale; which indicates the potential severity of fire based on fuel loads, topography, and other factors; in order to detail potential wildfire extent in the Town of Elon. There are small clusters of moderate (Class 3) and high (Class 4) potential fire intensity in the northern edges of the Town. Overall, these clusters only comprise 7.7% and 0.5% of the Town's total area.

Table E.14 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table E.15 provides counts and estimated damages for High Potential Loss Properties in the Town of Elon.

**Table E.14 – Critical Facilities Exposed to Wildfire, Town of Elon**

Sector	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	19	\$22,953,181
Critical Manufacturing	7	\$3,844,060
Energy	1	\$10,000,000
Food and Agriculture	4	\$190,177
Government Facilities	106	\$114,192,121
Healthcare and Public Health	42	\$54,555,540
Transportation Systems	6	\$8,213,993
Water	1	\$800,000
<b>All Categories</b>	<b>186</b>	<b>\$214,749,072</b>

Source: NCEM Risk Management Tool

**Table E.15 – High Potential Loss Properties Exposed to Wildfire, Town of Elon**

Category	Number of Buildings at Risk	Estimated Damages
Commercial	24	\$49,288,090
Government	38	\$97,015,324
Industrial	2	\$2,526,242

## ANNEX E: TOWN OF ELON

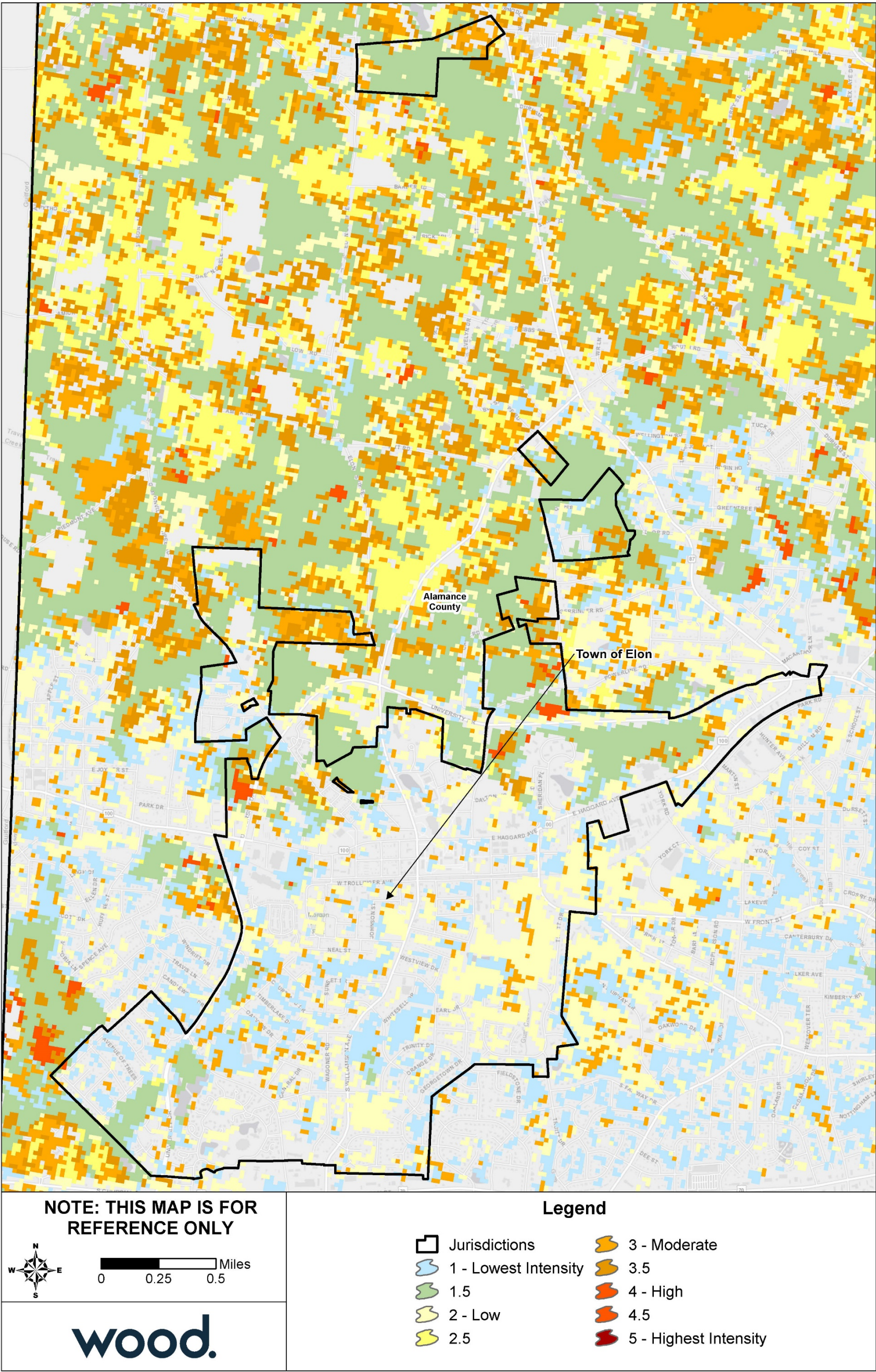
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Category	Number of Buildings at Risk	Estimated Damages
Religious	7	\$18,657,115
Residential	7	\$9,708,281
Utilities	1	\$10,000,000
<b>All Categories</b>	<b>79</b>	<b>\$187,195,052</b>

Source: NCEM Risk Management Tool



Figure E.5 – Fire Intensity Scale, Town of Elon



Source: Southern Wildfire Risk Assessment



## E.4 CAPABILITY ASSESSMENT

### E.4.1 Overall Capability

Details on the tools and resources in place and available to the Town of Elon are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Elon has a low overall capability rating. The Town relies on Alamance County for much regulatory and planning capability support. The Town has moderate administrative capability, limited fiscal and outreach capability, and no structural mitigation experience.

### E.4.2 Floodplain Management

The Town of Elon joined the NFIP through emergency entry in 1988 and has been a regular participant since June 1989. The following tables reflect NFIP policy and claims data for the Town categorized by structure type, flood zone, Pre-FIRM and Post-FIRM.

**Table E.16 – NFIP Policy and Claims Data by Structure Type**

Structure Type	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
Single Family	26	\$13,473	\$7,059,100	5	\$114,402.89
2-4 Family	2	\$900	\$700,000	0	\$0.00
<b>Total</b>	<b>28</b>	<b>\$14,373</b>	<b>\$7,759,100</b>	<b>5</b>	<b>\$114,402.89</b>

Source: FEMA Community Information System, accessed May 2020

**Table E.17 – NFIP Policy and Claims Data by Flood Zone**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	12	\$7,848	\$2,839,600	3	\$27,590.23
B, C & X Zone					
Standard	3	\$1,578	\$754,500	1	\$10,473.56
Preferred	13	\$4,947	\$4,165,000	1	\$76,339.10
<b>Total</b>	<b>28</b>	<b>\$14,373</b>	<b>\$7,759,100</b>	<b>5</b>	<b>\$114,402.89</b>

Source: FEMA Community Information System, accessed May 2020

**Table E.18 – NFIP Policy and Claims Data Pre-FIRM**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	7	\$4,854	\$1,693,500	0	\$0.00
B, C & X Zone	6	\$2,625	\$1,734,500	1	\$10,473.56
Standard	1	\$678	\$54,500	1	\$10,473.56
Preferred	5	\$1,947	\$1,680,000	0	\$0.00
<b>Total</b>	<b>13</b>	<b>\$7,479</b>	<b>\$3,428,000</b>	<b>1</b>	<b>\$10,473.56</b>

Source: FEMA Community Information System, accessed May 2020

Table E.19 – NFIP Policy and Claims Data Post-FIRM

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	5	\$2,994	\$1,146,100	3	\$27,590.23
B, C & X Zone	10	\$3,900	\$3,185,000	1	\$76,339.10
Standard	2	\$900	\$700,000	0	\$0.00
Preferred	8	\$3,000	\$2,485,000	1	\$76,339.10
<b>Total</b>	<b>15</b>	<b>\$6,894</b>	<b>\$4,331,100</b>	<b>4</b>	<b>\$103,929.33</b>

Source: FEMA Community Information System, accessed May 2020

E.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Review methods of school construction to ensure that all new schools are constructed to the maximum cost feasible standards of wind resistance, flood resistance, and access so that they can be used as shelters for evacuees during and after natural hazard events.	All Hazards	1.2	High	Alamance County, Town of Elon	Elon University	2020-2025	Carried forward	Completed and continuing ongoing implementation. Elon University donated and built a new Elementary school for the residents of Elon and surrounding community. Built in 2019. Estimated cost \$19m.
P-2	Consider adopting a policy prohibiting the development of critical public facilities in the 100-year floodplain in cases where viable alternatives exist. Presently, most critical facilities located in the floodplain are waste pump stations because they must be located at low elevations because the handle gravity flowing sewage.	Flood	1.2	Moderate	Town of Elon Public Works Department, Town of Elon Planning Department	General Fund	2020-2025	Carried forward	Completed and continuing ongoing implementation. The Town of Elon Public Works along with Town of Elon Planning(TRC) coordinate an inventory of all public facilities and identify the facilities that are within the 100 year floodplain-if any.
P-3	Expand the County's Geographic Information System (GIS) capabilities to include maintaining Elevation Certificates in a computer database.	Flood	1.2	Moderate	Alamance County, Town of Elon	General Fund	2020-2025	Carried forward	Completed and continuing ongoing implementation. The Town of Elon works in conjunction with Alamance Co. GIS in computer based driven software on this.
P-4	Continue Town of Elon's participation in the National Flood Insurance Program (NFIP) so citizens are eligible for flood insurance.	Flood	1.2	Moderate	Town of Elon	General Fund	2020-2025	Carried Forward	Completed and continuing ongoing implementation. Elon actively participates in the NFIP for its citizens.
P-5	Review all fire districts coverage to ensure that there are adequate quantities of water for firefighting purposes and that all water points are maintained on a regular basis.	Wildfire	2.2	Moderate	Alamance County, Town of Elon Fire Department	General Fund	2020-2025	Carried forward	Completed and continuing ongoing implementation. Town of Elon contracts with 3rd party testing company to model and project needed water supplies for firefighting and domestic use on a yearly basis to keep up with growth and to help with FD ISO rating. Estimated cost \$10,000.
P-6	When the county land use plan is complete, create a land use map with an overlay of flood hazards and any other natural hazards that can be mapped.	All Hazards	1.2	Moderate	Town of Elon	N/A	2020-2025	Carried forward	Completed and continuing ongoing implementation. Town participated with Alamance Co EM on flood mapping. Mapping was completed in 2015-2016.
P-7	Direct Town of Elon to assess how it can better incorporate hazard mitigation plan goals and objectives into its planning and implementation of its duties with the County's plans.	All Hazards	1.2	Moderate	Alamance County/Town of Elon	General Fund	2020-2025	New	
Property Protection									
PP-1	Monitor reservoirs, lakes, and streams for potential flooding problems and note any unexpected flooding issues.	Flood	1.2	Moderate	Town of Elon, Alamance County	N/A	2020-2025	Carried forward	Completed and continuing ongoing implementation. No new flood risks were identified in the last five years, but the Town and the County will continue to monitor for any new potential flood issues within the area.
Structural Projects									
SP-1	Seek funding to the retrofit of critical facilities and Town-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, 320 or 361 compliant safe rooms, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	4.2	Moderate	Town Buildings and Inspections Department, Town Planning Department, Town Emergency Services	General Fund, Local, State Grants, UHMA Grants, other potential federal grants	2020-2025	Carried forward	The Towns TRC committee together with plans review have been able to review and approve all new construction builds from 2015-2020 particularly with new construction at Elon University with backup generators (where applicable and required by the NC Fire Code) along with fire resistant materials, wind retrofits and upgrades, as well as 911 communications requirements in buildings for effective radio transmissions.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Emergency Services									
ES-1	Meet annually with State Forester for Alamance County to improve coordination of wildfire control and response.	Wildfire	3.2	Moderate	Alamance County, Town of Elon Fire Department	NA	2020-2025	Carried forward	The Town of Elon FD conducts monthly meeting with the local arson task force and topics such as wildland fires are discussed occasionally with local FS Rep.
ES-2	Coordinate with the North Carolina Department of Transportation (NCDOT) to maintain adequate and effective snow and ice removal plans by the towns/cities and NCDOT. "Adequate" means that all major thoroughfares are cleared and remain clear within 12 hours of last snowfall.	Severe Winter Weather	2.2	Moderate	Town of Elon	General Fund	2020-2025	Carried forward	The Town's Public Works Department provided completed snow removal from the Towns streets during every snow storm from 2015-2020. This was for any storm which produced enough precipitation to cover the roads and maintained them clear.
Public Education & Awareness									
PEA-1	Encourage builders, developers, and architects to become familiar with the National Flood Insurance Program (NFIP) land use and building standards by attending annual workshops presented by the North Carolina Division of Emergency Management (NCEM). This can be accomplished by creating a mailing list and providing it to NCEM to use for its announcements. This task can be further supported by distributing copies of NCEM's announcements from the Alamance County Inspections Department when builders and developers apply for permits.	Flood	1.2	Moderate	Town of Elon	General Fund	2020-2025	Carried forward	The Town of Elon along with Alamance County provides this information during the Town's Technical Review Committee meetings with contractors, architects, etc. The Town continues to provide this information to the institutions with the most development activity such as Elon University, Blakey Hall and Twin Lakes Retirement Centers. A link to the Flood Damage Prevention Ordinance has been placed on the Town's website.
PEA-2	Encourage citizens and businesses/industries to develop emergency preparedness plans.	All Hazards	2.1	Moderate	Town of Elon	General Fund	2020-2025	Carried forward	The Town will continue to coordinate efforts to meet with the major institutions and businesses (Elon University, Twin Lakes, Blakey Hall, Labcorp, Carolina Biological, Sonoco, and Engineering Controls) to encourage continued development of their plans as their operations expand.
PEA-3	Encourage homeowners to review insurance policies as part of an overall family disaster plan.	All Hazards	2.1	Moderate	Town of Elon	Staff Time	2020-2025	Carried forward	The Town of Elon FD's Emergency Management currently maintains an updated preparedness page on their website. This information will continue to be updated periodically to help inform town residents.
PEA-4	Increase awareness of the natural hazards potential to local officials, the general public, and private industry.	All Hazards	2.1	Moderate	Town of Elon	Staff Time	2020-2025	Carried forward	In the Town of Elon FD preparedness page on the Town's website and a link also is added to the Alamance Co. Emergency Preparedness website.
PEA-5	Maintain hazard mitigation plan and floodplain information on the Town's website (www.elonnc.com).	All Hazards	2.1	Moderate	Town of Elon	Staff Time	2020-2025	Carried forward	The website carries you to the Hazard Mitigation Plan, NFIP website, and flood damage prevention ordinance (which is already in the Planning Departments documentation for download).
PEA-6	Maintain documents about flood insurance, flood protections, floodplain management, and natural and beneficial functions of floodplains at the local libraries and government offices.	Flood	2.1	Moderate	Town of Elon, Alamance County	General Fund	2020-2025	Carried forward	The Town of Elon is the FEMA repository for all related documents within its jurisdiction. The Town also works closely in conjunction with Alamance County concerning flooding issues.
PEA-7	Maintain GIS system at www.alamance-nc.com. From this site anyone from a private citizen, builder, insurance company, etc. can see if a property is located in the 1-percent-annual-chance (100-year) floodplain.	Flood	2.1	Moderate	Alamance County	Staff Time	2020-2025	Carried forward	The Town provides a link on the Town's website to the County's GIS. The Town will continue to maintain this link.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
PEA-8	Provide local real estate agents with handouts that will advise potential buyers to investigate the flood hazard for the property they are considering purchasing.	Flood	2.1	Moderate	Town of Elon	Staff Time	2020-2025	Carried forward	The Town provides links or info to the County GIS and NC FRIS website.
PEA-9	Educate citizens to listen for the watches and warnings issued by the National Weather Service	Flood	2.2	Moderate	Town of Elon	Staff Time	2020-2025	Carried forward	The Town of Elon in conjunction with Alamance Co. inform the residents via website as well as the countywide emergency alert system, Nixle, of upcoming warnings and watches.



## Annex F Town of Green Level

### F.1 PLANNING PROCESS

The table below lists the HMPC members who represented the Town of Green Level.

**Table F.1 – HMPC Members**

Representative	Position or Title
Dylan Galloway	Town Administrator
Rodney Gunn	Public Works Director

### F.2 COMMUNITY PROFILE

#### Geography

The Town of Green Level is located in central Alamance County, north of the Town of Haw River. Green Level is part of the Burlington, NC Metropolitan Statistical Area. The Town comprises a total area of 1.4 square miles.

#### Population and Demographics

Table F.2 provides population counts and growth estimates for the Town of Green Level as compared to Alamance County and the Eno-Haw region overall. Table F.3 provides demographic information for Green Level as compared to the county and the state.

**Table F.2 – Population Counts, Green Level, 2010-2018**

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
Town of Green Level	2,042	2,100	2,153	53	2.5%
<b>Alamance County</b>	<b>130,800</b>	<b>146,902</b>	<b>160,576</b>	<b>13,674</b>	<b>9.3%</b>
<b>Region Total</b>	<b>507,964</b>	<b>567,634</b>	<b>649,276</b>	<b>81,642</b>	<b>14.4%</b>

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

**Table F.3 – Demographic and Social Characteristics, Green Level, 2018**

Demographic & Social Characteristics	Green Level	Alamance County	North Carolina
Median Age	34.6	39.5	38.6
% of Population Under 5 years old	11.4	5.8	5.9
% of population Over 65 years old	14.4	16.4	15.5
% of Population Over 25 with high school diploma	76.8%	85.5%	87.4%
% of Population Over 25 with bachelor's degree or higher	5.8%	24.0%	30.5%
% with Disability	15.7%	14.3	13.6
% Speak English less than "very well"	14.9%	5.5	4.6

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

#### Housing

The table below details key housing statistics for Green Level as compared to the County overall.

**Table F.4 – Housing Statistics, Green Level, 2010-2018**

Housing Characteristics	Green Level	Alamance County
Housing Units (2010)	909	66,576
Housing Units (2018)	886	69,749
Housing Units Percent Change (2010-2018)	-2.5%	4.8%
Housing Occupancy Rate	89.2%	91.8%
% Owner-Occupied	66.1	65.0%
Average Household Size	2.72	2.43
% of Housing Units with no Vehicles Available	7.8	5.3%
% of Housing Units that are mobile homes	41.5	12.0%
Median Home Value	\$71,600	\$147,800

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2014-2018 5-Year Estimates

### Economy

The following tables present key economic statistics for Green Level as compared to the county and the state.

**Table F.5 – Economic Statistics, Green Level, 2018**

Demographic & Social Characteristics	Green Level	Alamance County	North Carolina
Median Household Income	31,627	\$45,735	\$52,413
Per Capita Income	14,790	\$26,215	\$29,456
Unemployment Rate	6.5%	5.7%	6.3%
% of Individuals Below Poverty Level	26.0	16.8	15.4
% Without Health Insurance	20.3	11.9	11.1

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

## F.3 RISK ASSESSMENT

This section contains a summary of the Town's asset inventory as well as hazard profile and vulnerability assessment for those hazards that are spatially defined and have variations in risk that could be evaluated quantitatively on a jurisdictional level. The hazards included in this section are: Flood and Wildfire.

### Asset Inventory

The following tables summarize the asset inventory for the Town of Green Level in order to estimate the total physical exposure to hazards in this area. No specific critical facilities in or near the Town were identified in IRISK from the Critical Infrastructure & Key Resources (CIKR) dataset, therefore there is no map of critical facilities for Green Level. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted.

Building counts are provided based on data from the NCEM IRISK database, and supplemental parcel exposure is based on November 2019 county parcel data.

Table F.6 – Critical Infrastructure &amp; Key Resources by Type

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	Defense	Government Facilities	Healthcare	IT	National Monuments and Icons	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Green Level	15	0	0	76	0	16	0	5	0	0	0	0	0	7	1	0	0	120

Source: NCEM Risk Management Tool

Table F.7 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Green Level	0	1	4	1	0	0	1	7

Source: NCEM Risk Management Tool

Table F.8 – IRISK Inventory of Building Counts and Values

Jurisdiction	Building Count	Building Value
Town of Green Level	1,177	\$113,426,782

Source: NCEM Risk Management Tool

To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Eno-Haw Region, current parcel data was evaluated to identify recent development that was not included in NCEM's IRISK database. The building footprint layer from IRISK was compared to current parcel data; any parcels with an improved value that did not already have a building in IRISK were summarized in the table below. This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

Table F.9 – Parcels Development Not Included in IRISK, November 2019

Jurisdiction	Improved Parcel Count	Total Improved Value
Green Level	286	\$38,970,385

Source: County parcel data, retrieved November 2019; IRISK database building footprints

### F.3.1 Flood

Table F.10 details the acreage of the Town of Green Level by flood zone on the effective DFIRM. Per this assessment, less than 1 percent of Green Level falls within the mapped 1%-annual-chance floodplains.

Table F.10 – Flood Zone Acreage in the Town of Green Level

Flood Zone	Acreage	Percent of Total (%)
Zone AE	6.7	0.7
Zone X (500-year)	1.6	0.2
Zone X Unshaded	947.5	99.1
<b>Total</b>	<b>955.8</b>	<b>--</b>

Source: FEMA Effective DFIRM

Figure F.1 reflects the effective mapped flood hazard zones for the Town of Green Level, and Figure F.2 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the region, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below and compared to total recent development counts and values. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. Additionally, this assessment does not evaluate flood impacts or provide damage estimates. According to this assessment, less than one percent of recent development in Green Level is located in or near the SFHA.

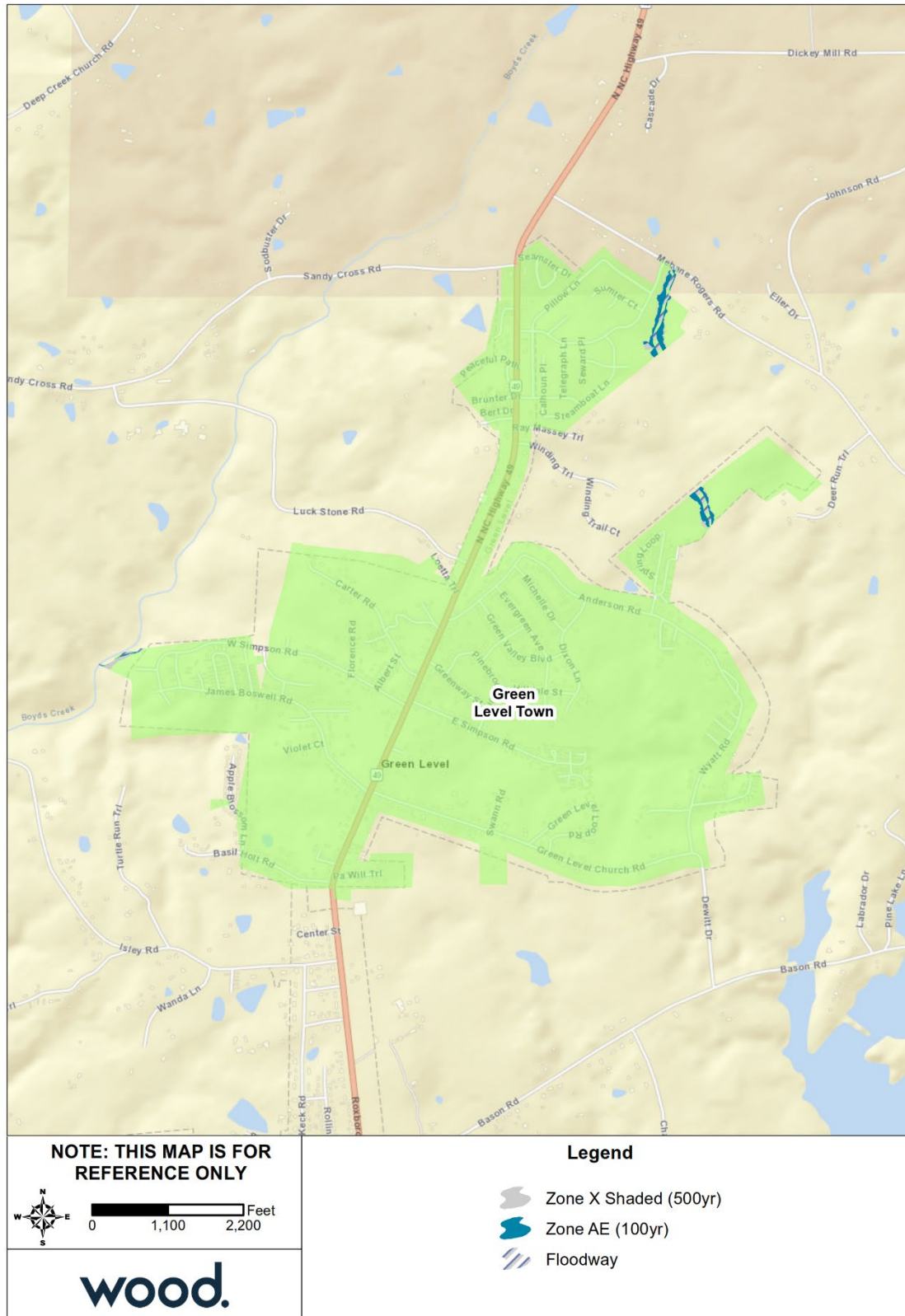
**Table F.11 – Recent Development at Risk to Flood, Town of Green Level**

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
1	\$78,651	0.3%	0.2%

Source: Parcel data retrieved November 2019; FEMA Effective DFIRM

There are no critical facilities or high potential loss properties with estimated flood damages in the Town of Green Level.

Figure F.1 – FEMA Flood Hazard Areas, Town of Green Level



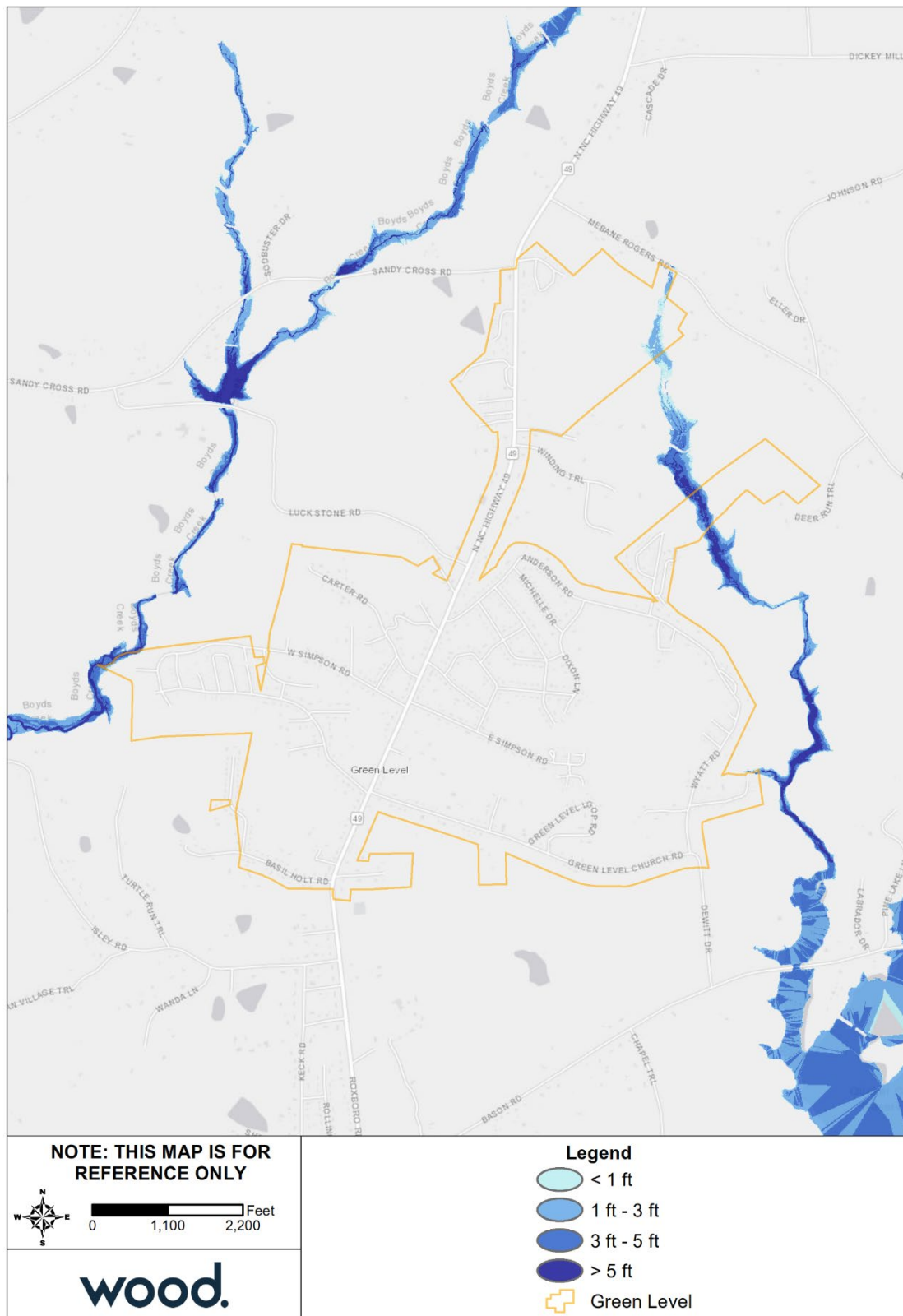
Source: FEMA Effective DFIRM

Eno-Haw

Regional Hazard Mitigation Plan  
2020



Figure F.2 – Flood Depth, 1%-Annual-Chance Floodplain, Town of Green Level



Source: FEMA Effective DFIRM

Eno-Haw

Regional Hazard Mitigation Plan  
2020

### F.3.2 Wildfire

Table F.12 summarizes the acreage in the Town of Green Level that falls within the Wildland Urban Interface (WUI), categorized by housing density. Areas in the WUI are those where development may intermix with flammable vegetation. Only 0.3 percent of the Town of Green Level is not included in the WUI.

**Table F.12 – Wildland Urban Interface Acreage, Town of Green Level**

	Housing Density	Total Acreage	Percent of Total Acreage
	<i>Not in WUI</i>	2.53	0.3%
	LT 1hs/40ac	2.13	0.2%
	1hs/40ac to 1hs/20ac	6.66	0.7%
	1hs/20ac to 1hs/10ac	23.37	2.4%
	1hs/10ac to 1hs/5ac	63.17	6.6%
	1hs/5ac to 1hs/2ac	148.93	15.6%
	1hs/2ac to 3hs/1ac	708.99	74.2%
	<b>Total</b>	<b>955.80</b>	

Source: Southern Wildfire Risk Assessment

Figure A.5 depicts the WUI for all incorporated areas in Alamance County, including the Town of Green Level. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure A.6 depicts Burn Probability for all of Alamance County based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Figure F.3 depicts the Fire Intensity Scale; which indicates the potential severity of fire based on fuel loads, topography, and other factors; in order to detail potential wildfire extent in the Town of Green Level. There is moderate potential fire intensity spread throughout the Town. Overall, 17.6% of the Town has a Class 3 fire intensity but less than 1 percent has a Class 4 fire intensity.

Table F.13 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table F.14 provides counts and estimated damages for High Potential Loss Properties in the Town of Green Level.

**Table F.13 – Critical Facilities Exposed to Wildfire, Town of Green Level**

Sector	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	24	\$5,478,827
Critical Manufacturing	4	\$4,660,160
Energy	1	\$10,000,000
Food and Agriculture	15	\$530,587
Government Facilities	4	\$1,883,515
Transportation Systems	6	\$1,773,070
<b>All Categories</b>	<b>54</b>	<b>\$24,326,159</b>

Source: NCEM Risk Management Tool

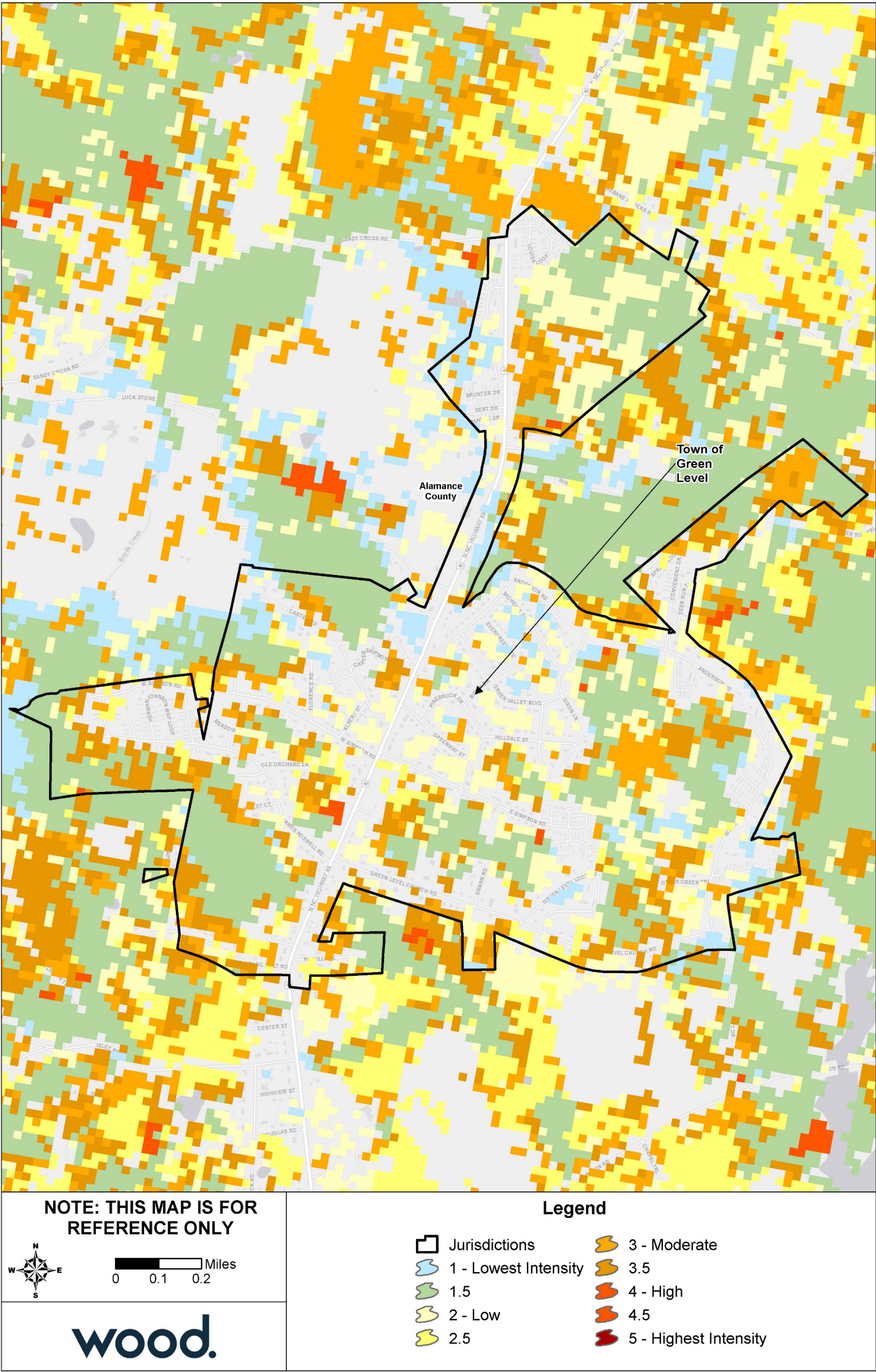
**Table F.14 – High Potential Loss Properties Exposed to Wildfire, Town of Green Level**

Category	Number of Buildings at Risk	Estimated Damages
Government	1	\$1,253,360
Industrial	1	\$4,132,142
Utilities	1	\$10,000,000
<b>All Categories</b>	<b>3</b>	<b>\$15,385,502</b>

Source: NCEM Risk Management Tool



Figure F.3 – Fire Intensity Scale, Town of Green Level



Source: Southern Wildfire Risk Assessment



## F.4 CAPABILITY ASSESSMENT

### F.4.1 Overall Capability

Details on the tools and resources in place and available to the Town of Green Level are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Green Level has a low overall capability rating. The Town relies significantly on Alamance County for regulatory and planning support. The Town has limited administrative, fiscal, and outreach capability and no structural mitigation experience.

### F.4.2 Floodplain Management

The Town of Green Level joined the NFIP as a regular participant in August 2007. There is one active policy in force in the Town. The policy is for a post-FIRM built single family residence in the B, C, and X Zone. It is a preferred risk policy with a total premium of \$320 providing \$210,000 of insurance in force.

F.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Review the subdivision regulations and make appropriate changes to encourage alternatives to placing lots in flood-prone areas and to minimize impervious surface coverings, if necessary.	Flood	1.2	Moderate	Town of Green Level	Local	2020-2025	Carried forward	No progress was made due to administrative limitations.
P-2	Discourage the public and developers from developing property in flood zones.	Flood	1.2	Moderate	Town of Green Level	Local	2020-2025	Carried forward	No progress made due to administrative limitations.
P-3	Expand the County's Geographic Information System (GIS) capabilities to include maintaining Elevation Certificates in a computer database	Flood	1.2	Low	Alamance County	Local, County	2020-2025	Carried forward	The Town now maintains ECs, but they are not yet made available on the County's GIS website.
P-4	Continue the Town of Green Level's participation in the National Flood Insurance Program (NFIP) so citizens are eligible for flood insurance.	Flood	1.2	Moderate	Town of Green Level	Local, County	2020-2025	Carried forward	The Town has remained an active participant in the NFIP.
P-5	Review all fire districts coverage to ensure that there are adequate quantities of water for firefighting purposes and that all water points are maintained on a regular basis.	Wildfire	2.2	Moderate	Town of Green Level, Town of Haw River	Local, County	2020-2025	Carried forward	No progress was made due to administrative limitations.
P-6	When the county land use plan is complete, create a land use map with an overlay of flood hazards and any other natural hazards that can be mapped.	All Hazards	1.2	Moderate	Town of Green Level	Local, County	2020-2025	Carried forward	County land use plan is now under development.
Structural Projects									
SP-1	Seek funding to the retrofit of critical facilities and Town-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	4.2	Moderate	Town Buildings and Inspections Department, Town Planning Department, Town Emergency Services	Local, State Grants, UHMA Grants, other potential federal grants	2020-2025	Carried forward	No progress was made due to limited administrative and fiscal resources.
SP-2	Seek funding for the installation of backup generators or quick connect hook ups for mobile generators on any newly constructed and existing county critical facilities.	All Hazards	4.2	Moderate	Town Buildings and Inspections Department, Town Planning Department, Town Emergency Services	Local, State Grants, UHMA Grants, other potential federal grants	2020-2025	Carried forward	No progress was made due to limited administrative and fiscal resources.
Emergency Services									
ES-1	Meet annually with State Forester for Alamance County to improve coordination of wildfire control and response.	Wildfire	3.2	Moderate	Town of Green Level, Town of Haw River	Local, County	2020-2025	Carried forward	No progress was made due to limited staff resources.
Public Education & Awareness									
PEA-1	Encourage residents to sign up for the countywide emergency notification system. Greater awareness of hazard events will help make residents more aware of their risks and encourage them to take preparedness and property protection actions to mitigate their individual hazard risk.	All Hazards	2.1	Moderate	Town of Green Level	Local	2020-2025	New	



## Annex G Town of Haw River

### G.1 PLANNING PROCESS

The table below lists the HMPC members who represented the Town of Haw River.

**Table G.1 – HMPC Members**

Representative	Position or Title
Sean Tencer	Town Manager
Jamie Joseph	Fire Chief
Buddy Boggs	Mayor
Lee Lovette	Mayor Pro-Tem

### G.2 COMMUNITY PROFILE

#### Geography

The Town of Haw River is located in central Alamance County. It is neighbored by Graham to the south, Burlington to the west, and Green Level to the north. The Town is part of the Burlington, NC Metropolitan Statistical Area. Haw River comprises a total land area of 2.9 square miles.

#### Population and Demographics

Table G.2 provides population counts and growth estimates for the Town of Haw River as compared to Alamance County and the Eno-Haw region. Table G.3 provides demographic information for Haw River as compared to the county and the state.

**Table G.2 – Population Counts, Haw River, 2010-2018**

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
Town of Haw River	1,908	2,298	2,516	218	9.5%
<b>Alamance County</b>	<b>130,800</b>	<b>146,902</b>	<b>160,576</b>	<b>13,674</b>	<b>9.3%</b>
<b>Region Total</b>	<b>507,964</b>	<b>567,634</b>	<b>649,276</b>	<b>81,642</b>	<b>14.4%</b>

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

**Table G.3 – Demographic and Social Characteristics, Haw River, 2018**

Demographic & Social Characteristics	Haw River	Alamance County	North Carolina
Median Age	39.0	39.5	38.6
% of Population Under 5 years old	7.4	5.8	5.9
% of population Over 65 years old	15.6	16.4	15.5
% of Population Over 25 with high school diploma	83.1%	85.5%	87.4%
% of Population Over 25 with bachelor's degree or higher	13.1%	24.0%	30.5%
% with Disability	14.0%	14.3	13.6
% Speak English less than "very well"	9.7%	5.5	4.6

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

#### Housing

The following table details key housing statistics for Haw River as compared to the County overall.

#### Eno-Haw

Regional Hazard Mitigation Plan  
2020

Table G.4 – Housing Statistics, Haw River, 2010-2018

Housing Characteristics	Haw River	Alamance County
Housing Units (2010)	1,035	66,576
Housing Units (2018)	1,145	69,749
Housing Units Percent Change (2010-2018)	10.6%	4.8%
Housing Occupancy Rate	91.6%	91.8%
% Owner-Occupied	69.3	65.0%
Average Household Size	2.39	2.43
% of Housing Units with no Vehicles Available	5.4	5.3%
% of Housing Units that are mobile homes	17.9	12.0%
Median Home Value	\$103,600	\$147,800

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2014-2018 5-Year Estimates

### Economy

The following tables present key economic statistics for Haw River as compared to the county and the state.

Table G.5 – Economic Statistics, Haw River, 2018

Demographic & Social Characteristics	Haw River	Alamance County	North Carolina
Median Household Income	36,971	\$45,735	\$52,413
Per Capita Income	20,431	\$26,215	\$29,456
Unemployment Rate	0.8%	5.7%	6.3%
% of Individuals Below Poverty Level	10.6	16.8	15.4
% Without Health Insurance	19.6	11.9	11.1

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

## G.3 RISK ASSESSMENT

This section contains a summary of the Town's asset inventory as well as hazard profile and vulnerability assessment for those hazards that are spatially defined and have variations in risk that could be evaluated quantitatively on a jurisdictional level. The hazards included in this section are: Dam Failure, Flood, and Wildfire.

### Asset Inventory

The following tables summarize the asset inventory for the Town of Haw River in order to estimate the total physical exposure to hazards in this area. The locations of critical facilities are shown in Figure G.1. Critical facilities are a subset of identified assets from the Critical Infrastructure & Key Resources (CIKR) dataset. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted and displayed.

Building counts are provided based on data from the NCEM IRISK database, and supplemental parcel exposure is based on November 2019 county parcel data.

Table G.6 – Critical Infrastructure &amp; Key Resources by Type

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	Defense	Government Facilities	Healthcare	IT	National Monuments and Icons	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Haw River	22	0	0	104	1	60	0	5	1	0	0	0	0	6	3	1	10	213

Source: NCEM Risk Management Tool

Table G.7 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Haw River	0	5	13	1	0	5	6	30

Source: NCEM Risk Management Tool

Table G.8 – IRISK Inventory of Building Counts and Values

Jurisdiction	Building Count	Building Value
Town of Haw River	2,352	\$409,669,987

Source: NCEM Risk Management Tool

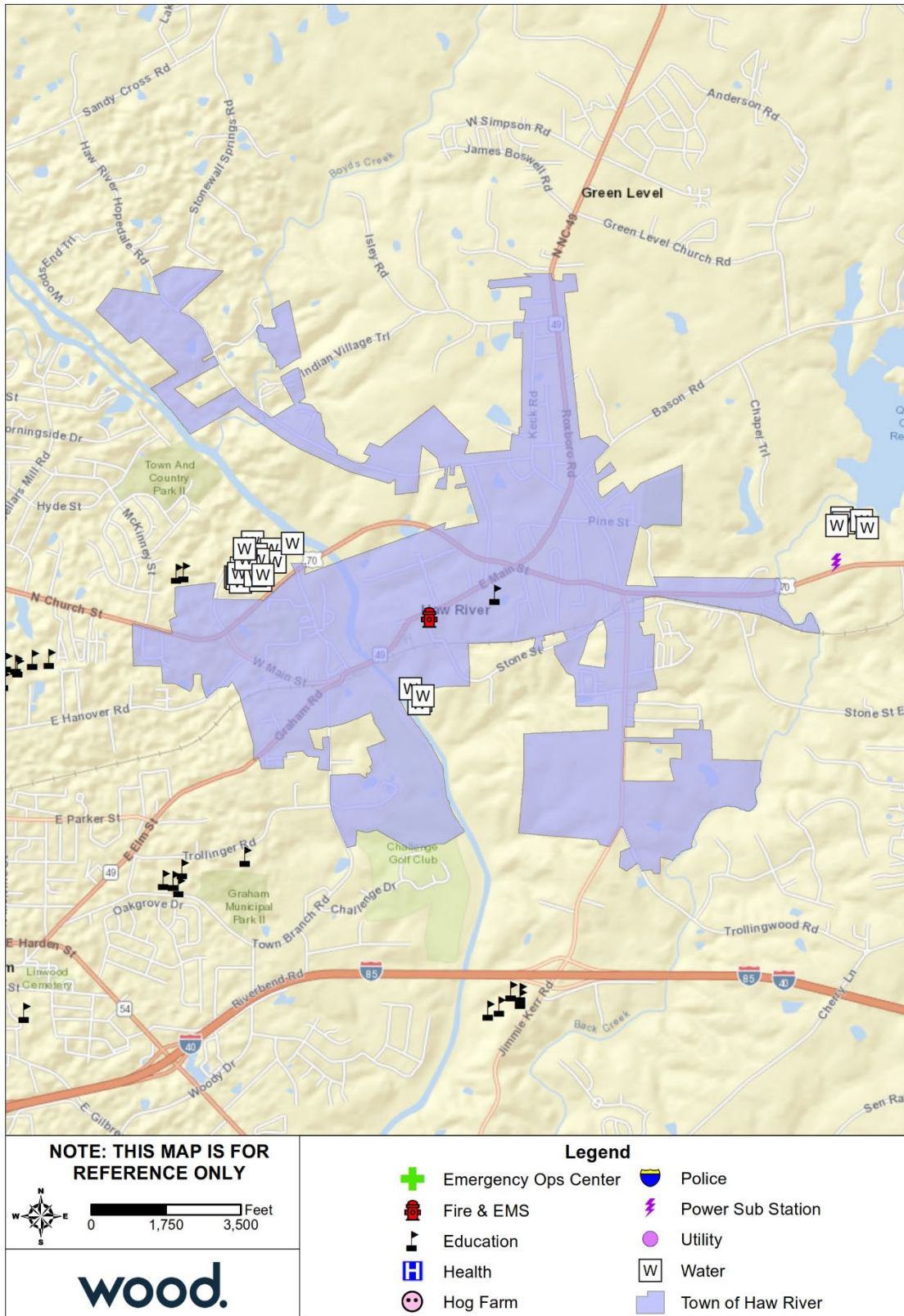
To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Eno-Haw Region, current parcel data was evaluated to identify recent development that was not included in NCEM's IRISK database. The building footprint layer from IRISK was compared to current parcel data; any parcels with an improved value that did not already have a building in IRISK were summarized in the table below. This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

Table G.9 – Parcels Development Not Included in IRISK, November 2019

Jurisdiction	Improved Parcel Count	Total Improved Value
Haw River	92	\$10,716,505

Source: County parcel data, retrieved November 2019; IRISK database building footprints

Figure G.1 – Critical Facilities, Town of Haw River



Source: NCEM IRISK Database, GIS Analysis

Eno-Haw

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2020

### G.3.1 Dam Failure

According to the North Carolina Dam Inventory as of July 2018, the Town of Haw River is the nearest downstream location to two high hazard dams located in unincorporated Alamance County, Forest Lake Dam and Back Creek Reservoir. Forest Lake Dam was in poor condition at the time of its last inspection.

### G.3.2 Flood

Table G.10 details the acreage of the Town of Haw River by flood zone on the effective DFIRM. Per this assessment, over 10 percent of Haw River falls within the mapped 1%-annual-chance floodplains.

**Table G.10 – Flood Zone Acreage in the Town of Haw River**

Flood Zone	Acreage	Percent of Total (%)
Zone AE	192.1	10.2
Zone X (500-year)	33.7	1.8
Zone X Unshaded	1,652.8	88.0
<b>Total</b>	<b>1,878.6</b>	<b>--</b>

Source: FEMA Effective DFIRM

Figure G.2 reflects the effective mapped flood hazard zones for the Town of Haw River, and Figure G.3 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the region, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below and compared to total recent development counts and values. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. Additionally, this assessment does not evaluate flood impacts or provide damage estimates. According to this assessment, only 4.3 percent of recent development in Haw River is located in or near the SFHA.

**Table G.11 – Recent Development at Risk to Flood, Town of Haw River**

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
4	\$493,875	4.3%	4.6%

Source: Parcel data retrieved November 2019; FEMA Effective DFIRM

Table G.12 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector and flood event in the Town of Haw River. Table G.13 summarizes high potential loss property vulnerability by sector and flood event.

**Table G.12 – Critical Facilities Exposed to Flooding, Town of Haw River**

Sector	Event	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	25 Year	2	\$3,913
	50 Year	2	\$14,702
	100 Year	2	\$24,658
	500 Year	3	\$74,673
Critical Manufacturing	500 Year	2	\$4,237
Food and Agriculture	100 Year	1	\$4,481
	500 Year	1	\$21,500



## ANNEX G: TOWN OF HAW RIVER

Sector	Event	Number of Buildings at Risk	Estimated Damages
Water	25 Year	1	\$243
	50 Year	1	\$515
	100 Year	3	\$2,482
	500 Year	4	\$1,810,438
All Categories	25 Year	3	\$4,156
	50 Year	3	\$15,217
	100 Year	6	\$31,621
	500 Year	10	\$1,910,848

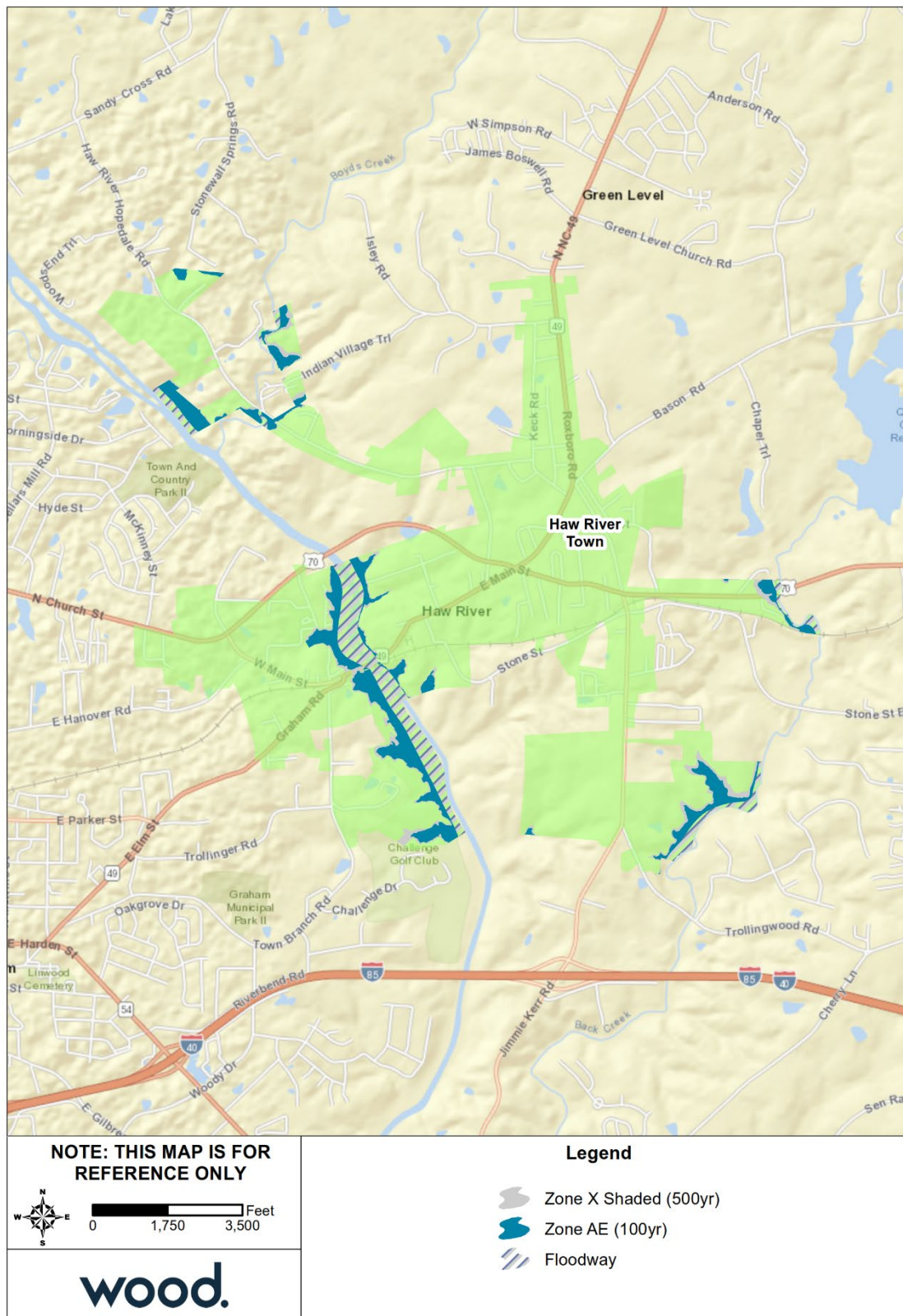
Source: NCEM Risk Management Tool

**Table G.13 – High Potential Loss Properties Exposed to Flooding, Town of Haw River**

Category	Event	Number of Buildings at Risk	Estimated Damages
Utilities	500 Year	1	\$1,802,168

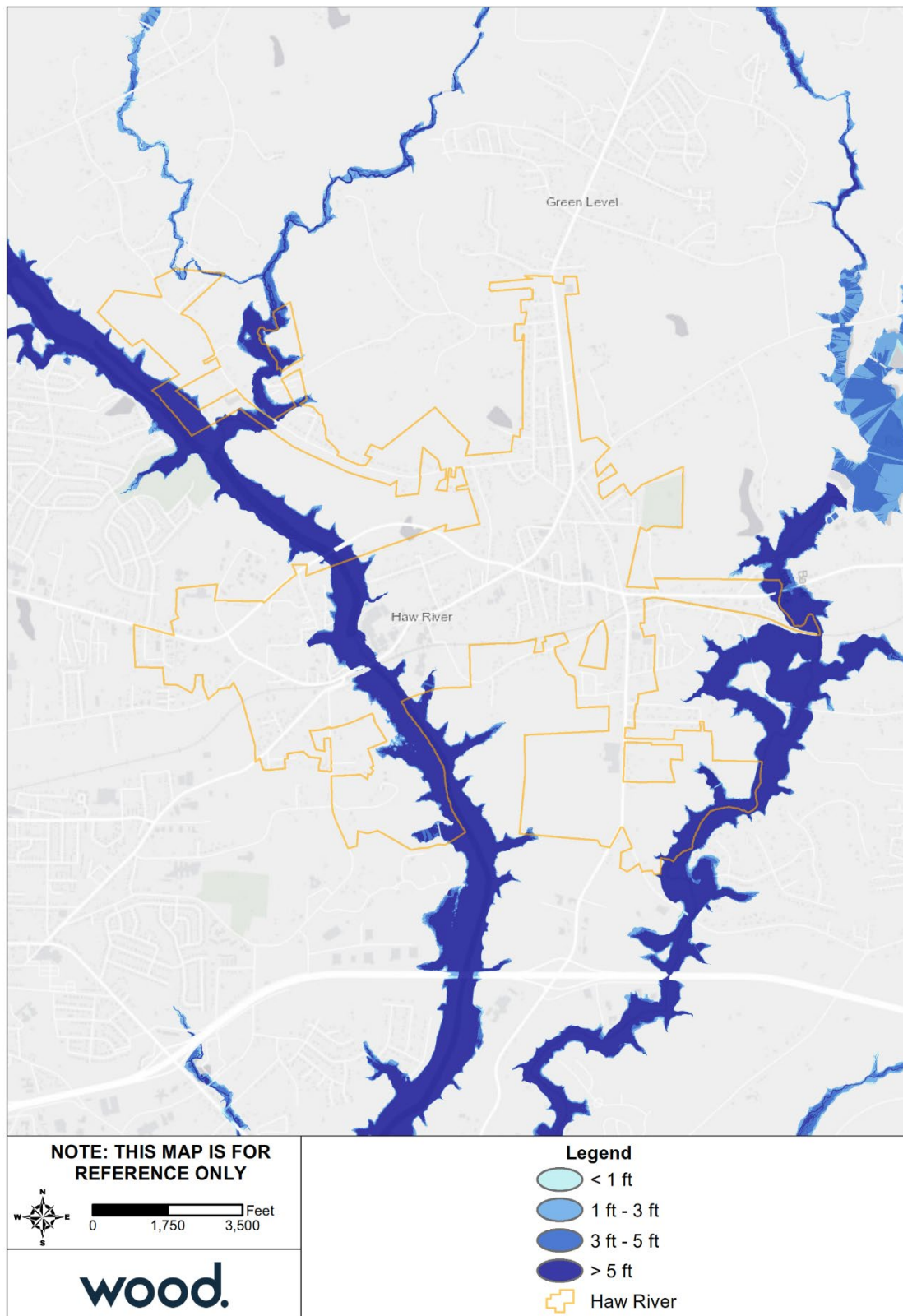
Source: NCEM Risk Management Tool

Figure G.2 – FEMA Flood Hazard Areas, Town of Haw River



Source: FEMA Effective DFIRM

Figure G.3 – Flood Depth, 1%-Annual-Chance Floodplain, Town of Haw River



Source: FEMA Effective DFIRM

### G.3.3 Wildfire

Table G.14 summarizes the acreage in the Town of Haw River that falls within the Wildland Urban Interface (WUI), categorized by housing density. Areas in the WUI are those where development may intermix with flammable vegetation. Over 12 percent of the Town of Haw River is not included in the WUI.

**Table G.14 – Wildland Urban Interface Acreage, Town of Haw River**

	Housing Density	Total Acreage	Percent of Total Acreage
	<i>Not in WUI</i>	228.96	12.2%
	LT 1hs/40ac	63.86	3.4%
	1hs/40ac to 1hs/20ac	86.49	4.6%
	1hs/20ac to 1hs/10ac	105.17	5.6%
	1hs/10ac to 1hs/5ac	162.61	8.7%
	1hs/5ac to 1hs/2ac	397.74	21.2%
	1hs/2ac to 3hs/1ac	833.82	44.4%
	<b>Total</b>	<b>1,878.65</b>	

Source: Southern Wildfire Risk Assessment

Figure A.5 depicts the WUI for all incorporated areas in Alamance County, including the Town of Haw River. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure A.6 depicts Burn Probability for all of Alamance County based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Figure G.4 depicts the Fire Intensity Scale; which indicates the potential severity of fire based on fuel loads, topography, and other factors; in order to detail potential wildfire extent in the Town of Haw River. There are pockets of moderate potential fire intensity in northwestern and southeastern Haw River, but overall less than one percent of the Town has a Class 4 fire intensity rating and only 11 percent has a Class 3 fire intensity.

Table G.15 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table G.16 provides counts and estimated damages for High Potential Loss Properties in the Town of Haw River.

**Table G.15 – Critical Facilities Exposed to Wildfire, Town of Haw River**

Sector	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	64	\$33,851,312
Communications	1	\$254,880
Critical Manufacturing	28	\$35,442,896
Emergency Services	1	\$785,723
Food and Agriculture	21	\$1,146,335
Government Facilities	4	\$2,075,942
Healthcare and Public Health	1	\$235,368
Transportation Systems	2	\$400,487
Water	7	\$51,695,441
<b>All Categories</b>	<b>129</b>	<b>\$125,888,384</b>

Source: NCEM Risk Management Tool

**Table G.16 – High Potential Loss Properties Exposed to Wildfire, Town of Haw River**

Category	Number of Buildings at Risk	Estimated Damages
Commercial	4	\$10,914,599

## ANNEX G: TOWN OF HAW RIVER

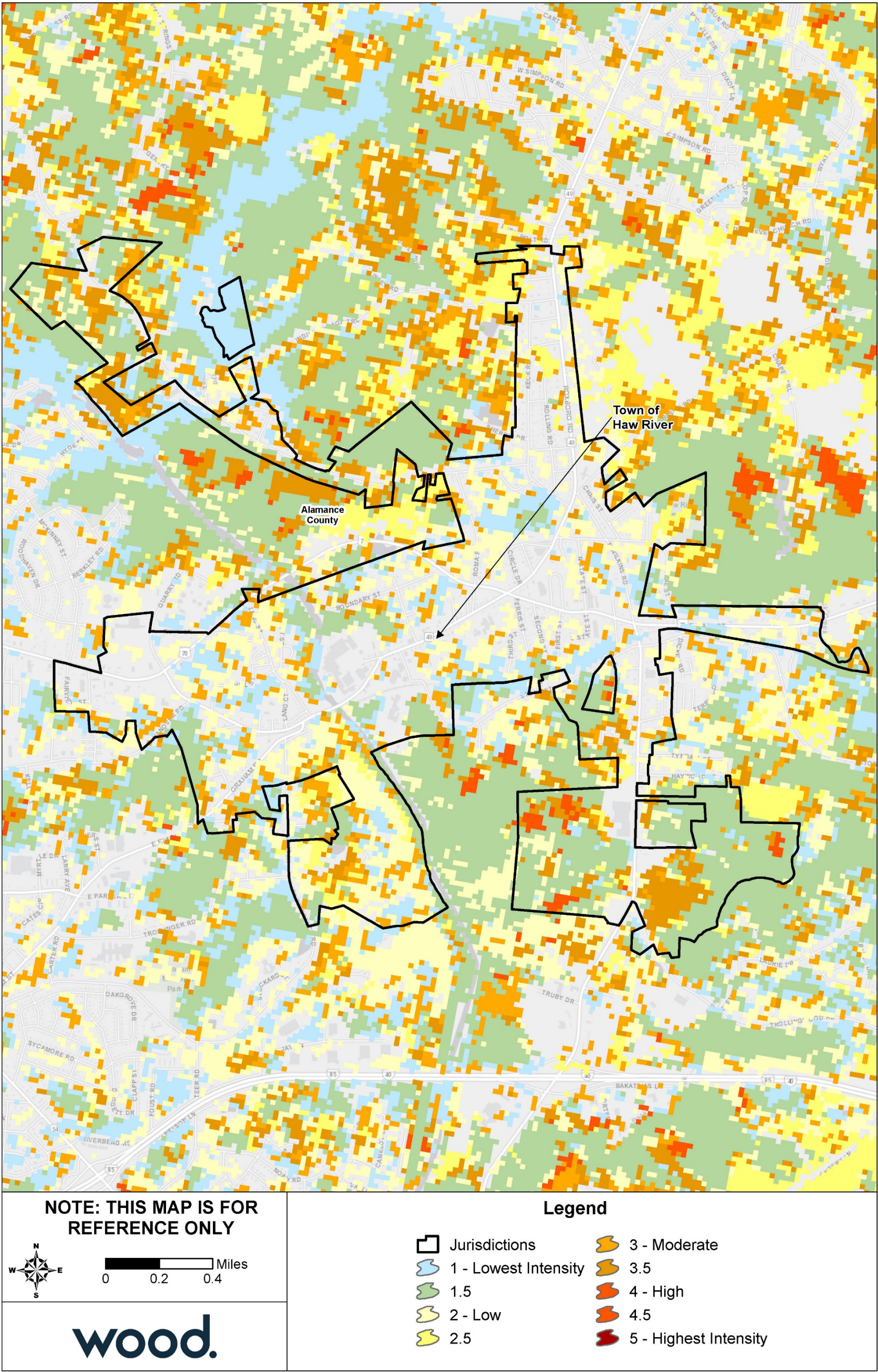
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Category	Number of Buildings at Risk	Estimated Damages
Government	1	\$1,762,394
Industrial	6	\$27,595,725
Religious	5	\$8,839,353
Utilities	2	\$51,274,685
<b>All Categories</b>	<b>18</b>	<b>\$100,386,756</b>

Source: NCEM Risk Management Tool



Figure G.4 – Fire Intensity Scale, Town of Haw River



Source: Southern Wildfire Risk Assessment



## G.4 CAPABILITY ASSESSMENT

### G.4.1 Overall Capability

Details on the tools and resources in place and available to the Town of Haw River are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Haw River has a low overall capability rating. The Town relies on Alamance County for regulatory and planning support. The Town has limited administrative, fiscal, and outreach capability and no structural mitigation experience.

### G.4.2 Floodplain Management

The Town of Haw River joined the NFIP through emergency entry in August 1975 and has been a regular participant since November 1980. The following tables reflect NFIP policy and claims data for the Town categorized by structure type, flood zone, Pre-FIRM and Post-FIRM.

**Table G.17 – NFIP Policy and Claims Data by Structure Type**

Structure Type	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
Single Family	4	\$3,362	\$705,100	1	\$60,000.00
2-4 Family	1	\$392	\$210,000	0	\$0.00
Non Residential	5	\$23,733	\$2,600,000	0	\$0.00
<b>Total</b>	<b>10</b>	<b>\$27,487</b>	<b>\$3,515,100</b>	<b>1</b>	<b>\$60,000.00</b>

Source: FEMA Community Information System, accessed May 2020

**Table G.18 – NFIP Policy and Claims Data by Flood Zone**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	6	\$21,202	\$1,855,100	1	\$60,000.00
B, C & X Zone					
Standard	1	\$392	\$210,000	0	\$0.00
Preferred	3	\$5,893	\$1,450,000	0	\$0.00
<b>Total</b>	<b>10</b>	<b>\$27,487</b>	<b>\$3,515,100</b>	<b>1</b>	<b>\$60,000.00</b>

Source: FEMA Community Information System, accessed May 2020

**Table G.19 – NFIP Policy and Claims Data Pre-FIRM**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	5	\$20,926	\$1,695,000	1	\$60,000.00
B, C & X Zone	3	\$5,893	\$1,450,000	0	\$0.00
Standard	0	\$0	\$0	0	\$0.00
Preferred	3	\$5,893	\$1,450,000	0	\$0.00
<b>Total</b>	<b>8</b>	<b>\$26,819</b>	<b>\$3,145,000</b>	<b>1</b>	<b>\$60,000.00</b>

Source: FEMA Community Information System, accessed May 2020

Table G.20 – NFIP Policy and Claims Data Post-FIRM

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	1	\$276	\$160,100	0	\$0.00
B, C & X Zone	1	\$392	\$210,000	0	\$0.00
Standard	1	\$392	\$210,000	0	\$0.00
Preferred	0	\$0	\$0	0	\$0.00
<b>Total</b>	<b>2</b>	<b>\$668</b>	<b>\$370,100</b>	<b>0</b>	<b>\$0.00</b>

Source: FEMA Community Information System, accessed May 2020

G.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Expand the County's Geographic Information System (GIS) capabilities to include maintaining Elevation Certificates in a computer database.	Flood	1.2	Moderate	Alamance County GIS Department	Local, County	2020-2025	Carried forward	The Town of Haw River now maintains ECs and will work in conjunction with Alamance County GIS Department to make them available in a computer database.
P-2	Continue Town of Haw River's participation in the National Flood Insurance Program (NFIP) so citizens are eligible for flood insurance.	Flood	1.2	Moderate	Town of Haw River	Local	2020-2025	Carried forward	The Town of Haw River has participated in the NFIP Program since 07/18/1975.
P-3	When the county land use plan is complete, create a land use map with an overlay of flood hazards and any other natural hazards that can be mapped.	All Hazards	1.2	Moderate	Town of Haw River	Local, County	2020-2025	Carried forward	The Town is now working on a new comprehensive plan to be completed in Fall 2020. Once complete, the Town can work to provide GIS land use data to the County. The Town of Haw River works in conjunction with Alamance County GIS Department on mapping.
P-4	Review all fire districts coverage to ensure that there are adequate quantities of water for firefighting purposes and that all water points are maintained on a regular basis.	Wildfire	2.2	Moderate	Town of Haw River Fire Department	Local, County	2020-2025	Carried forward	Completed an interconnect with Graham to improve pressure for emergency response. The Town of Haw River has budgeted for a water/fire flow study to be completed by Hazen-Sawyer for the FY 2020-2021.
Property Protection									
PP-1	Monitor recreational facilities located in the floodplain and evaluate flood resistance of county structures.	Flood	4.2	Moderate	Town of Haw River Public Works Department	Local, County	2020-2025	Carried forward	Red Slide Park is in the floodplain and experiences regular flooding and has been closed on several occasions. Regular monitoring will continue.
PP-2	Monitor reservoirs, lakes, and streams for potential flooding problems and note any unexpected flooding issues.	Flood	4.2	Moderate	Town of Haw River	Local, County	2020-2025	Carried forward	The Town will continue to monitor flooding problems. Recent changes to potential flood issues include a mill property being redeveloped with a new river access point. This land will be privately maintained.
Structural Projects									
SP-1	Seek funding to the retrofit of critical facilities and Town-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	4.2	Moderate	Town Buildings and Inspections Department, Town Planning Department, Town Emergency Services	Local, State Grants, UHMA Grants, other potential federal grants	2020-2025	Carried forward	Surge protection was installed for electrical equipment at Town Hall. The Town of Haw River will continue to look for grant money regarding upgrading critical facilities to improve resilience to all hazards and to improve energy usage.
SP-2	Seek funding for the installation of backup generators or quick connect hook ups for mobile generators on any newly constructed and existing county critical facilities.	All Hazards	4.2	Moderate	Town Buildings and Inspections Department, Town Planning Department, Town Emergency Services	Local, State Grants, UHMA Grants, other potential federal grants	2020-2025	Carried forward	Ongoing. The Town of Haw River has installed a back-up generator for Town Hall, the Fire Department, and the Civic Center. The generator is maintained on a regular basis. The Haw River Police Department will be purchasing a generator in the 2020-2021 Budget year using grant money. Most of

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
									our pump stations do have generators and we will continue to upgrade pump stations without generators when possible.
Emergency Services									
ES-1	Meet annually with State Forester for Alamance County to improve coordination of wildfire control and response.	Wildfire	3.2	Moderate	Town of Haw River Fire Department	Local, County	2020-2025	Carried forward	This has been performed annually with the Haw River Fire Chief and the Alamance County Fire Marshall's office.
Public Education & Awareness									
PEA-1	Encourage citizens and businesses/industries to develop emergency preparedness plans.	All Hazards	2.1	Moderate	Town of Haw River	Local	2020-2025	Carried forward	The Haw River Fire Department has continued to work with business owners on developing emergency response plans.
PEA-2	Encourage homeowners to review insurance policies as part of an overall family disaster plan.	All Hazards	2.1	Moderate	Town of Haw River, Alamance County	Local	2020-2025	Carried forward	The Haw River Fire Department continued to work with homeowners on developing family emergency plans.
PEA-3	Increase awareness of the natural hazards potential to local officials, the general public, and private industry.	All Hazards	2.1	Moderate	Town of Haw River	Local	2020-2025	Carried forward	The Haw River Fire Department continued to promote awareness on natural hazards through education at local schools.
PEA-4	Discourage the public and developers from developing property in flood zones.	All Hazards	1.2	Moderate	Town of Haw River	Local	2020-2025	Carried forward	No progress to report due to limited administrative capability. The Town of Haw River reviews all new development through the TRC process.
PEA-5	Maintain documents about flood insurance, flood protections, floodplain management, and natural and beneficial functions of floodplains at the local libraries and government offices.	Flood	2.1	Moderate	Alamance County, Town of Haw River	Local, County	2020-2025	Carried forward	The Town of Haw River works in conjunction with Alamance County GIS Department on this, and the Town is the repository for all flood documents
PEA-6	Encourage residents to sign up for the countywide emergency notification system. Greater awareness of hazard events will help make residents more aware of their risks and encourage them to take preparedness and property protection actions to mitigate their individual hazard risk.	All Hazards	2.1	Moderate	Town of Haw River	Local	2020-2025	New	



## Annex H Town of Ossipee

### H.1 PLANNING PROCESS

The table below lists the HMPC members who represented the Town of Ossipee.

**Table H.1 – HMPC Members**

Representative	Position or Title
Edward Lipscomb	Fire Chief
Justin Newton	Deputy Fire Chief

### H.2 COMMUNITY PROFILE

#### Geography

The Town of Ossipee is located in western Alamance County, north of the Town of Elon. The Town is part of the Burlington, NC Metropolitan Statistical Area. Ossipee comprises a total land area of 0.6 square miles.

#### Population and Demographics

Table H.2 provides population counts and growth estimates for the Town of Ossipee as compared to Alamance County and the Eno-Haw region. Table H.3 provides demographic information for Ossipee as compared to the county and the state.

**Table H.2 – Population Counts, Ossipee, 2010-2018**

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
Town of Ossipee	n/a	543	488	-55	-10.1%
<b>Alamance County</b>	<b>130,800</b>	<b>146,902</b>	<b>160,576</b>	<b>13,674</b>	<b>9.3%</b>
<b>Region Total</b>	<b>507,964</b>	<b>567,634</b>	<b>649,276</b>	<b>81,642</b>	<b>14.4%</b>

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

**Table H.3 – Demographic and Social Characteristics, Ossipee, 2018**

Demographic & Social Characteristics	Ossipee	Alamance County	North Carolina
Median Age	44.0	39.5	38.6
% of Population Under 5 years old	4.5	5.8	5.9
% of population Over 65 years old	18.6	16.4	15.5
% of Population Over 25 with high school diploma	72.0%	85.5%	87.4%
% of Population Over 25 with bachelor's degree or higher	12.2%	24.0%	30.5%
% with Disability	14.3%	14.3	13.6
% Speak English less than "very well"	3.6%	5.5	4.6

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

#### Housing

The table below details key housing statistics for Ossipee as compared to the County overall.

Table H.4 – Housing Statistics, Ossipee, 2010-2018

Housing Characteristics	Ossipee	Alamance County
Housing Units (2010)	273	66,576
Housing Units (2018)	224	69,749
Housing Units Percent Change (2010-2018)	-17.9%	4.8%
Housing Occupancy Rate	80.8%	91.8%
% Owner-Occupied	76.8	65.0%
Average Household Size	2.70	2.43
% of Housing Units with no Vehicles Available	2.2	5.3%
% of Housing Units that are mobile homes	23.2	12.0%
Median Home Value	\$106,500	\$147,800

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2014-2018 5-Year Estimates

### Economy

The following tables present key economic statistics for Ossipee as compared to the county and the state.

Table H.5 – Economic Statistics, Ossipee, 2018

Demographic & Social Characteristics	Ossipee	Alamance County	North Carolina
Median Household Income	49,219	\$45,735	\$52,413
Per Capita Income	20,820	\$26,215	\$29,456
Unemployment Rate	5.7%	5.7%	6.3%
% of Individuals Below Poverty Level	12.3	16.8	15.4
% Without Health Insurance	14.8	11.9	11.1

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

## H.3 RISK ASSESSMENT

This section contains a summary of the Town's asset inventory as well as hazard profile and vulnerability assessment for those hazards that are spatially defined and have variations in risk that could be evaluated quantitatively on a jurisdictional level. The hazards included in this section are: Flood and Wildfire.

### Asset Inventory

The following tables summarize the asset inventory for the Town of Ossipee in order to estimate the total physical exposure to hazards in this area. The locations of critical facilities are shown in Figure H.1. Critical facilities are a subset of identified assets from the Critical Infrastructure & Key Resources (CIKR) dataset. There are no critical facilities identified in Ossipee, but there are facilities in the unincorporated county located near the Town. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted and displayed.

Building counts are provided based on data from the NCEM IRISK database, and supplemental parcel exposure is based on November 2019 county parcel data.

Table H.6 – Critical Infrastructure &amp; Key Resources by Type

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	Defense	Government Facilities	Healthcare	IT	National Monuments and Icons	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Ossipee	0	0	0	21	0	4	0	2	0	0	0	0	0	1	3	0	0	31

Source: NCEM Risk Management Tool

Table H.7 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Ossipee	0	1	2	0	0	1	3	7

Source: NCEM Risk Management Tool

Table H.8 – IRISK Inventory of Building Counts and Values

Jurisdiction	Building Count	Building Value
Town of Ossipee	330	\$135,545,050

Source: NCEM Risk Management Tool

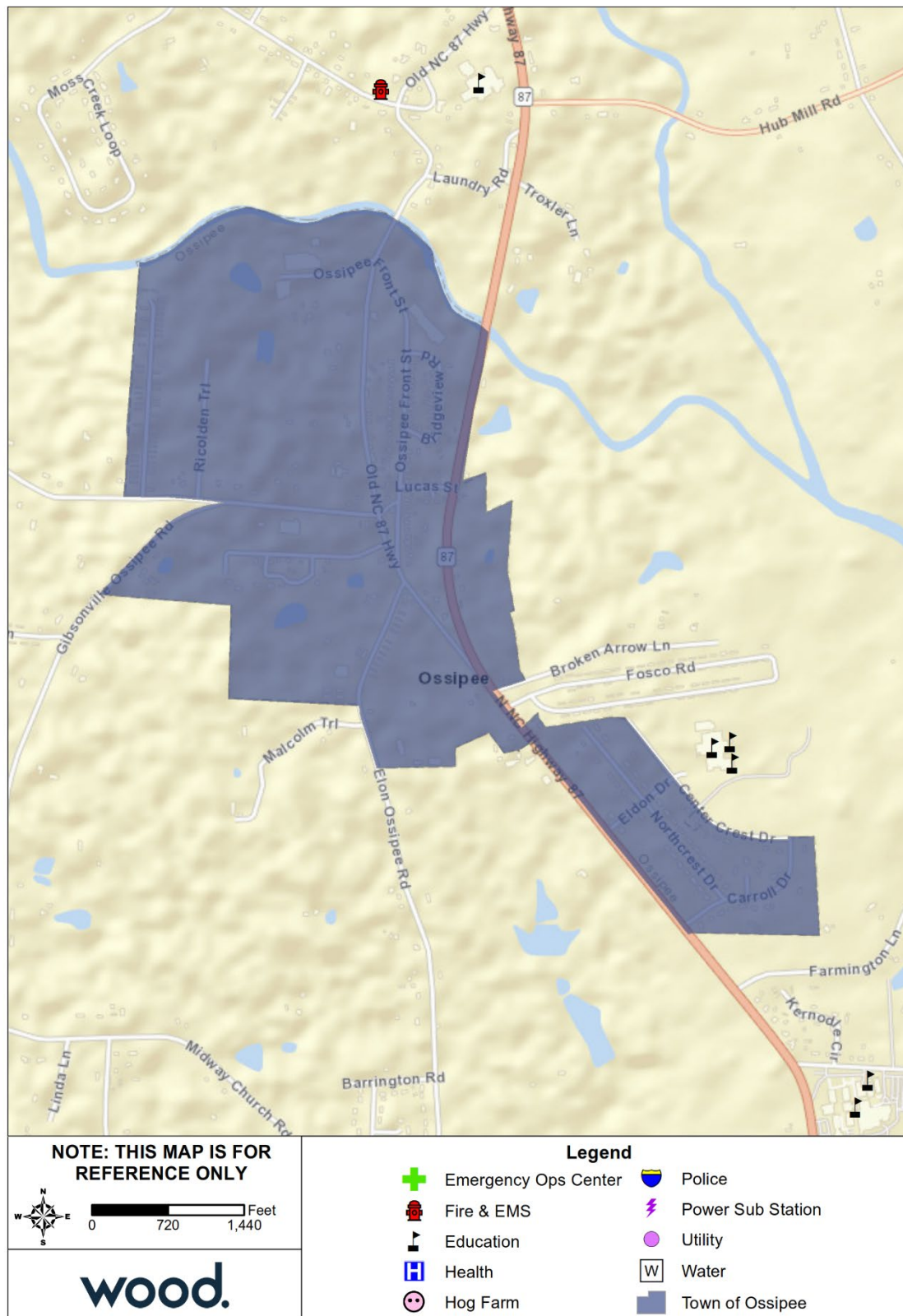
To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Eno-Haw Region, current parcel data was evaluated to identify recent development that was not included in NCEM's IRISK database. The building footprint layer from IRISK was compared to current parcel data; any parcels with an improved value that did not already have a building in IRISK were summarized in the table below. This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

Table H.9 – Parcels Development Not Included in IRISK, November 2019

Jurisdiction	Improved Parcel Count	Total Improved Value
Ossipee	12	\$1,598,119

Source: County parcel data, retrieved November 2019; IRISK database building footprints

Figure H.1 – Critical Facilities, Town of Ossipee



Source: NCEM IRISK Database, GIS Analysis

Eno-Haw

Regional Hazard Mitigation Plan  
2020

### H.3.1 Flood

Table H.10 details the acreage of the Town of Ossipee by flood zone on the effective DFIRM. Per this assessment, over 5 percent of Ossipee falls within the mapped 1%-annual-chance floodplains.

**Table H.10 – FEMA Flood Hazard Areas, Town of Ossipee**

<b>Flood Zone</b>	<b>Acreage</b>	<b>Percent of Total (%)</b>
Zone AE	20.0	5.0
Zone X (500-year)	2.6	0.7
Zone X Unshaded	376.4	94.3
<b>Total</b>	<b>399.0</b>	<b>--</b>

Source: FEMA Effective DFIRM

Figure H.2 reflects the effective mapped flood hazard zones for the Town of Ossipee, and Figure H.3 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the region, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below and compared to total recent development counts and values. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. Additionally, this assessment does not evaluate flood impacts or provide damage estimates. According to this assessment, only 8.3 percent of recent development in Ossipee is located in or near the SFHA.

**Table H.11 – Recent Development at Risk to Flood, Town of Ossipee**

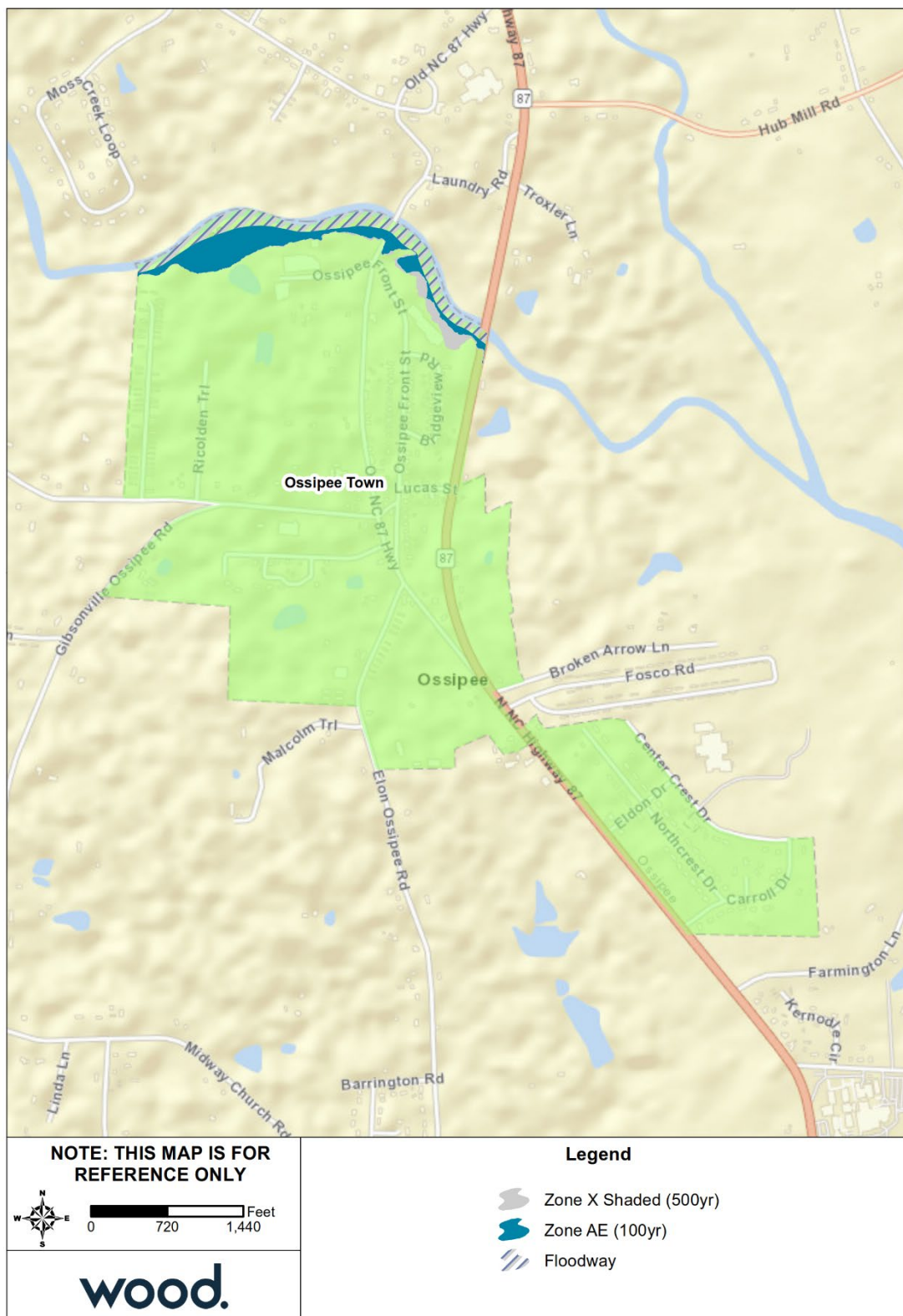
<b>Recent Development at Risk</b>		<b>Percent of Total Recent Development</b>	
<b>Count of Parcels</b>	<b>Value of Parcels</b>	<b>Percent of Parcels</b>	<b>Percent of Values</b>
1	\$70,385	8.3%	4.4%

Source: Parcel data retrieved November 2019; FEMA Effective DFIRM

There are no critical facilities or high potential loss properties with estimated flood damages in the Town of Ossipee.

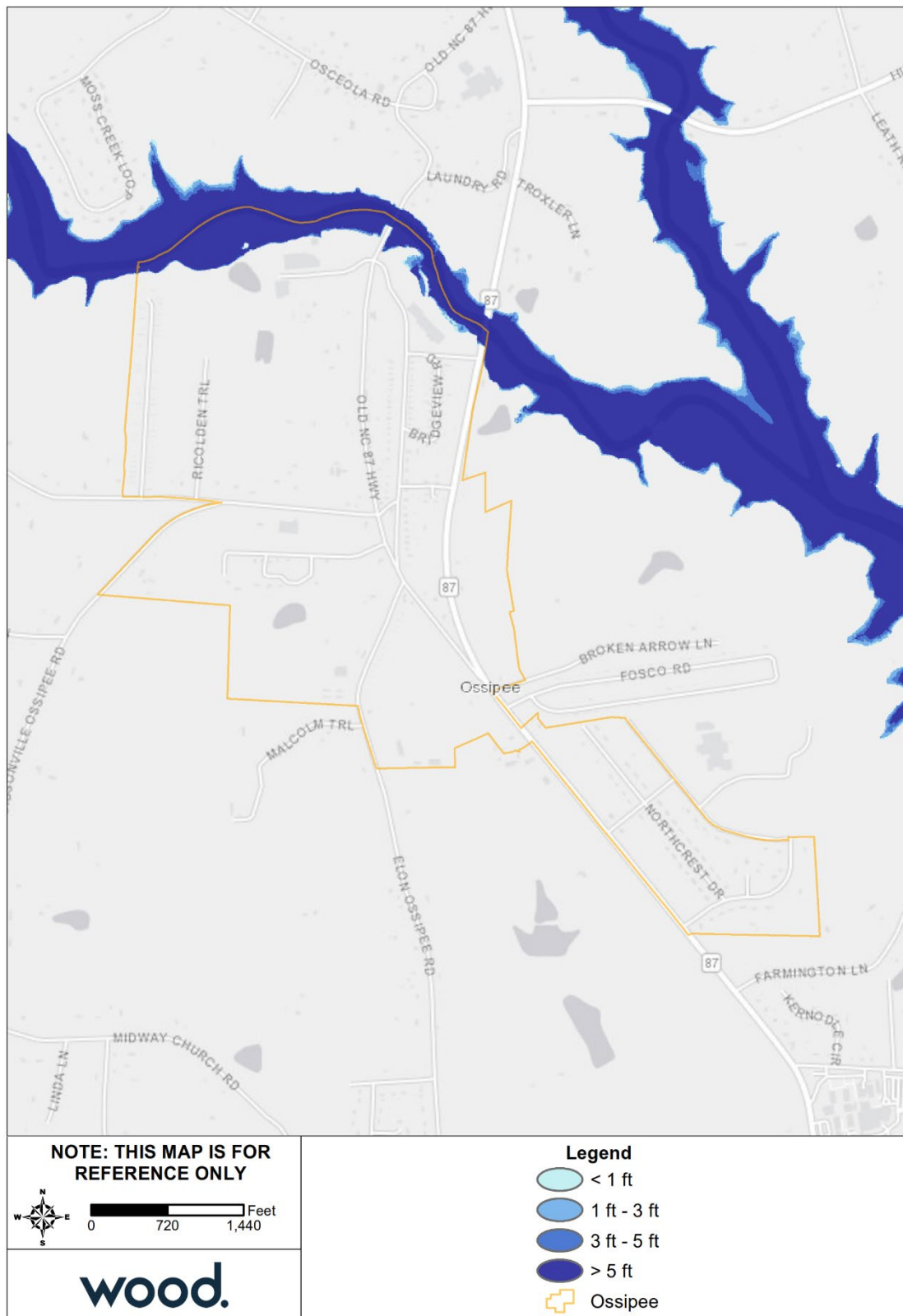


Figure H.2 – FEMA Flood Hazard Areas, Town of Ossipee



Source: FEMA Effective DFIRM

Figure H.3 – Flood Depth, 1%-Annual-Chance Floodplain, Town of Ossipee



Source: FEMA Effective DFIRM

### H.3.2 Wildfire

Table H.12 summarizes the acreage in the Town of Ossipee that falls within the Wildland Urban Interface (WUI), categorized by housing density. Areas in the WUI are those where development may intermix with flammable vegetation. Only 4 percent of the Town of Ossipee is not included in the WUI.

**Table H.12 – Wildland Urban Interface Acreage, Town of Ossipee**

	Housing Density	Total Acreage	Percent of Total Acreage
	<i>Not in WUI</i>	16.93	4.2%
	LT 1hs/40ac	0.49	0.1%
	1hs/40ac to 1hs/20ac	5.63	1.4%
	1hs/20ac to 1hs/10ac	26.56	6.7%
	1hs/10ac to 1hs/5ac	70.42	17.6%
	1hs/5ac to 1hs/2ac	125.20	31.4%
	1hs/2ac to 3hs/1ac	153.80	38.5%
	<b>Total</b>	<b>399.03</b>	

Source: Southern Wildfire Risk Assessment

Figure A.5 depicts the WUI for all incorporated areas in Alamance County, including the Town of Ossipee. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure A.6 depicts Burn Probability for all of Alamance County based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Figure H.4 depicts the Fire Intensity Scale; which indicates the potential severity of fire based on fuel loads, topography, and other factors; in order to detail potential wildfire extent in the Town of Ossipee. Moderate potential fire intensity is spread throughout the Town. Overall, areas of Class 3 fire intensity comprise 23.5% of the Town's total area; however there is no high potential fire intensity in the Town.

Table H.13 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table H.14 provides counts and estimated damages for High Potential Loss Properties in the Town of Ossipee.

**Table H.13 – Critical Facilities Exposed to Wildfire, Town of Ossipee**

Sector	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	15	\$6,181,850
Critical Manufacturing	3	\$3,041,950
Government Facilities	1	\$194,735
Transportation Systems	1	\$1,288,308
<b>All Categories</b>	<b>20</b>	<b>\$10,706,843</b>

Source: NCEM Risk Management Tool

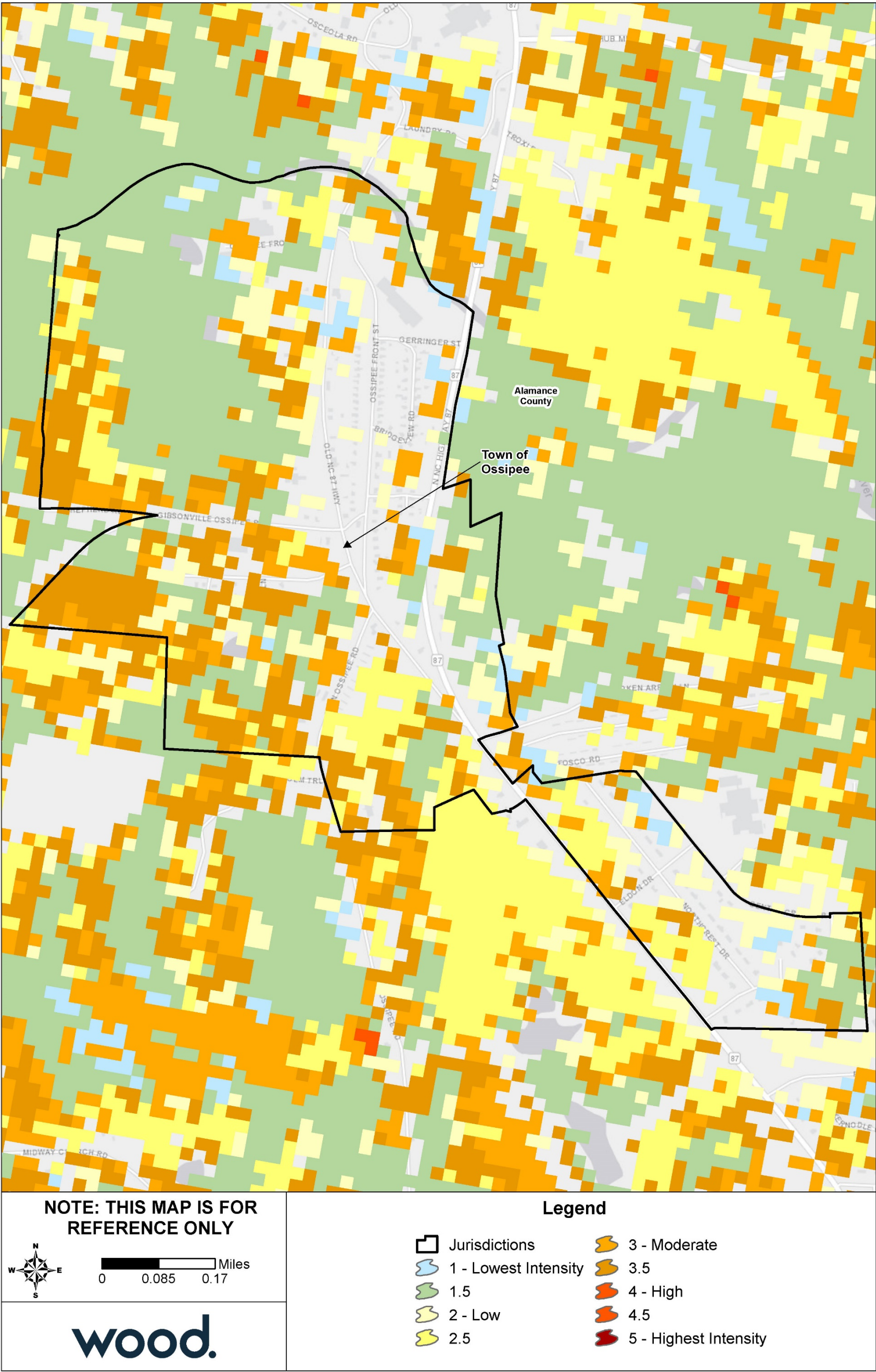
**Table H.14 – High Potential Loss Properties Exposed to Wildfire, Town of Ossipee**

Category	Number of Buildings at Risk	Estimated Damages
Commercial	1	\$1,288,308
Industrial	2	\$2,863,312
Religious	1	\$1,192,558
<b>All Categories</b>	<b>4</b>	<b>\$5,344,178</b>

Source: NCEM Risk Management Tool



Figure H.4 – Fire Intensity Scale, Town of Ossipee



Source: Southern Wildfire Risk Assessment

## H.4 CAPABILITY ASSESSMENT

### H.4.1 Overall Capability

Details on the tools and resources in place and available to the Town of Ossipee are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Ossipee has a low overall capability rating. The Town relies on Alamance County for regulatory and planning support. The Town has limited administrative, fiscal, and outreach capability and no structural mitigation experience.

### H.4.2 Floodplain Management

The Town of Ossipee has a current FIRM updated November 17, 2017; however, the Town is not participating in the NFIP.



H.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Review all fire districts coverage to ensure that there are adequate quantities of water for firefighting purposes and that all water points are maintained on a regular basis.	Wildfire	2.2	Moderate	Town of Ossipee	Local, County	2020-2025	Carried forward	No progress was made due to limited administrative resources.
P-2	When the county land use plan is complete, create a land use map with an overlay of flood hazards and any other natural hazards that can be mapped.	All Hazards	1.2	Moderate	Town of Ossipee	Local, County	2020-2025	Carried forward	The County land use plan is now in the process of being developed.
Property Protection									
PP-1	Monitor reservoirs, lakes, and streams for potential flooding problems and note any unexpected flooding issues.	Flood	4.2	Moderate	Town of Ossipee	Local, County	2020-2025	Carried forward	No progress was made due to limited administrative resources.
Structural Projects									
SP-1	Seek funding to the retrofit of critical facilities and Town-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	4.2	Moderate	Town of Ossipee	Local, State Grants, UHMA Grants, other potential federal grants	2020-2025	Carried forward	No progress was made due to lack of funding.
SP-2	Seek funding for the installation of backup generators or quick connect hook ups for mobile generators on any newly constructed and existing county critical facilities.	All Hazards	4.2	Moderate	Town of Ossipee	Local, State Grants, UHMA Grants, other potential federal grants	2020-2025	Carried forward	No progress was made due to lack of funding.
Emergency Services									
ES-1	Meet annually with State Forester for Alamance County to improve coordination of wildfire control and response.	Wildfire	3.2	Moderate	Town of Ossipee	Local, County	Annually	Carried forward	No progress was made due to limited administrative resources.
Public Education & Awareness									
PEA-1	Encourage homeowners to review insurance policies as part of an overall family disaster plan.	All Hazards	2.1	Moderate	Town of Ossipee	Local	2020-2025	Carried forward	No progress was made due to administrative limitations.
PEA-2	Increase awareness of the natural hazards potential to local officials, the general public, and private industry.	All Hazards	2.1	Moderate	Town of Ossipee	Local	2020-2025	Carried forward	No progress was made due to administrative and technical limitations.
PEA-3	Encourage residents to sign up for the countywide emergency notification system. Greater awareness of hazard events will help make residents more aware of their risks and encourage them to take preparedness and property protection actions to mitigate their individual hazard risk.	All Hazards	2.1	Moderate	Town of Ossipee	Local	2020-2025	New	

# Annex I Town of Swepsonville

## I.1 PLANNING PROCESS

The table below lists the HMPC members who represented the Town of Swepsonville.

**Table I.1 – HMPC Members**

Representative	Position or Title
Tim Albritton	Fire Chief
Steve Couturier	Deputy Fire Chief

## I.2 COMMUNITY PROFILE

### Geography

The Town of Swepsonville is located in central Alamance County, southeast of the City of Graham. The Town is part of the Burlington, NC Metropolitan Statistical Area. Swepsonville comprises a total land area of 1.5 square miles.

### Population and Demographics

Table I.2 provides population counts and growth estimates for the Town of Swepsonville as compared to Alamance County and the Eno-Haw region overall. Table I.3 provides demographic information for Swepsonville as compared to the county and the state.

**Table I.2 – Population Counts, Swepsonville, 2010-2018**

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
Town of Swepsonville	922	1,154	1,844	690	59.8%
<b>Alamance County</b>	<b>130,800</b>	<b>146,902</b>	<b>160,576</b>	<b>13,674</b>	<b>9.3%</b>
<b>Region Total</b>	<b>507,964</b>	<b>567,634</b>	<b>649,276</b>	<b>81,642</b>	<b>14.4%</b>

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

**Table I.3 – Demographic and Social Characteristics, Swepsonville, 2018**

Demographic & Social Characteristics	Swepsonville	Alamance County	North Carolina
Median Age	41.5	39.5	38.6
% of Population Under 5 years old	7	5.8	5.9
% of population Over 65 years old	17.1	16.4	15.5
% of Population Over 25 with high school diploma	90.5%	85.5%	87.4%
% of Population Over 25 with bachelor's degree or higher	28.9%	24.0%	30.5%
% with Disability	13.8%	14.3	13.6
% Speak English less than "very well"	2.7%	5.5	4.6

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

### Housing

The following table details key housing statistics for Swepsonville as compared to the County overall.

Table I.4 – Housing Statistics, Swepsonville, 2010-2018

Housing Characteristics	Swepsonville	Alamance County
Housing Units (2010)	531	66,576
Housing Units (2018)	793	69,749
Housing Units Percent Change (2010-2018)	49.3%	4.8%
Housing Occupancy Rate	94.5%	91.8%
% Owner-Occupied	83.8	65.0%
Average Household Size	2.46	2.43
% of Housing Units with no Vehicles Available	3.2	5.3%
% of Housing Units that are mobile homes	6.7	12.0%
Median Home Value	\$190,900	\$147,800

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2014-2018 5-Year Estimates

### Economy

The following tables present key economic statistics for Swepsonville as compared to the county and the state.

Table I.5 – Economic Statistics, Swepsonville, 2018

Demographic & Social Characteristics	Swepsonville	Alamance County	North Carolina
Median Household Income	65,060	\$45,735	\$52,413
Per Capita Income	31,565	\$26,215	\$29,456
Unemployment Rate	2.7%	5.7%	6.3%
% of Individuals Below Poverty Level	3.0	16.8	15.4
% Without Health Insurance	9.8	11.9	11.1

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

## I.3 RISK ASSESSMENT

This section contains a summary of the Town's asset inventory as well as hazard profile and vulnerability assessment for those hazards that are spatially defined and have variations in risk that could be evaluated quantitatively on a jurisdictional level. The hazards included in this section are: Flood and Wildfire.

### Asset Inventory

The following tables summarize the asset inventory for the Town of Swepsonville in order to estimate the total physical exposure to hazards in this area. The locations of critical facilities are shown in Figure I.1. Critical facilities are a subset of identified assets from the Critical Infrastructure & Key Resources (CIKR) dataset. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted and displayed.

Building counts are provided based on data from the NCEM IRISK database, and supplemental parcel exposure is based on November 2019 county parcel data.

Table I.6 – Critical Infrastructure &amp; Key Resources by Type

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	Defense	Government Facilities	Healthcare	IT	National Monuments and Icons	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Sweepsonville	2	0	0	13	0	5	0	2	0	0	0	0	0	6	0	1	1	30

Source: NCEM Risk Management Tool

Table I.7 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Sweepsonville	0	5	3	2	0	0	0	10

Source: NCEM Risk Management Tool

Table I.8 – IRISK Inventory of Building Counts and Values

Jurisdiction	Building Count	Building Value
Town of Sweepsonville	573	\$110,607,193

Source: NCEM Risk Management Tool

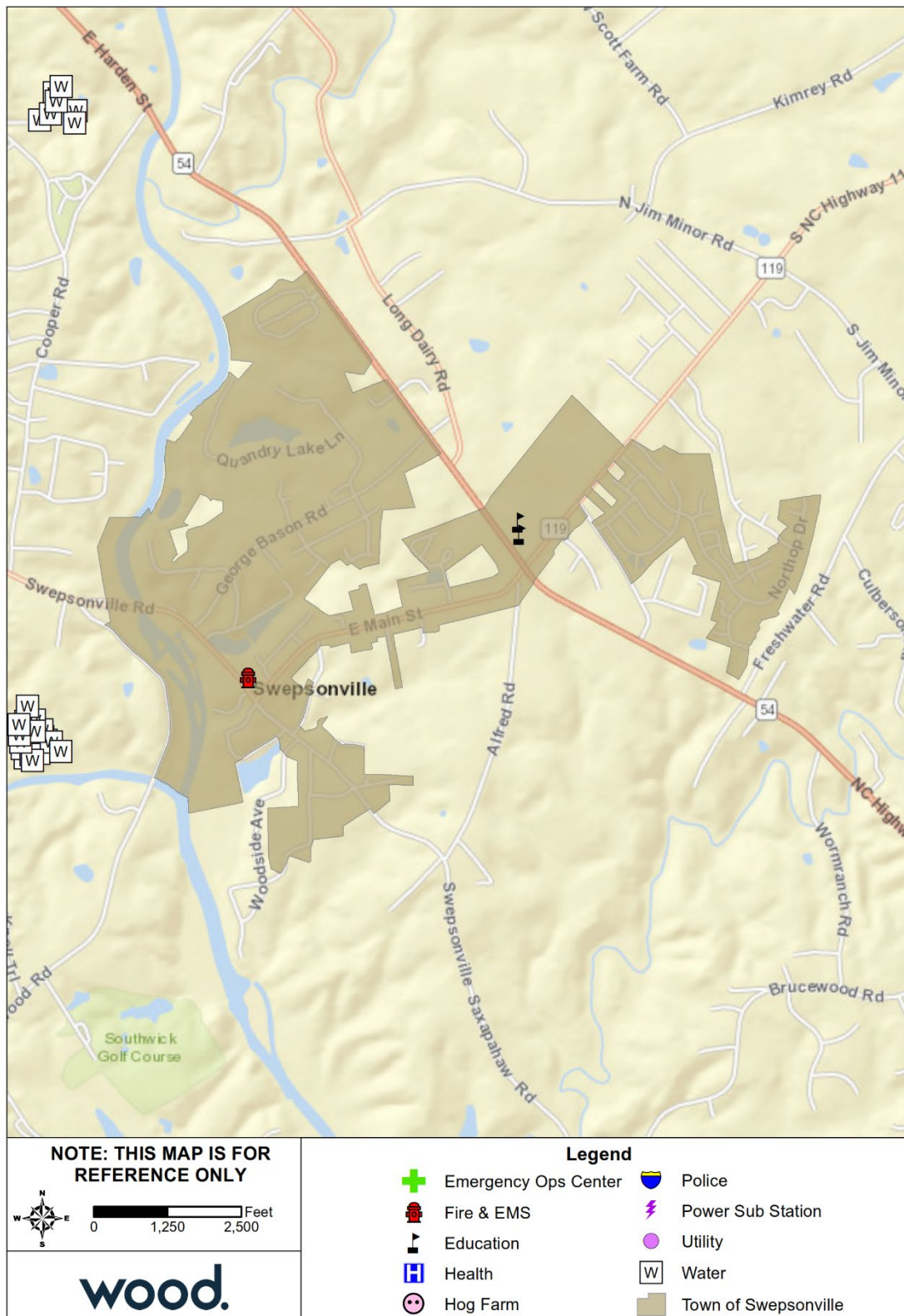
To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Eno-Haw Region, current parcel data was evaluated to identify recent development that was not included in NCEM's IRISK database. The building footprint layer from IRISK was compared to current parcel data; any parcels with an improved value that did not already have a building in IRISK were summarized in the table below. This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

Table I.9 – Parcels Development Not Included in IRISK, November 2019

Jurisdiction	Improved Parcel Count	Total Improved Value
Sweepsonville	501	\$89,335,581

Source: County parcel data, retrieved November 2019; IRISK database building footprints

Figure I.1 – Critical Facilities, Town of Swebsonville



Source: NCEM IRISK Database, GIS Analysis

Eno-Haw

Regional Hazard Mitigation Plan  
2020



### I.3.1 Flood

Table I.10 details the acreage of the Town of Swepsonville by flood zone on the effective DFIRM. Per this assessment, 12 percent of Swepsonville falls within the mapped 1%-annual-chance floodplains.

**Table I.10 – Flood Zone Acreage, Town of Swepsonville**

Flood Zone	Acreage	Percent of Total (%)
Zone AE	115.3	12.0
Zone X (500-year)	5.3	0.6
Zone X Unshaded	844.2	87.5
<b>Total</b>	<b>964.8</b>	<b>--</b>

Source: FEMA Effective DFIRM

Figure I.2 reflects the effective mapped flood hazard zones for Town of Swepsonville, and Figure I.3 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the region, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below and compared to total recent development counts and values. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. Additionally, this assessment does not evaluate flood impacts or provide damage estimates. According to this assessment, less than one percent of recent development in Swepsonville is located in or near the SFHA.

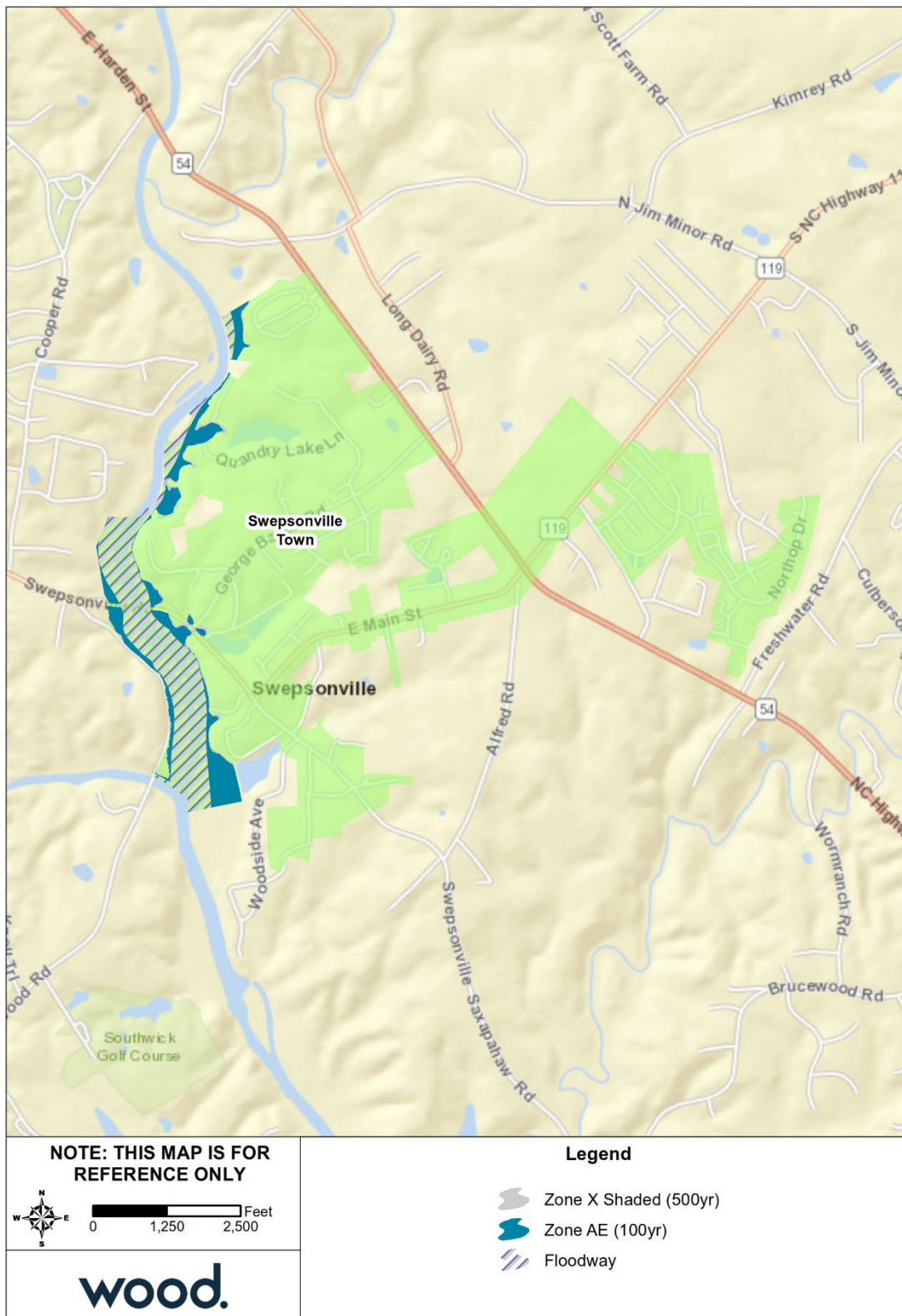
**Table I.11 – Recent Development at Risk to Flood, Town of Swepsonville**

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
2	\$556,211	0.4%	0.6%

Source: Parcel data retrieved November 2019; FEMA Effective DFIRM

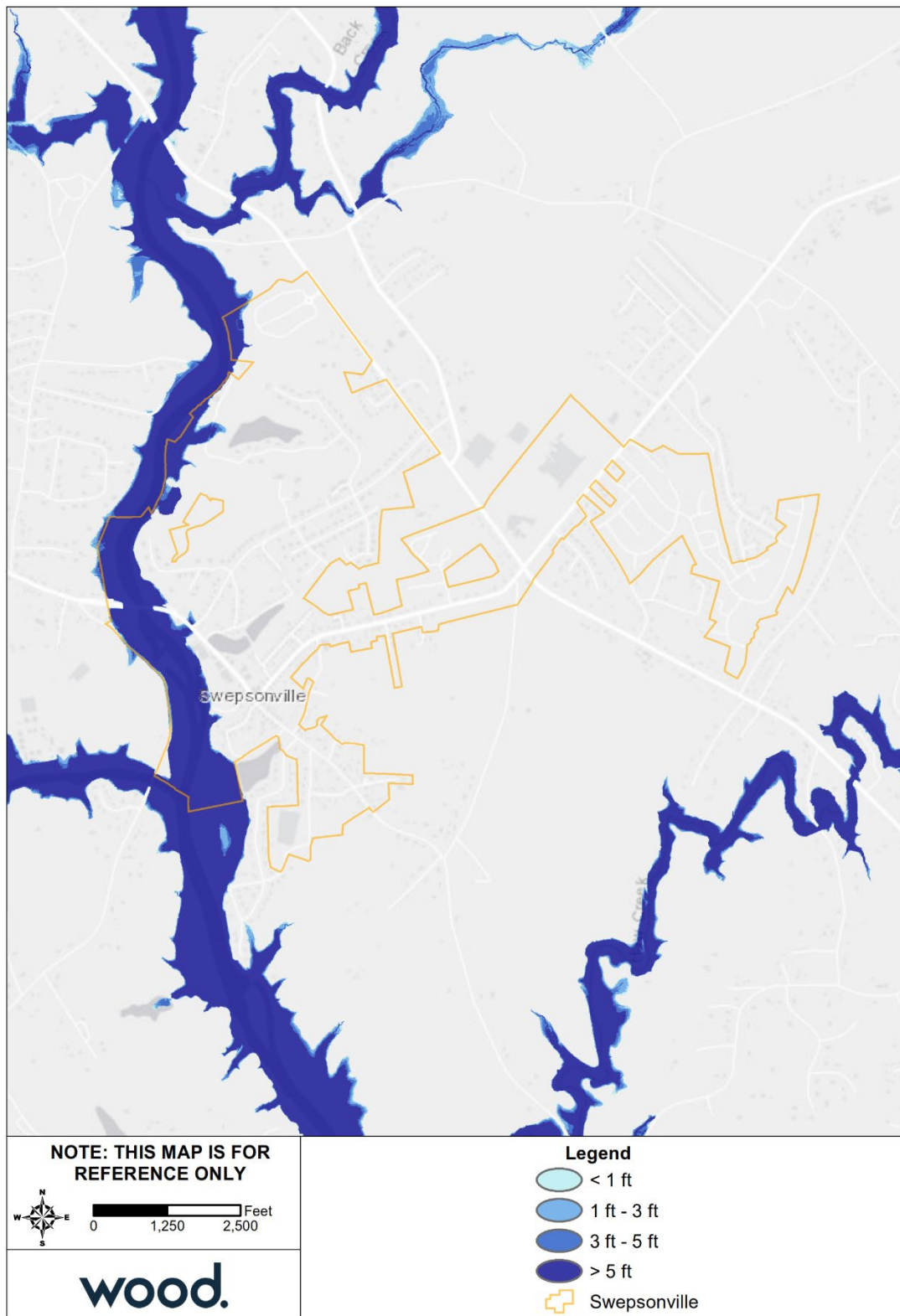
There are no critical facilities or high potential loss properties with estimated flood damages in the Town of Swepsonville.

Figure I.2 – FEMA Flood Hazard Areas, Town of Swebsonville



Source: FEMA Effective DFIRM

Figure I.3 – Flood Depth, 1%-Annual-Chance Floodplain, Town of Swepsonville



Source: FEMA Effective DFIRM

### I.3.2 Wildfire

Table I.12 summarizes the acreage in the Town of Swepsonville that falls within the Wildland Urban Interface (WUI), categorized by housing density. Areas in the WUI are those where development may intermix with flammable vegetation. Over 9% percent of Swepsonville is not included in the WUI.

**Table I.12 – Wildland Urban Interface Acreage, Town of Swepsonville**

	Housing Density	Total Acreage	Percent of Total Acreage
	<i>Not in WUI</i>	91.73	9.5%
	LT 1hs/40ac	27.03	2.8%
	1hs/40ac to 1hs/20ac	23.08	2.4%
	1hs/20ac to 1hs/10ac	56.99	5.9%
	1hs/10ac to 1hs/5ac	107.02	11.1%
	1hs/5ac to 1hs/2ac	210.35	21.8%
	1hs/2ac to 3hs/1ac	448.63	46.5%
	<b>Total</b>	<b>964.84</b>	

Source: Southern Wildfire Risk Assessment

Figure A.5 depicts the WUI for all incorporated areas in Alamance County, including the Town of Swepsonville. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure A.6 depicts Burn Probability for all of Alamance County based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Figure I.4 depicts the Fire Intensity Scale; which indicates the potential severity of fire based on fuel loads, topography, and other factors; in order to detail potential wildfire extent in the Town of Swepsonville. There are clusters of moderate potential fire intensity in the eastern edges of the Town. In total, over 15 percent of the Town's total area has a Class 3 fire intensity rating.

Table I.13 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table I.14 provides counts and estimated damages for High Potential Loss Properties in the Town of Swepsonville.

**Table I.13 – Critical Facilities Exposed to Wildfire, Town of Swepsonville**

Sector	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	12	\$13,101,905
Critical Manufacturing	5	\$23,213,247
Food and Agriculture	2	\$38,832
Government Facilities	2	\$3,953,472
Transportation Systems	3	\$2,450,770
Water	1	\$800,000
<b>All Categories</b>	<b>25</b>	<b>\$43,558,226</b>

Source: NCEM Risk Management Tool

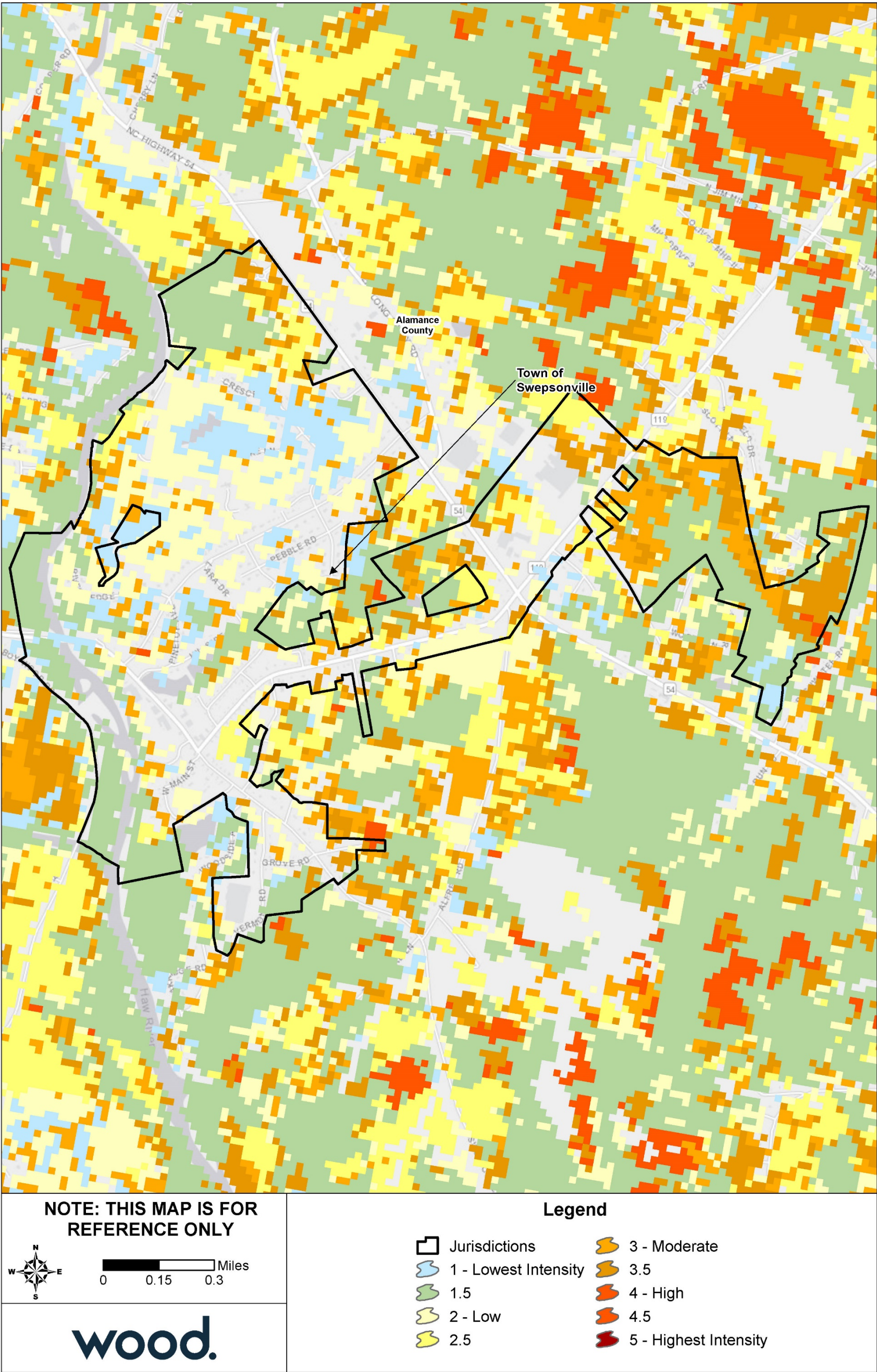
**Table I.14 – High Potential Loss Properties Exposed to Wildfire, Town of Swepsonville**

Category	Number of Buildings at Risk	Estimated Damages
Commercial	4	\$11,792,830
Government	2	\$3,953,472
Industrial	3	\$22,829,027
<b>All Categories</b>	<b>9</b>	<b>\$38,575,329</b>

Source: NCEM Risk Management Tool



Figure I.4 – Fire Intensity Scale, Town of Swebsonville



Source: Southern Wildfire Risk Assessment



## I.4 CAPABILITY ASSESSMENT

### I.4.1 Overall Capability

Details on the tools and resources in place and available to the Town of Swepsonville are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Swepsonville has a low overall capability rating. The Town relies on Alamance County for regulatory and planning support. The Town has limited administrative, fiscal, and outreach capability and no structural mitigation experience.

### I.4.2 Floodplain Management

The Town of Swepsonville joined the NFIP as a regular participant in July 2001. The following tables reflect NFIP policy and claims data for the Town categorized by structure type, flood zone, Pre-FIRM and Post-FIRM.

**Table I.15 – NFIP Policy and Claims Data by Structure Type**

Structure Type	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
Single Family	8	\$2,761	\$2,268,000	0	\$0.00
<b>Total</b>	<b>8</b>	<b>\$2,761</b>	<b>\$2,268,000</b>	<b>0</b>	<b>\$0.00</b>

Source: FEMA Community Information System, accessed May 2020

**Table I.16 – NFIP Policy and Claims Data by Flood Zone**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
B, C & X Zone					
Preferred	8	\$2,761	\$2,268,000	0	\$0.00
<b>Total</b>	<b>8</b>	<b>\$2,761</b>	<b>\$2,268,000</b>	<b>0</b>	<b>\$0.00</b>

Source: FEMA Community Information System, accessed May 2020

**Table I.17 – NFIP Policy and Claims Data Pre-FIRM**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
B, C & X Zone	1	\$421	\$350,000	0	\$0.00
Preferred	1	\$421	\$350,000	0	\$0.00
<b>Total</b>	<b>1</b>	<b>\$421</b>	<b>\$350,000</b>	<b>0</b>	<b>\$0.00</b>

Source: FEMA Community Information System, accessed May 2020

**Table I.18 – NFIP Policy and Claims Data Post-FIRM**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
B, C & X Zone	7	\$2,340	\$1,918,000	0	\$0.00
Preferred	7	\$2,340	\$1,918,000	0	\$0.00
<b>Total</b>	<b>7</b>	<b>\$2,340</b>	<b>\$1,918,000</b>	<b>0</b>	<b>\$0.00</b>

Source: FEMA Community Information System, accessed May 2020

I.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Review the subdivision regulations and make appropriate changes to encourage alternatives to placing lots in flood-prone areas and to minimize impervious surface coverings, if necessary.	Flood	1.2	Moderate	Town of Swepsonville	Local	2020-2025	Carried forward	No progress made due to administrative limitations
P-2	Continue Town of Swepsonville's participation in the National Flood Insurance Program (NFIP) so citizens are eligible for flood insurance.	Flood	1.2	Moderate	Town of Swepsonville	Local	2020-2025	Carried forward	The Town has maintained compliance with NFIP requirements for continued participation.
P-3	Develop specific regulations that prohibit dumping in the county's watersheds	Flood	1.1	Moderate	Town of Swepsonville	Local	2020-2025	Carried forward	No progress made due to administrative limitations
P-4	Review all fire districts coverage to ensure that there are adequate quantities of water for firefighting purposes and that all water points are maintained on a regular basis.	Wildfire	2.2	Moderate	Town of Swepsonville	Local, County	2020-2025	Carried forward	No progress made due to administrative limitations
Property Protection									
PP-1	Monitor reservoirs, lakes, and streams for potential flooding problems and note any unexpected flooding issues.	Flood	4.2	Moderate	Town of Swepsonville	Local, County	2020-2025	Carried forward	No progress made due to administrative limitations
Structural Projects									
SP-1	Seek funding to the retrofit of critical facilities and Town-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	4.2	Moderate	Town of Swepsonville	Local, State Grants, UHMA Grants, other potential federal grants	2020-2025	Carried forward	No progress made due to staff and funding limitations.
SP-2	Seek funding for the installation of backup generators or quick connect hook ups for mobile generators on any newly constructed and existing county critical facilities.	All Hazards	4.2	Moderate	Town of Swepsonville	Local, State Grants, UHMA Grants, other potential federal grants	2020-2025	Carried forward	No progress made due to staff and funding limitations.
Public Education & Awareness									
PEA-1	Encourage citizens and businesses/industries to develop emergency preparedness plans.	All Hazards	2.1	Moderate	Town of Swepsonville	Local	2020-2025	Carried forward	No progress made due to lack of administrative resources for outreach.
PEA-2	Encourage homeowners to review insurance policies as part of an overall family disaster plan.	All Hazards	2.1	Moderate	Town of Swepsonville	Local	2020-2025	Carried forward	No progress made due to lack of administrative resources for outreach.
PEA-3	Increase awareness of the natural hazards potential to local officials, the general public, and private industry.	All Hazards	2.1	Moderate	Town of Swepsonville	Local	2020-2025	Carried forward	No progress made due to lack of administrative resources for outreach.
PEA-4	Discourage the public and developers from developing property in flood zones.	All Hazards	1.2	Moderate	Town of Swepsonville	Local	2020-2025	Carried forward	No progress made due to lack of administrative resources for outreach.
PEA-5	Maintain documents about flood insurance, flood protections, floodplain management, and natural and beneficial functions of floodplains at the local libraries and government offices.	Flood	2.1	Moderate	Town of Swepsonville	Local	2020-2025	Carried forward	No progress made due to lack of administrative resources for outreach.

## Annex J Village of Alamance

### J.1 PLANNING PROCESS

The table below lists the HMPC member who represented the Village of Alamance.

**Table J.1 – HMPC Members**

Representative	Position or Title
Ben York	Town Manager

### J.2 COMMUNITY PROFILE

#### Geography

The Village of Alamance is located in western Alamance County, south of the City of Burlington. The Village is part of the Burlington, NC Metropolitan Statistical Area. Alamance comprises a total land area of 0.8 square miles.

#### Population and Demographics

Table J.2 provides population counts and growth estimates for the Village of Alamance as compared to Alamance County and the Eno-Haw region. Table J.3 provides demographic information for Alamance as compared to the county and the state.

**Table J.2 – Population Counts, Alamance, 2010-2018**

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
Village of Alamance	310	951	1,069	118	12.4%
<b>Alamance County</b>	<b>130,800</b>	<b>146,902</b>	<b>160,576</b>	<b>13,674</b>	<b>9.3%</b>
<b>Region Total</b>	<b>507,964</b>	<b>567,634</b>	<b>649,276</b>	<b>81,642</b>	<b>14.4%</b>

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

**Table J.3 – Demographic and Social Characteristics, Alamance, 2018**

Demographic & Social Characteristics	Alamance	Alamance County	North Carolina
Median Age	44.1	39.5	38.6
% of Population Under 5 years old	2.7	5.8	5.9
% of population Over 65 years old	14.4	16.4	15.5
% of Population Over 25 with high school diploma	96.5%	85.5%	87.4%
% of Population Over 25 with bachelor's degree or higher	37.4%	24.0%	30.5%
% with Disability	7.6%	14.3	13.6
% Speak English less than "very well"	0.0%	5.5	4.6

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

#### Housing

The following table details key housing statistics for Alamance as compared to the County overall.

**Table J.4 – Housing Statistics, Alamance, 2010-2018**

Housing Characteristics	Alamance	Alamance County
Housing Units (2010)	401	66,576
Housing Units (2018)	450	69,749
Housing Units Percent Change (2010-2018)	12.2%	4.8%
Housing Occupancy Rate	92.9%	91.8%
% Owner-Occupied	86.1	65.0%
Average Household Size	2.56	2.43
% of Housing Units with no Vehicles Available	2.6	5.3%
% of Housing Units that are mobile homes	0.7	12.0%
Median Home Value	\$296,800	\$147,800

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2014-2018 5-Year Estimates

### Economy

The following tables present key economic statistics for the Village of Alamance as compared to the county and the state.

**Table J.5 – Economic Statistics, Alamance, 2018**

Demographic & Social Characteristics	Alamance	Alamance County	North Carolina
Median Household Income	86,875	\$45,735	\$52,413
Per Capita Income	40,813	\$26,215	\$29,456
Unemployment Rate	2.2%	5.7%	6.3%
% of Individuals Below Poverty Level	1.1	16.8	15.4
% Without Health Insurance	4.3	11.9	11.1

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

## J.3 RISK ASSESSMENT

This section contains a summary of the Village's asset inventory as well as hazard profile and vulnerability assessment for those hazards that are spatially defined and have variations in risk that could be evaluated quantitatively on a jurisdictional level. The hazards included in this section are: Dam Failure, Flood and Wildfire.

### Asset Inventory

The following tables summarize the asset inventory for the Village of Alamance in order to estimate the total physical exposure to hazards in this area. The locations of critical facilities are shown in Figure J.1. Critical facilities are a subset of identified assets from the Critical Infrastructure & Key Resources (CIKR) dataset. There are no critical facilities identified in Alamance, but there are facilities in the unincorporated county located near the Village. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted and displayed.

Building counts are provided based on data from the NCEM IRISK database, and supplemental parcel exposure is based on November 2019 county parcel data.

Table J.6 – Critical Infrastructure &amp; Key Resources by Type

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	Defense	Government Facilities	Healthcare	IT	National Monuments and Icons	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Alamance	33	0	0	18	0	15	0	12	1	0	0	0	0	4	0	0	1	84

Source: NCEM Risk Management Tool

Table J.7 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Alamance	0	1	4	2	0	3	0	10

Source: NCEM Risk Management Tool

Table J.8 – IRISK Inventory of Building Counts and Values

Jurisdiction	Building Count	Building Value
Village of Alamance	798	\$111,618,918

Source: NCEM Risk Management Tool

To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Eno-Haw Region, current parcel data was evaluated to identify recent development that was not included in NCEM's IRISK database. The building footprint layer from IRISK was compared to current parcel data; any parcels with an improved value that did not already have a building in IRISK were summarized in the table below. This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

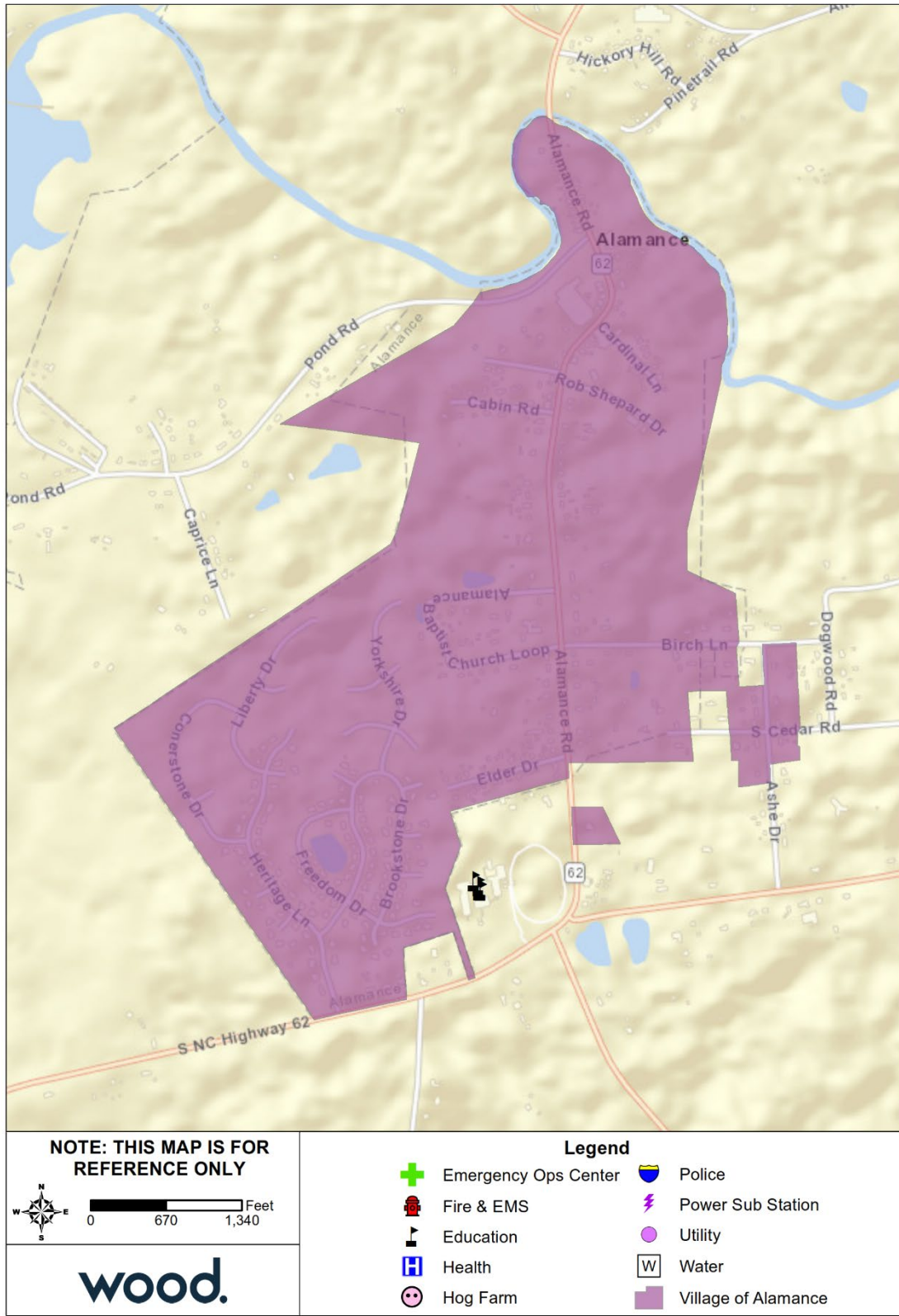
Table J.9 – Parcels Development Not Included in IRISK, November 2019

Jurisdiction	Improved Parcel Count	Total Improved Value
Alamance	137	\$38,010,047

Source: County parcel data, retrieved November 2019; IRISK database building footprints



Figure J.1 – Critical Facilities, Village of Alamance



Source: NCEM IRISK Database, GIS Analysis

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### J.3.1 Dam Failure

According to the North Carolina Dam Inventory as of July 2018, the Village of Alamance is the nearest downstream location to two high hazard dams located in the City of Burlington. Both of these dams, McEwan Estate Dam and Lake Mackintosh Dam, were in fair condition at the time of their last inspection.

### J.3.2 Flood

Table J.10 details the acreage of the Village of Alamance by flood zone on the effective DFIRM. Per this assessment, just over 4 percent of Alamance falls within the mapped 1%-annual-chance floodplains.

**Table J.10 – Flood Zone Acreage in the Village of Alamance**

Flood Zone	Acreage	Percent of Total (%)
Zone AE	21.9	4.5
Zone X (500-year)	7.1	1.4
Zone X Unshaded	460.6	94.1
<b>Total</b>	<b>489.5</b>	<b>--</b>

Source: FEMA Effective DFIRM

Figure J.2 reflects the effective mapped flood hazard zones for the Village of Alamance, and Figure J.3 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the region, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below and compared to total recent development counts and values. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. Additionally, this assessment does not evaluate flood impacts or provide damage estimates. According to this assessment, 1.5 percent of recent development in Alamance is located in or near the SFHA.

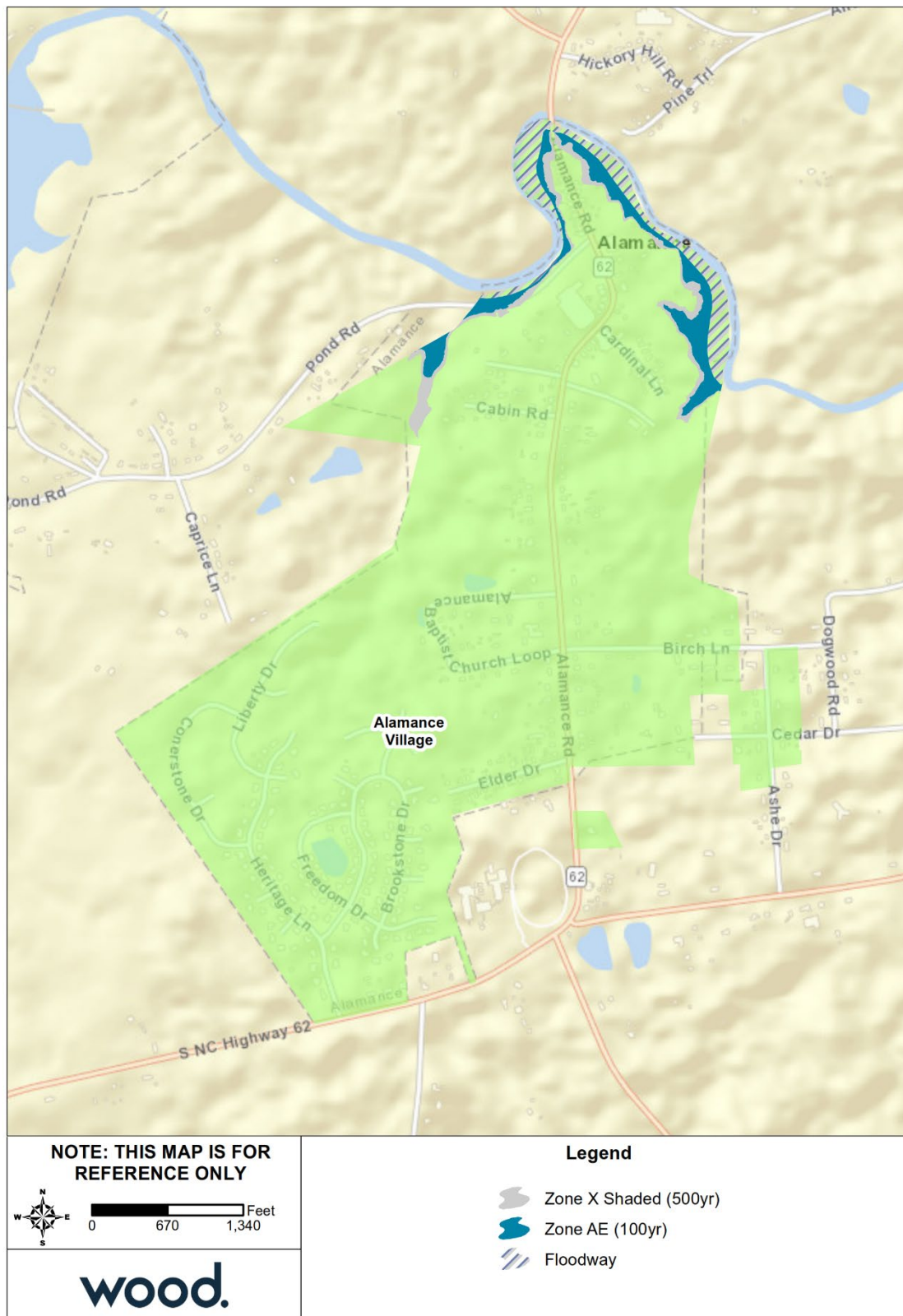
**Table J.11 – Recent Development at Risk to Flood, Village of Alamance**

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
2	\$11,505	1.5%	0.0%

Source: Parcel data retrieved November 2019; FEMA Effective DFIRM

There are no critical facilities or high potential loss properties with estimated flood damages in the Village of Alamance.

Figure J.2 – FEMA Flood Hazard Areas, Village of Alamance

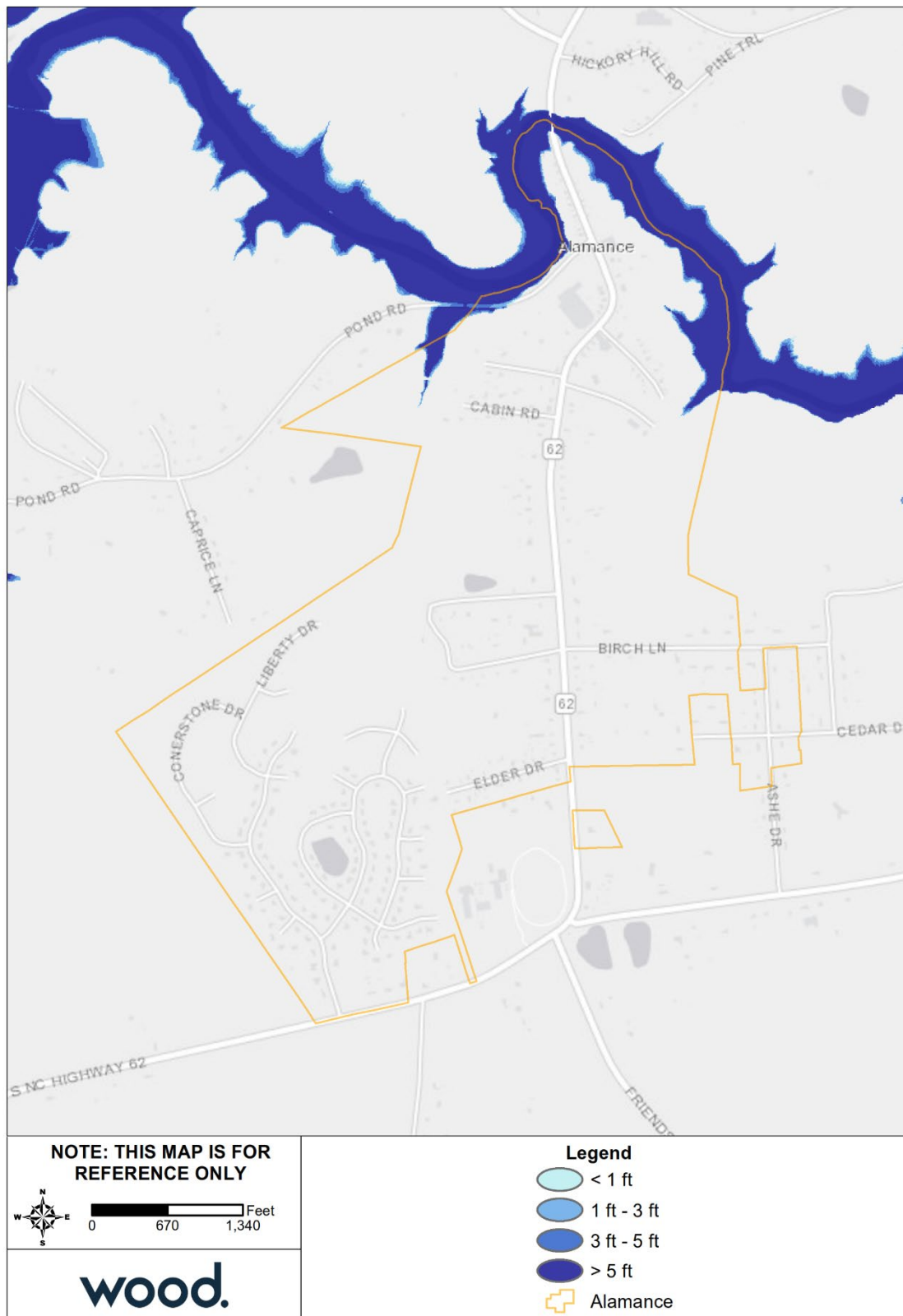


Source: FEMA Effective DFIRM

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Figure J.3 – Flood Depth, 1%-Annual-Chance Floodplain, Village of Alamance



Source: FEMA Effective DFIRM



### J.3.3 Wildfire

Table J.12 summarizes the acreage in the Village of Alamance that falls within the Wildland Urban Interface (WUI), categorized by housing density. Areas in the WUI are those where development may intermix with flammable vegetation. Over 6 percent of the Village of Alamance is not included in the WUI.

**Table J.12 – Wildland Urban Interface Acreage, Village of Alamance**

	Housing Density	Total Acreage	Percent of Total Acreage
	<i>Not in WUI</i>	31.33	6.4%
	LT 1hs/40ac	8.80	1.8%
	1hs/40ac to 1hs/20ac	15.12	3.1%
	1hs/20ac to 1hs/10ac	10.64	2.2%
	1hs/10ac to 1hs/5ac	33.01	6.7%
	1hs/5ac to 1hs/2ac	121.79	24.9%
	1hs/2ac to 3hs/1ac	268.83	54.9%
	<b>Total</b>	<b>489.53</b>	

Source: Southern Wildfire Risk Assessment

Figure A.5 depicts the WUI for all incorporated areas in Alamance County, including the Village of Alamance. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure A.6 depicts Burn Probability for all of Alamance County based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Figure J.4 depicts the Fire Intensity Scale; which indicates the potential severity of fire based on fuel loads, topography, and other factors; in order to detail potential wildfire extent in the Village of Alamance. There is moderate potential fire intensity throughout the Village and a small cluster of high potential fire intensity near the Village's western border. Overall, 23 percent of the Village has a Class 3 fire intensity rating, while less than one percent has a Class 4 rating.

Table J.13 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table J.14 provides counts and estimated damages for High Potential Loss Properties in the Village of Alamance.

**Table J.13 – Critical Facilities Exposed to Wildfire, Village of Alamance**

Sector	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	10	\$4,987,616
Critical Manufacturing	12	\$15,548,011
Food and Agriculture	26	\$873,576
Government Facilities	10	\$5,332,712
Healthcare and Public Health	1	\$1,058,966
Transportation Systems	1	\$740,880
Water	1	\$800,000
<b>All Categories</b>	<b>61</b>	<b>\$29,341,761</b>

Source: NCEM Risk Management Tool

**Table J.14 – High Potential Loss Properties Exposed to Wildfire, Village of Alamance**

Category	Number of Buildings at Risk	Estimated Damages
Commercial	1	\$1,058,966
Government	2	\$3,392,209
Industrial	4	\$13,855,312



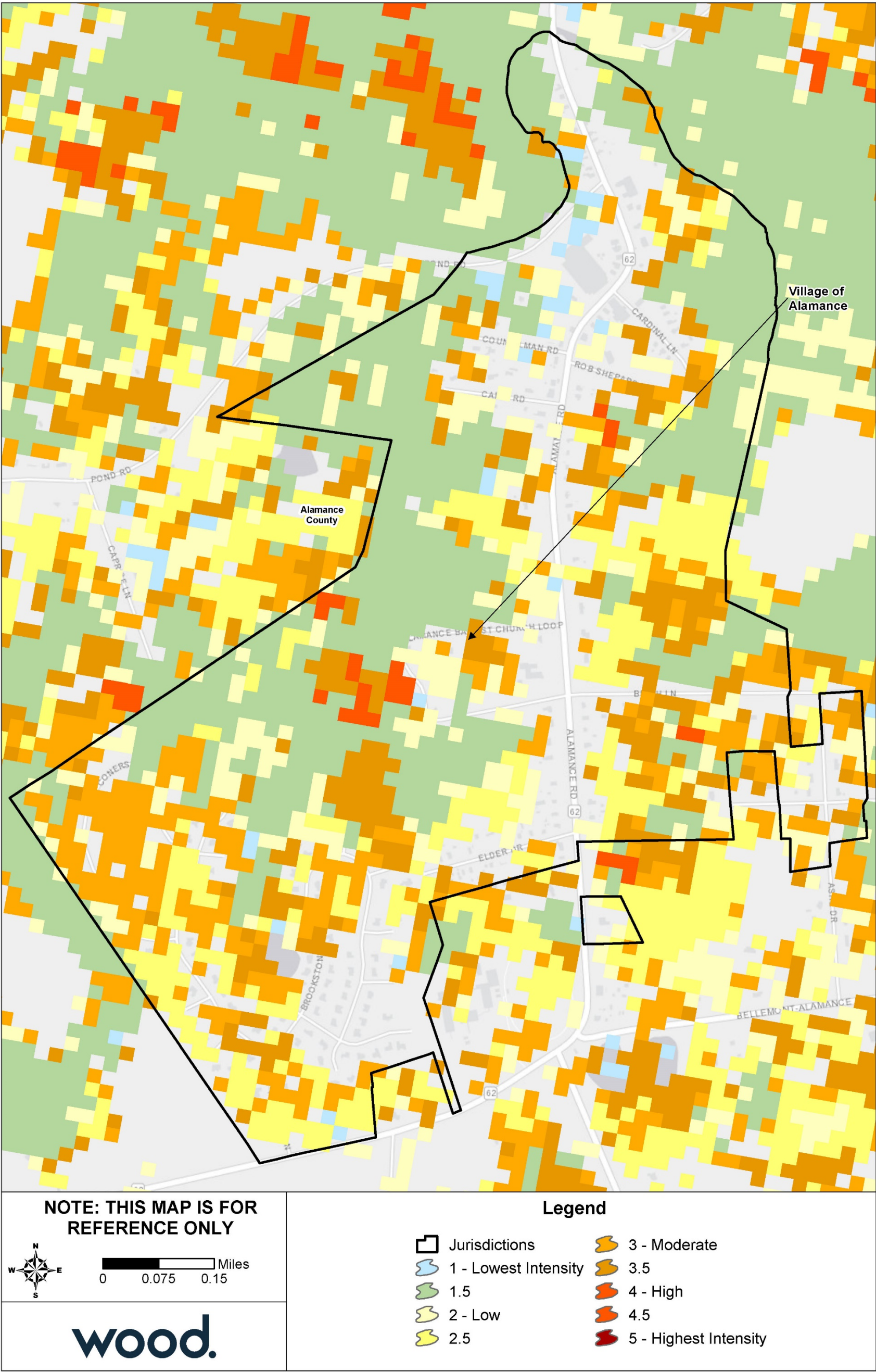
## ANNEX J: VILLAGE OF ALAMANCE

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Category	Number of Buildings at Risk	Estimated Damages
Religious	2	\$3,704,302
<b>All Categories</b>	<b>9</b>	<b>\$22,010,789</b>

Source: NCEM Risk Management Tool

Figure J.4 – Fire Intensity Scale, Village of Alamance



Source: Southern Wildfire Risk Assessment

## J.4 CAPABILITY ASSESSMENT

### J.4.1 Overall Capability

Details on the tools and resources in place and available to the Village of Alamance are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Alamance has a low overall capability rating. The Village relies on Alamance County for regulatory and planning support. The Village has limited administrative, fiscal, and outreach capability and no structural mitigation experience.

### J.4.2 Floodplain Management

The Village of Alamance joined the NFIP through emergency entry in 1987 and has been a regular participant since December 1987. There is one active policy in force in the Village. The policy is for a post-FIRM built single family residence in the B, C, and X Zone. It is a preferred risk policy with a total premium of \$251 providing \$105,000 of insurance in force.

J.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Continue to expand the County's Geographic Information System (GIS) capabilities to include maintaining Elevation Certificates in a computer database.	Flood	1.2	Moderate	Village of Alamance	Local, County	2020-2025	Carried forward	County now maintains ECs in a computer database. The Village will work to compile and provide ECs to the County.
P-2	Continue the Village of Alamance's participation in the National Flood Insurance Program (NFIP) so citizens are eligible for flood insurance.	Flood	1.2	Moderate	Village of Alamance	Local	2020-2025	Carried forward	The Village has maintained compliance with the NFIP
P-3	Review all fire districts coverage to ensure that there are adequate quantities of water for firefighting purposes and that all water points are maintained on a regular basis.	Wildfire	2.2	Moderate	Village of Alamance	Local, County	2020-2025	Carried forward	No progress made due to administrative limitations.
P-4	When the county land use plan is complete, create a land use map with an overlay of flood hazards and any other natural hazards that can be mapped.	All Hazards	1.2	Moderate	Village of Alamance	Local, County	2020-2025	Carried forward	The County land use plan is now under development.
Property Protection									
PP-1	Monitor reservoirs, lakes, and streams for potential flooding problems and note any unexpected flooding issues.	Flood	4.2	Moderate	Village of Alamance	Local	2020-2025	Carried forward	No progress made due to administrative limitations.
Structural Projects									
SP-1	Seek funding to the retrofit of critical facilities and Village-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	4.2	Moderate	Village of Alamance	Local, State Grants, UHMA Grants, other potential federal grants	2020-2025	Carried forward	No progress made due to administrative and fiscal limitations.
SP-2	Seek funding for the installation of backup generators or quick connect hook ups for mobile generators on any newly constructed and existing county critical facilities.	All Hazards	4.2	Moderate	Village of Alamance	Local, State Grants, UHMA Grants, other potential federal grants	2020-2025	Carried forward	No progress made due to administrative and fiscal limitations.
Emergency Services									
ES-1	Meet annually with State Forester for Alamance County to improve coordination of wildfire control and response.	Wildfire	3.2	Moderate	Village of Alamance	Local, County	Annually	Carried forward	No progress reported
Public Education & Awareness									
PEA-1	Encourage homeowners to review insurance policies as part of an overall family disaster plan.	All Hazards	2.1	Moderate	Village of Alamance	Local	2020-2025	Carried forward	No progress made due to administrative limitations.
PEA-2	Increase awareness of the natural hazards potential to local officials, the general public, and private industry.	All Hazards	2.1	Moderate	Village of Alamance	Local	2020-2025	Carried forward	No progress made due to administrative limitations.
PEA-3	Maintain hazard mitigation plan and floodplain information on the Village's website.	All Hazards	2.1	Moderate	Village of Alamance	Local	2020-2025	Carried forward	No progress made due to administrative limitations.



## Annex K Durham County

### K.1 PLANNING PROCESS

The table below lists the HMPC members who represented Durham County.

**Table K.1 – HMPC Members**

Representative	Position or Title
Ryan Eaves	Erosion Control
McKenzie Gentry	Stormwater Manager
Leslie B. O'Connor	Division Chief of Emergency Management
Ari Schein	Durham County EM
Kay Jowers	Duke University
Diana Graham	Stakeholder
Sharlene Simon	Stakeholder

### K.2 COMMUNITY PROFILE

#### Geography

Durham County is located in the north-central portion of the Piedmont of North Carolina. It is neighbored by Person County to the north, Wake and Granville Counties to the east, Chatham County to the south, and Orange County to the west. Durham County comprises a total area of 286.3 square miles.

Durham County is the core of the Durham-Chapel Hill, NC Metropolitan Statistical Area, which is also included in the Raleigh-Durham-Cary, NC Combined Statistical Area. The county was formed on April 17, 1881 from parts of Orange County and Wake County, taking the name of its own county seat. In 1911, parts of Cedar Fork Township of Wake County was transferred to Durham County and became Carr Township. Durham County has one major municipality, the City of Durham. Durham County is also home to Research Triangle Park (RTP), the largest and most successful planned research park in the United States. The park is located on 7,000 acres of North Carolina pine forest and nearly 75% of the Park's property and 95% of the corporate enterprises are located in Durham County.

#### Population and Demographics

Table K.2 provides population counts and growth estimates for Durham County unincorporated areas as compared to the county and the region overall.

**Table K.2 – Population Counts, Unincorporated Durham County, 2010-2018**

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
Unincorporated Durham County	36,279	29,136	42,147	13,011	44.7%
<b>Durham County</b>	<b>223,314</b>	<b>257,466</b>	<b>306,457</b>	<b>48,991</b>	<b>19.0%</b>
<b>Region Total</b>	<b>507,964</b>	<b>567,634</b>	<b>649,276</b>	<b>81,642</b>	<b>14.4%</b>

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

Note: Unincorporated areas statistics calculated by subtracting jurisdiction counts from the county total. The total population of Durham includes population residing in Wake County.



## Housing

The table below details housing unit counts for Durham County unincorporated areas as compared to the county overall. Overall, housing unit estimates decreased slightly in unincorporated Durham County. However, these counts are calculated by subtracting the estimates of the incorporated area from the county total estimate, which may skew these numbers.

**Table K.3 – Housing Statistics, Unincorporated Durham County, 2010-2018**

Housing Characteristics	Durham County	Unincorporated Durham County
Housing Units (2010)	120,217	16,996
Housing Units (2018)	133,429	16,778
Housing Units Percent Change (2010-2018)	11.0%	-1.3%

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2014-2018 5-Year Estimates

## K.3 RISK ASSESSMENT

This section contains a summary of the County’s asset inventory as well as hazard profile and vulnerability assessment for those hazards that are spatially defined and have variations in risk that could be evaluated quantitatively on a jurisdictional level. The hazards included in this section are: Flood and Wildfire.

### Asset Inventory

The following tables summarize the asset inventory for unincorporated Durham County in order to estimate the total physical exposure to hazards in this area. The locations of critical facilities are shown in Figure K.1. Critical facilities are a subset of identified assets from the Critical Infrastructure & Key Resources (CIKR) dataset and are supplemented with additional facilities identified by the HMPC. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted and displayed.

Building counts are provided based on data from the NCEM IRISK database, and supplemental parcel exposure is based on November 2019 county parcel data.

**Table K.4 – Critical Infrastructure & Key Resources by Type**

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	Defense	Government Facilities	Healthcare	IT	National Monuments and Icons	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Unincorporated Durham County	1,230	4	0	766	0	544	0	98	41	0	0	0	0	351	1	0	17	3,052

Source: NCEM Risk Management Tool

The following facilities were identified by Durham’s HMPC and added to the critical facilities maps. It is the intention of the HMPC that future updates of IRISK incorporate these facilities as critical assets.

Table K.5 – Supplemental Critical Facilities

Facility Type	Facility Name
EOC	Durham Emergency Operations Center
Police Station	District 4 Substation
Police Station	District 3 Substation
Police Station	Headquarters and District 5 Substation
Police Station	District 1 Substation
Police Station	District 2 Substation
Police Station	Sheriff's Office Main Office
Police Station	Sheriff's Office Detention Facility
Police Station	Sheriff's Office North Station
Police Station	Sheriff's Office East Station
Police Station	Sheriff's Office Animal Services
Fire Station	Station 18
Fire Station	Station 19
Fire Station	Redwood 1
Fire Station	Redwood 2
Fire Station	Redwood 3
Fire Station	Station 1
Fire Station	Station 2
Fire Station	Station 3
Fire Station	Station 4
Fire Station	Station 5
Fire Station	Station 6
Fire Station	Station 7
Fire Station	Station 10
Fire Station	Station 11
Fire Station	Station 12
Fire Station	Station 14
Fire Station	Bahama 2
Fire Station	Lebanon 1
Fire Station	Station 9
Fire Station	Bahama 1
Fire Station	Station 8
Fire Station	Station 16
Fire Station	Station 15
Fire Station	Bahama 3
Fire Station	Eno
Fire Station	Lebanon 2
Fire Station	Station 17
EMS	EMS #1
EMS	EMS #2
EMS	EMS #3
EMS	EMS #4
EMS	EMS #5
EMS	Bahama EMS
EMS	Bethesda EMS
EMS	Parkwood EMS
EMS	Parkwood 2 EMS
EMS	Redwood EMS

## ANNEX K: DURHAM COUNTY UNINCORPORATED AREAS

Facility Type	Facility Name
EMS	EMS #6
EMS	Parkwood 3 EMS

Source: Durham County

Note: Durham also identified 59 dams in its critical facilities list, however all of these facilities are evaluated under the dam failure hazard.

**Table K.6 – High Potential Loss Facilities by Use**

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Unincorporated Durham County	24	78	83	21	0	6	18	230

Source: NCEM Risk Management Tool

**Table K.7 – IRISK Inventory of Building Counts and Values**

Jurisdiction	Building Count	Building Value
Unincorporated Durham County	21,038	\$3,615,069,306

Source: NCEM Risk Management Tool

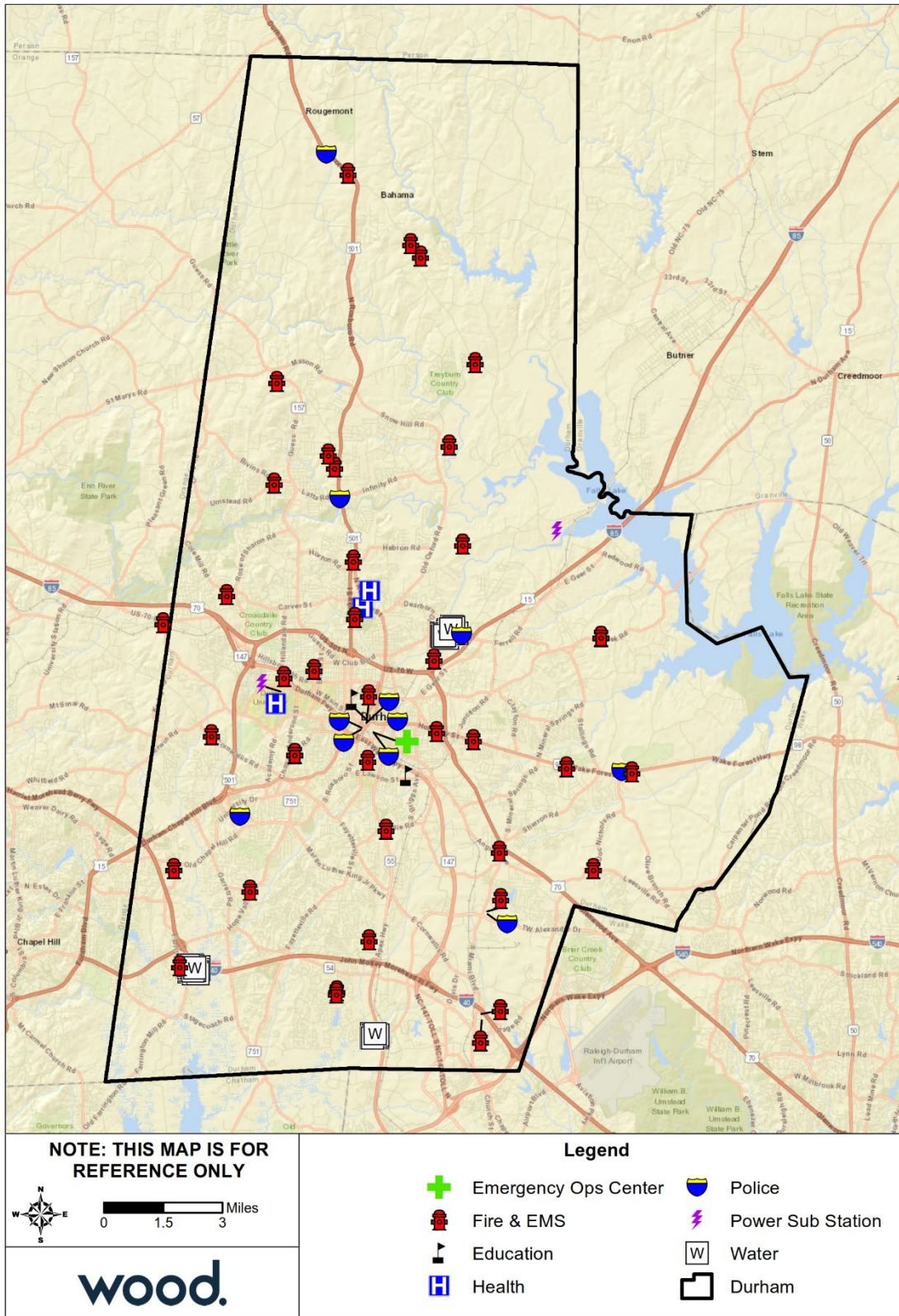
To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Eno-Haw Region, current parcel data was evaluated to identify recent development that was not included in NCEM's IRISK database. The building footprint layer from IRISK was compared to current parcel data; any parcels with an improved value that did not already have a building in IRISK were summarized in the table below. This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

**Table K.8 – Parcels Development Not Included in IRISK, November 2019**

Jurisdiction	Improved Parcel Count	Total Improved Value
Unincorporated Durham County	1,073	\$354,853,208

Source: County parcel data, retrieved November 2019; IRISK database building footprints

Figure K.1 – Critical Facilities, Durham County



Source: NCEM IRISK Database, GIS Analysis

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**K.3.1 Dam Failure**

Table K.9 lists the high hazard dams in unincorporated Durham County identified by the North Carolina Dam Inventory as of July 2018. All dam locations throughout the county are shown in Figure K.2.

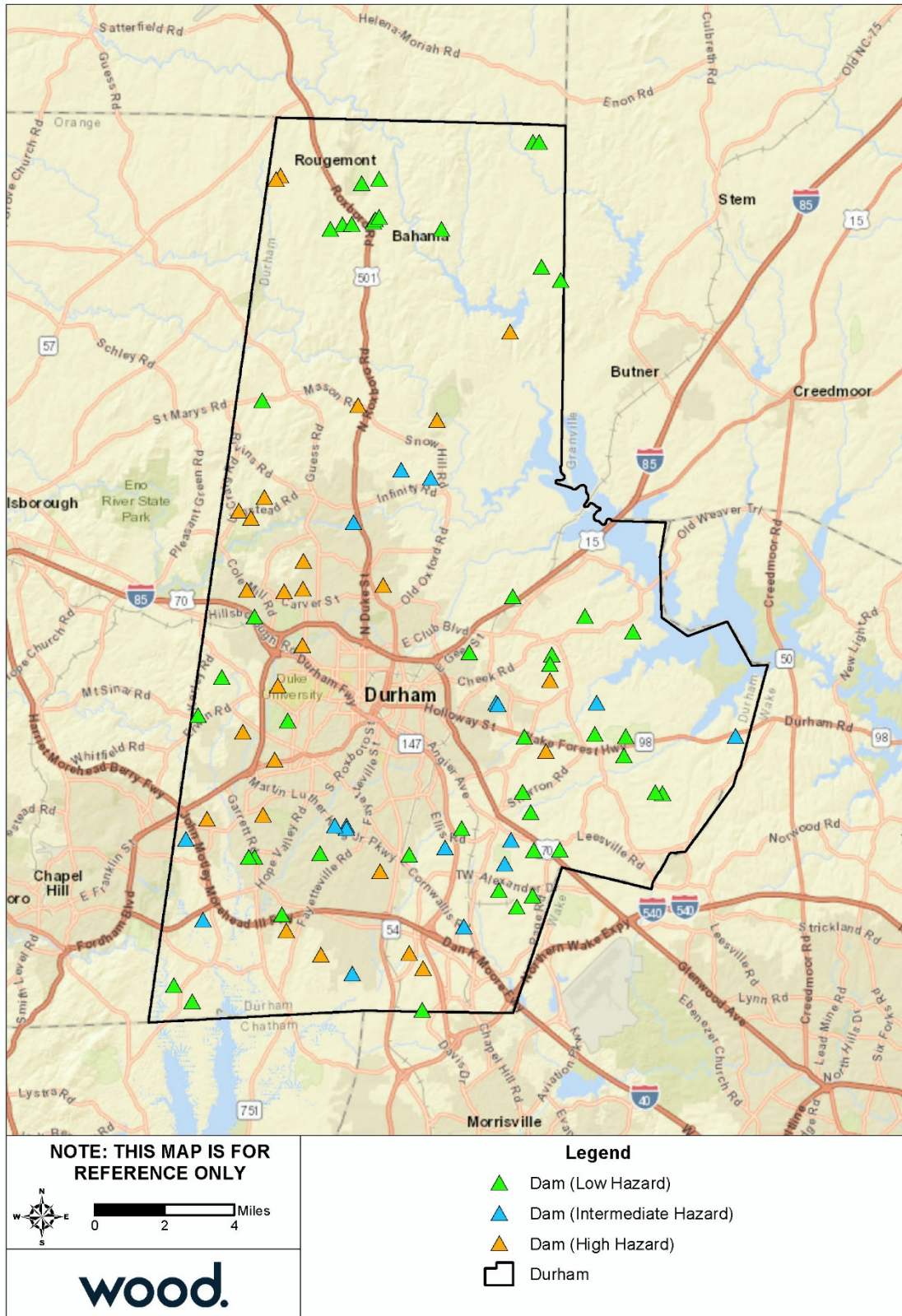
**Table K.9 – High Hazard Dams in Unincorporated Durham County**

Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
Lake Michie Dam	NC01027	Satisfactory	18,660	Redwood
Eden Lake Dam	NC01043		140	Orange Factory
Willowhaven Lake Dam #2	NC01050	Satisfactory	58	Durham
Lake Vista Dam	NC01051	Fair	69	Durham
Discovery Lake Dam	NC01666	Satisfactory	336	Haywood
N. Durham Quarry East Dam	NC05165	Satisfactory	134	Bunny Rd at Lick Creek
N. Durham Quarry West Dam	NC05166	Satisfactory	83	Cothran Rd

Source: NC Dam Inventory, July 2018



Figure K.2 – Dam Locations, Durham County



Source: NC Dam Inventory, July 2018

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### K.3.2 Flood

Table K.10 details the acreage of unincorporated Durham County by flood zone on the effective DFIRM. Per this assessment, nearly 15 percent of unincorporated Durham County falls within the mapped 1%-annual-chance floodplains.

**Table K.10 – Flood Zone Acreage in Unincorporated Durham County**

Flood Zone	Acreage	Percent of Total (%)
Zone A	65.7	0.0
Zone AE	27,717.6	14.6
Zone X (500-year)	1,167.3	0.6
Zone X Unshaded	160,736.1	84.7
<b>Total</b>	<b>189,621.0</b>	<b>--</b>

Source: FEMA Effective DFIRM

Figure K.3 reflects the effective mapped flood hazard zones for Durham County, and Figure K.4 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the region, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below and compared to total recent development counts and values. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. Additionally, this assessment does not evaluate flood impacts or provide damage estimates. According to this assessment, 4.2 percent of recent development in unincorporated Durham County is located in or near the SFHA.

**Table K.11 – Recent Development at Risk to Flood, Unincorporated Durham County**

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
45	\$37,168,956	4.2%	10.5%

Source: Parcel data retrieved November 2019; FEMA Effective DFIRM

Table K.12 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector and flood event in unincorporated Durham County. Table K.13 summarizes high potential loss property vulnerability by sector and flood event.

**Table K.12 – Critical Facilities Exposed to Flooding, Unincorporated Durham County**

Sector	Event	Number of Buildings at Risk	Estimated Damages
Banking and Finance	25 Year	3	\$15,116
	50 Year	4	\$166,670
	100 Year	4	\$267,602
	500 Year	4	\$280,111
Commercial Facilities	10 Year	2	\$34,669
	25 Year	4	\$47,472
	50 Year	5	\$67,421
	100 Year	5	\$120,643
	500 Year	5	\$212,880
Critical Manufacturing	50 Year	1	\$11,163

## ANNEX K: DURHAM COUNTY UNINCORPORATED AREAS

Sector	Event	Number of Buildings at Risk	Estimated Damages
	100 Year	2	\$380,541
	500 Year	2	\$444,070
Food and Agriculture	10 Year	3	\$8,644
	25 Year	3	\$10,267
	50 Year	4	\$11,494
	100 Year	4	\$12,680
	500 Year	6	\$17,681
Government Facilities	10 Year	1	\$9,742
	25 Year	1	\$10,482
	50 Year	1	\$10,817
	100 Year	1	\$10,910
	500 Year	1	\$11,160
Water	100 Year	3	\$62,845
	500 Year	8	\$5,857,858
All Categories	25 Year	11	\$83,337
	50 Year	15	\$267,565
	100 Year	19	\$855,221
	500 Year	26	\$6,823,760
	10 Year	6	\$53,055

Source: NCEM Risk Management Tool

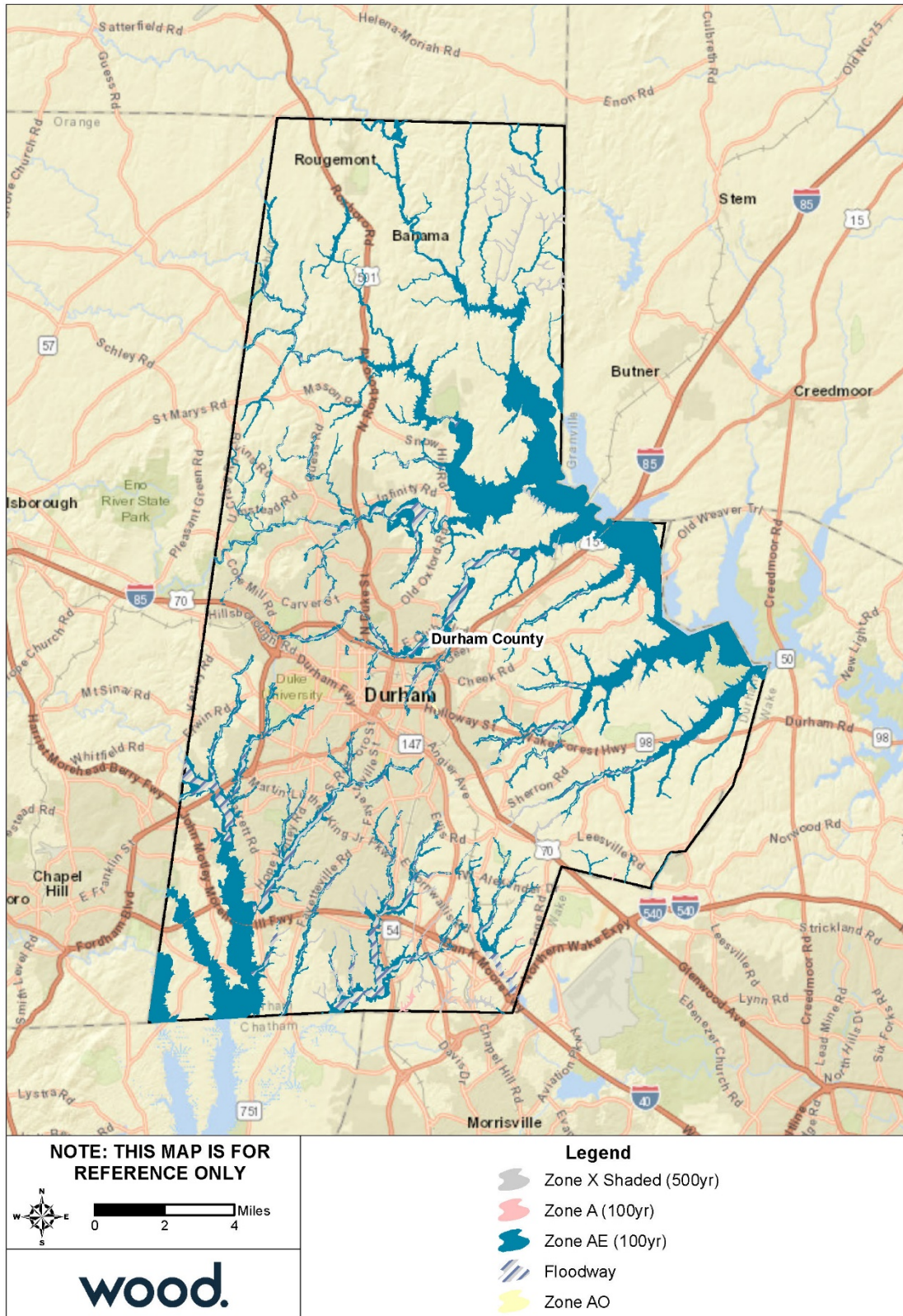
**Table K.13 – High Potential Loss Properties Exposed to Flooding, Unincorporated Durham County**

Category	Event	Number of Buildings at Risk	Estimated Damages
Industrial	100 Year	1	\$365,144
	500 Year	1	\$427,903
Utilities	100 Year	3	\$62,845
	500 Year	8	\$5,857,858
All Categories	100 Year	4	\$427,989
	500 Year	9	\$6,285,761

Source: NCEM Risk Management Tool



Figure K.3 – FEMA Flood Hazard Areas, Durham County



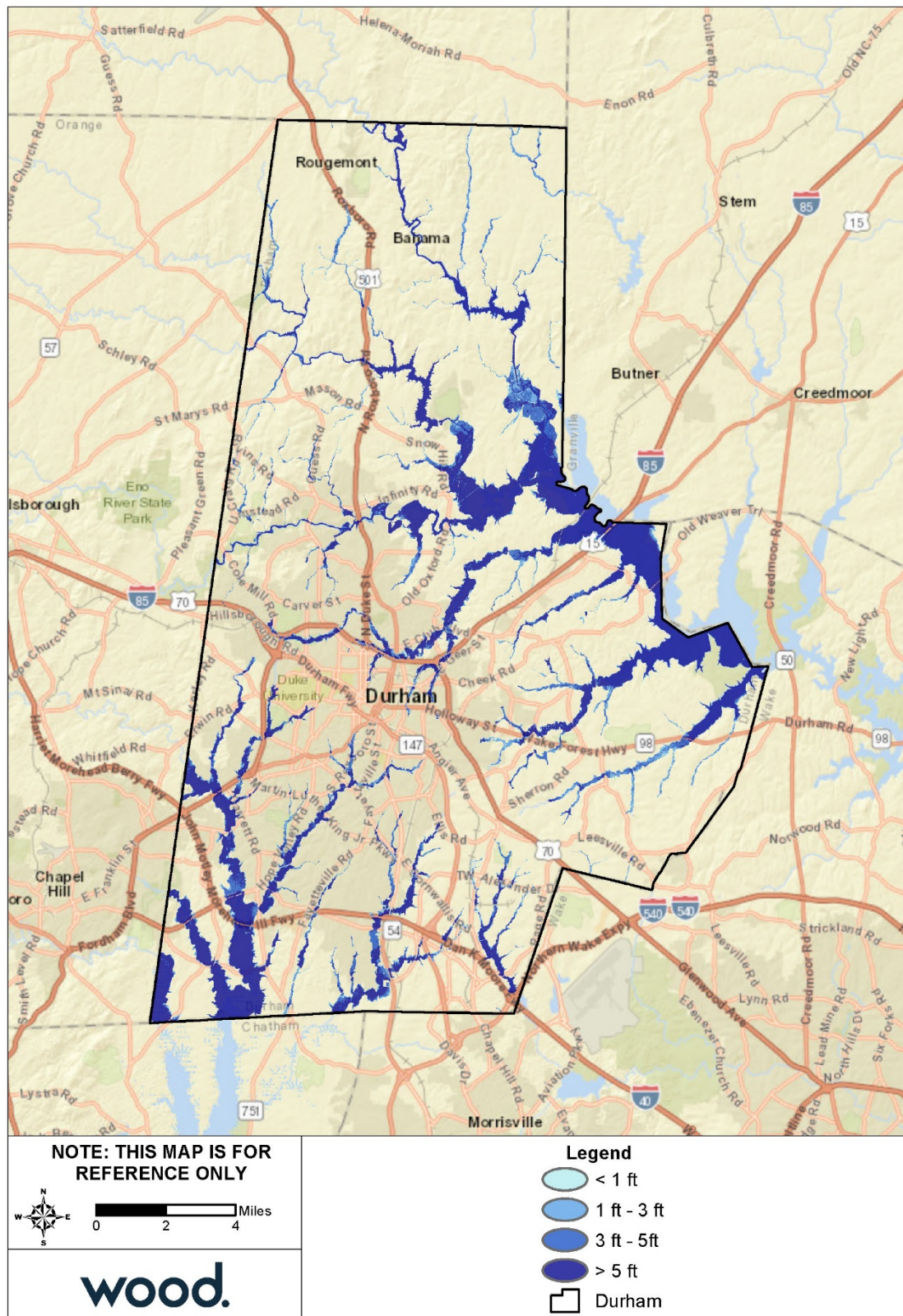
Source: FEMA Effective DFIRM

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Figure K.4 – Flood Depth, 1%-Annual-Chance Floodplain, Durham County



Source: FEMA Effective DFIRM

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### K.3.3 Wildfire

Table K.14 summarizes the acreage in unincorporated Durham County that falls within the Wildland Urban Interface (WUI), categorized by housing density. Areas in the WUI are those where development may intermix with flammable vegetation. Over 30 percent of unincorporated Durham County is not included in the WUI.

**Table K.14 – Wildland Urban Interface Acreage, Durham County**

	Housing Density	Total Acreage	Percent of Total Acreage
	<i>Not in WUI</i>	57,562.57	30.2%
	LT 1hs/40ac	16,492.10	8.7%
	1hs/40ac to 1hs/20ac	11,128.54	5.8%
	1hs/20ac to 1hs/10ac	15,007.23	7.9%
	1hs/10ac to 1hs/5ac	16,085.06	8.5%
	1hs/5ac to 1hs/2ac	19,505.77	10.2%
	1hs/2ac to 3hs/1ac	47,537.80	25.0%
	GT 3hs/1ac	7,010.34	3.7%
	<b>Total</b>	<b>190,329.42</b>	

Source: Southern Wildfire Risk Assessment

Figure K.5 depicts the WUI for all of Durham County. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure K.6 depicts Burn Probability based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Fire Intensity Scale, which indicates the potential severity of fire based on fuel loads, topography, and other factors, is depicted for Durham County in Section 4 of this plan and detailed for the City of Durham in the City's annex.

WUI areas are distributed throughout the county with the highest densities around the City of Durham. It should be noted that there is a gap in the WUI at Research Triangle Park because the WUI is determined based on housing density; however, there is development in RTP that could be at risk to wildfire. Burn probability is low throughout the county with clusters of slightly elevated burn probability in northern Durham County. A small portion, approximately 5.9 percent, of Durham County may experience up to a Class 4 Fire Intensity, which poses significant harm or damage to life and property. An additional 15.7 percent of the County may experience Class 3 Fire Intensity, which has potential for harm to life and property but is easier to suppress with dozer and plows. The remainder of the County is either non-burnable (23.7%) or would face a Class 1 or Class 2 Fire Intensity, which are easily suppressed.

Table K.13 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table K.14 provides counts and estimated damages for High Potential Loss Properties in unincorporated Durham County.

**Table K.15 – Critical Facilities Exposed to Wildfire, Unincorporated Durham County**

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	13	\$16,458,500
Commercial Facilities	15	\$13,378,517
Critical Manufacturing	6	\$107,386,488
Food and Agriculture	146	\$5,480,650
Government Facilities	2	\$987,230
Healthcare and Public Health	1	\$2,288,602
<b>All Categories</b>	<b>183</b>	<b>\$145,979,987</b>

Source: NCEM Risk Management Tool

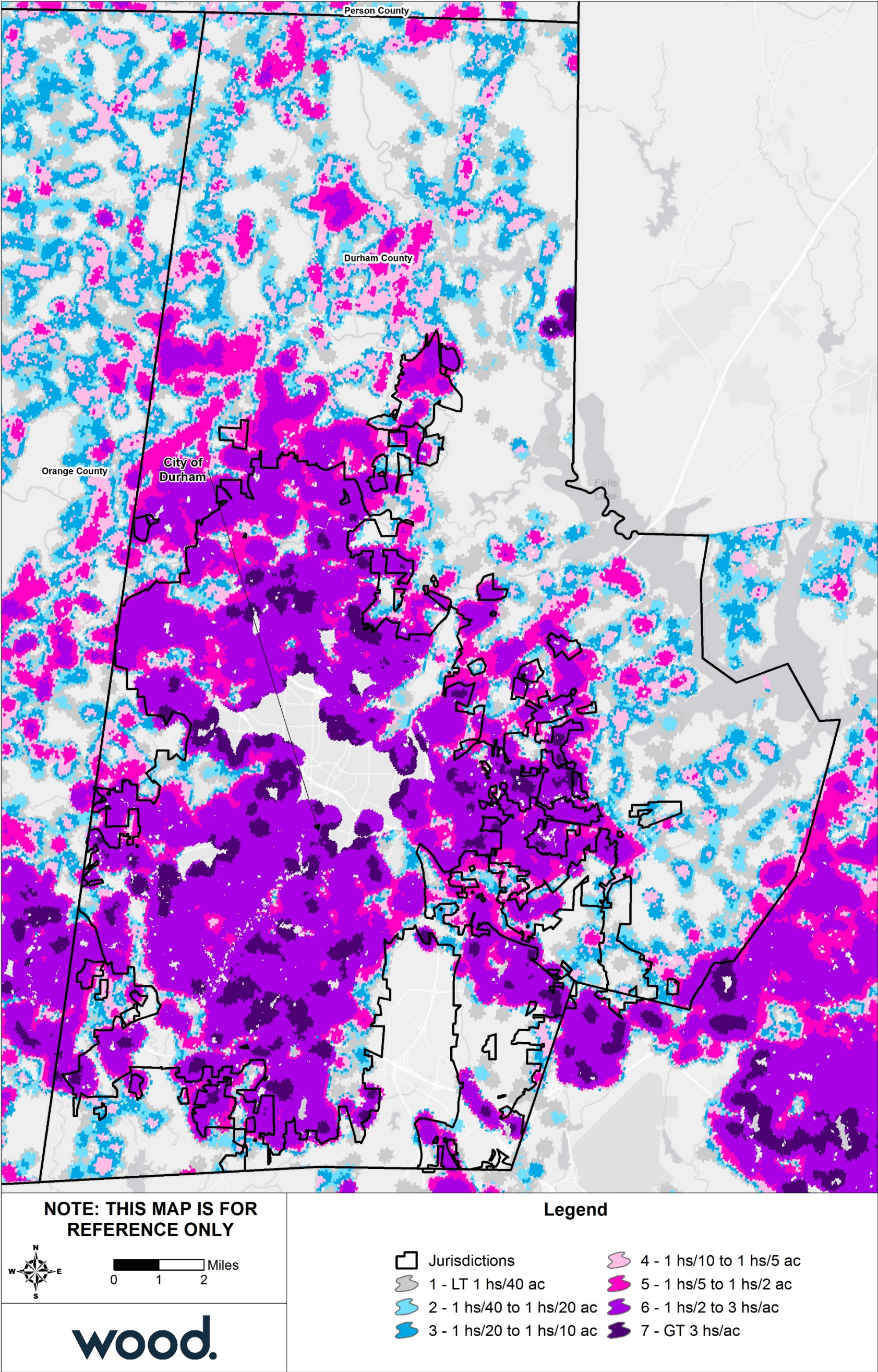
**Table K.16 – High Potential Loss Properties Exposed to Wildfire, Unincorporated Durham County**

Category	Number of Buildings at Risk	Estimated Damages
Commercial	1	\$4,141,931
Industrial	1	\$104,928,195
<b>All Categories</b>	<b>2</b>	<b>\$109,070,126</b>

Source: NCEM Risk Management Tool



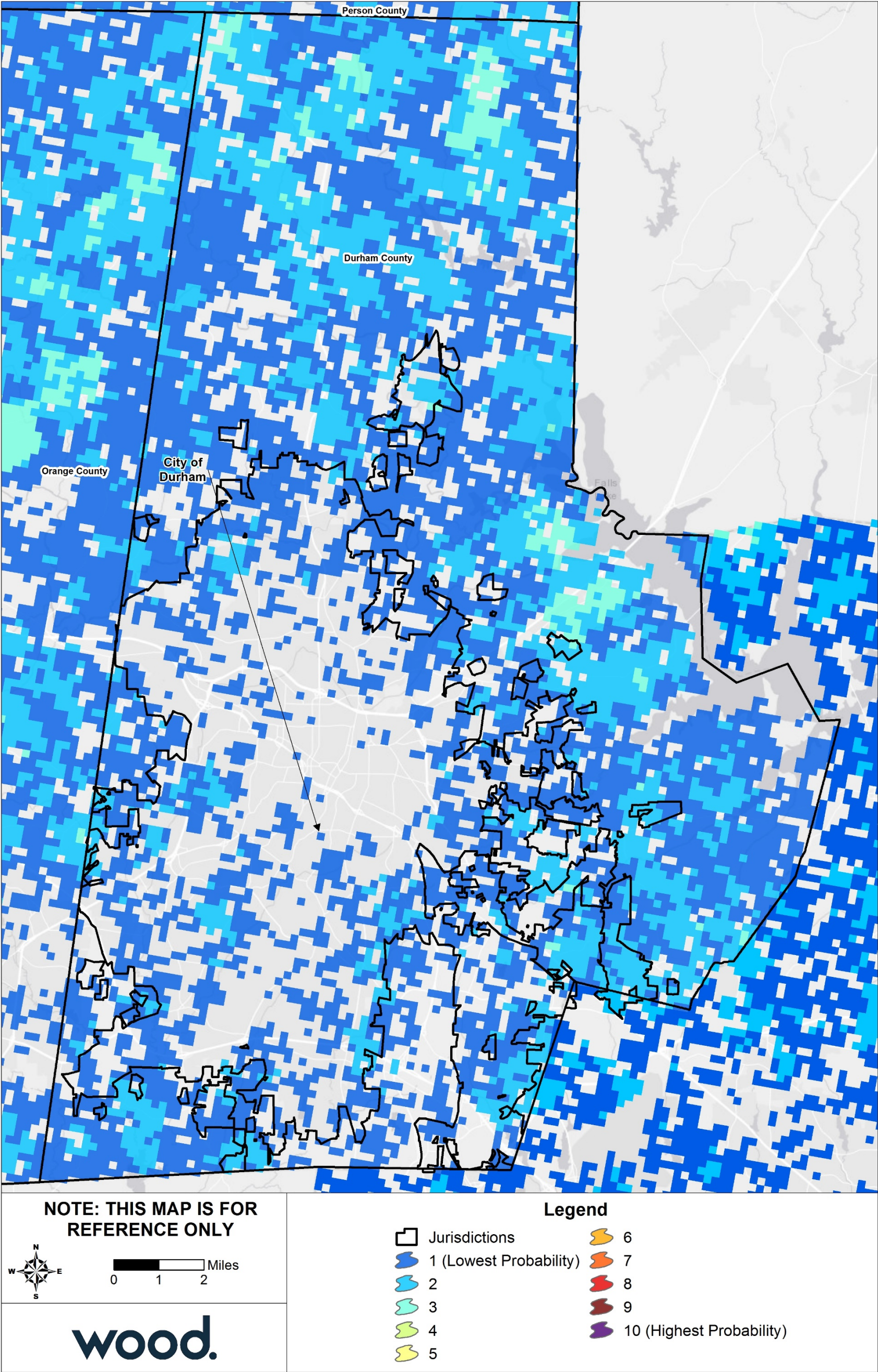
Figure K.5 – Wildland Urban Interface, Durham County



Source: Southern Wildfire Risk Assessment



Figure K.6 – Burn Probability, Durham County



Source: Southern Wildfire Risk Assessment



## K.4 CAPABILITY ASSESSMENT

### K.4.1 Overall Capability

Details on the tools and resources in place and available to Durham County were provided by the County's HMPC representatives and are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Durham County has an overall capability rating of High. The County could improve regulatory capability by developing an Evacuation Plan, which would support emergency preparedness and response efforts and/or a Post-Disaster Redevelopment Ordinance to plan and set mitigation requirements for post-disaster reconstruction. The County has strong administrative, fiscal, and outreach capability as well as extensive experience with structural mitigation.

### K.4.2 Floodplain Management

Durham County joined the NFIP through emergency entry in 1973 and has been a regular participant since February 1979. The County is also a participant in the CRS and currently is rated as a Class 8 community. The following tables reflect NFIP policy and claims data for the County categorized by structure type, flood zone, Pre-FIRM and Post-FIRM.

**Table K.17 – NFIP Policy and Claims Data by Structure Type**

Structure Type	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
Single Family	231	\$117,197	\$64,339,800	47	\$493,305.09
All Other Residential	4	\$2,679	\$2,150,000	22	\$237,771.32
Non Residential	7	\$2,819	\$1,561,400	2	\$9,480.90
<b>Total</b>	<b>242</b>	<b>\$122,695</b>	<b>\$68,051,200</b>	<b>71</b>	<b>\$740,557.31</b>

Source: FEMA Community Information System, accessed May 2020

**Table K.18 – NFIP Policy and Claims Data by Flood Zone**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	63	\$51,854	\$14,339,000	19	\$260,758.69
A Zones	1	\$451	\$168,400	2	\$27,379.82
B, C & X Zone					
Standard	19	\$11,964	\$4,681,800	28	\$234,937.46
Preferred	159	\$58,426	\$48,862,000	22	\$217,481.34
<b>Total</b>	<b>242</b>	<b>\$122,695</b>	<b>\$68,051,200</b>	<b>71</b>	<b>\$740,557.31</b>

Source: FEMA Community Information System, accessed May 2020

**Table K.19 – NFIP Policy and Claims Data Pre-FIRM**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	29	\$33,545	\$4,682,100	16	\$259,026.78
A Zones	0	\$0	\$0	1	\$4,312.77
B, C & X Zone	41	\$14,966	\$11,893,000	38	\$362,950.31
Standard	6	\$1,952	\$1,260,000	28	\$234,937.46
Preferred	35	\$13,014	\$10,633,000	10	\$128,012.85
<b>Total</b>	<b>70</b>	<b>\$48,511</b>	<b>\$16,575,100</b>	<b>55</b>	<b>\$626,289.86</b>

Source: FEMA Community Information System, accessed May 2020



Table K.20 – NFIP Policy and Claims Data Post-FIRM

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	34	\$18,309	\$9,656,900	3	\$1,731.91
A Zones	1	\$451	\$168,400	1	\$23,067.05
B, C & X Zone	137	\$55,424	\$41,650,800	12	\$89,468.49
Standard	13	\$10,012	\$3,421,800	0	\$0.00
Preferred	124	\$45,412	\$38,229,000	12	\$89,468.49
<b>Total</b>	<b>172</b>	<b>\$74,184</b>	<b>\$51,476,100</b>	<b>16</b>	<b>\$114,267.45</b>

Source: FEMA Community Information System, accessed May 2020

K.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Implement a Stormwater Utility Fee for all properties within the unincorporated areas of Durham County.	All Hazards	1.2	High	County Engineering and Environmental Services	Fee funded, staff time; estimated cost \$300,000	August 2020	New	The County will implement a stormwater utility fee to collect funds to ensure the County has resources to implement projects throughout the unincorporated areas of the County to meet the future Falls Lake and Jordan Lake rules. Estimated cost includes consultant costs for data development, rate development, public education, and full implementation of the new fee.
Property Protection									
PP-1	Seek funding to install backup generators or quick connect hook ups for mobile generators on any newly constructed County or City critical facilities	All Hazards	4.2	Moderate	Buildings and Inspections Department, Planning Department, Emergency Services	Local, State grants, UHMA grants, other federal grants	2020-2025	Carried forward	No new generators installed in last five years due to competing priorities.
Natural Resource Protection									
NRP-1	Identify and obtain additional properties to increase protected open space as a land-use tool to reduce adverse impacts from floods.	Flood	1.2	Moderate	City-County Planning Department	HMGP or PDM with local or State match	2020-2025	Carried forward	Acquisition and elevation projects are in progress in the City. City and County will work to identify more properties to pursue additional acquisitions.
Structural Projects									
SP-1	Seek funding to retrofit critical facilities and City- and County-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, 320 or 361 compliant safe rooms, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	4.2	Moderate	Buildings and Inspections Department, Planning Department, Emergency Services	Local, State grants, UHMA grants, other federal grants	2020-2025	Carried forward	No retrofits were completed due to competing priorities and funding limitations. A new police department headquarters and emergency communications center was completed and opened in 2018 and incorporated resilient design including hurricane-resistant glass and low energy consumption features. City and County will work to identify existing facilities in need of retrofits.

# Annex L City of Durham

## L.1 PLANNING PROCESS

The table below lists the HMPC members who represented the City of Durham.

**Table L.1 – HMPC Members**

Representative	Position or Title
Graham Summerson	Public Works Civil Engineer
Stephan Windsor	Planning Department Senior Engineering Specialist
Maie Armstrong	Planning Department Senior Engineer
April Johnson	Preservation Durham
Michelle Hartman	Duke University
Haley Schomburg	Stakeholder
Sara Feusen	Stakeholder

## L.2 COMMUNITY PROFILE

### Geography

The City of Durham is located in central Durham County. Durham is part of the Durham-Chapel Hill, NC Metropolitan Statistical Area, which falls within the larger Raleigh-Durham-Chapel Hill, NC Combined Statistical Area. A small section of the City of Durham extends into Wake County. The statistics reported here are for the entirety of the City. Durham comprises a total land area of 108.3 square miles, accounting for over a third of Durham County's total area.

### Population and Demographics

Table L.2 provides population counts and growth estimates for the City of Durham as compared to Durham County and the Eno-Haw region. Table L.3 provides demographic information for Durham as compared to the county and the state.

**Table L.2 – Population Counts, Durham, 2010-2018**

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
City of Durham	187,035	228,330	264,310	35,980	15.8%
<b>Durham County</b>	<b>223,314</b>	<b>257,466</b>	<b>306,457</b>	<b>48,991</b>	<b>19.0%</b>
<b>Region Total</b>	<b>507,964</b>	<b>567,634</b>	<b>649,276</b>	<b>81,642</b>	<b>14.4%</b>

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

Note: The total population of Durham includes population residing in Wake County.

**Table L.3 – Demographic and Social Characteristics, Durham, 2018**

Demographic & Social Characteristics	Durham	Durham County	North Carolina
Median Age	33.8	35.2	38.6
% of Population Under 5 years old	6.9	6.7	5.9
% of population Over 65 years old	11.3	12.1	15.5
% of Population Over 25 with high school diploma	87.9%	88.4%	87.4%
% of Population Over 25 with bachelor's degree or higher	48.7%	47.5%	30.5%

Demographic & Social Characteristics	Durham	Durham County	North Carolina
% with Disability	9.6%	10	13.6
% Speak English less than "very well"	9.3%	8.7	4.6

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

## Housing

The table below details key housing statistics for the City of Durham as compared to the County overall.

**Table L.4 – Housing Statistics, Durham, 2010-2018**

Housing Characteristics	Durham	Durham County
Housing Units (2010)	103,221	120,217
Housing Units (2018)	116,651	133,429
Housing Units Percent Change (2010-2018)	13.0%	11.0%
Housing Occupancy Rate	92.3	92.5%
% Owner-Occupied	49.5	53.8%
Average Household Size	2.35	2.37
% of Housing Units with no Vehicles Available	8.8	8.0%
% of Housing Units that are mobile homes	0.8	1.4%
Median Home Value	\$207,900	\$209,300

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2014-2018 5-Year Estimates

## Economy

The following tables present key economic statistics for Durham as compared to the county and the state.

**Table L.5 – Economic Statistics, Durham, 2018**

Demographic & Social Characteristics	Durham	Durham County	North Carolina
Median Household Income	55,851	\$58,190	\$52,413
Per Capita Income	32,932	\$34,063	\$29,456
Unemployment Rate	5.2%	5.2%	6.3%
% of Individuals Below Poverty Level	16.8	16.0	15.4
% Without Health Insurance	12.8	12.2	11.1

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

## L.3 RISK ASSESSMENT

This section contains a summary of the City's asset inventory as well as hazard profile and vulnerability assessment for those hazards that are spatially defined and have variations in risk that could be evaluated quantitatively on a jurisdictional level. The hazards included in this section are: Flood and Wildfire.

### Asset Inventory

The following tables summarize the asset inventory for the City of Durham in order to estimate the total physical exposure to hazards in this area. The locations of critical facilities are shown in Figure L.1. Critical facilities are a subset of identified assets from the Critical Infrastructure & Key Resources (CIKR) dataset and are supplemented with additional facilities identified by the HMPC. See Table K.5 in the Durham County annex for a list of facilities added by the HMPC. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted and displayed.

Building counts are provided based on data from the NCEM IRISK database, and supplemental parcel exposure is based on November 2019 county parcel data.

**Table L.6 – Critical Infrastructure & Key Resources by Type**

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	Defense	Government Facilities	Healthcare	IT	National Monuments and Icons	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Durham	88	62	0	3,552	0	1,215	0	1,013	364	0	0	0	4	1,404	77	0	37	7,816

Source: NCEM Risk Management Tool

**Table L.7 – High Potential Loss Facilities by Use**

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Durham	451	704	133	239	0	60	51	1,638

Source: NCEM Risk Management Tool

**Table L.8 – IRISK Inventory of Building Counts and Values**

Jurisdiction	Building Count	Building Value
City of Durham	75,589	\$18,139,339,725

Source: NCEM Risk Management Tool

To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Eno-Haw Region, current parcel data was evaluated to identify recent development that was not included in NCEM's IRISK database. The building footprint layer from IRISK was compared to current parcel data; any parcels with an improved value that did not already have a building in IRISK were summarized in the table below. This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

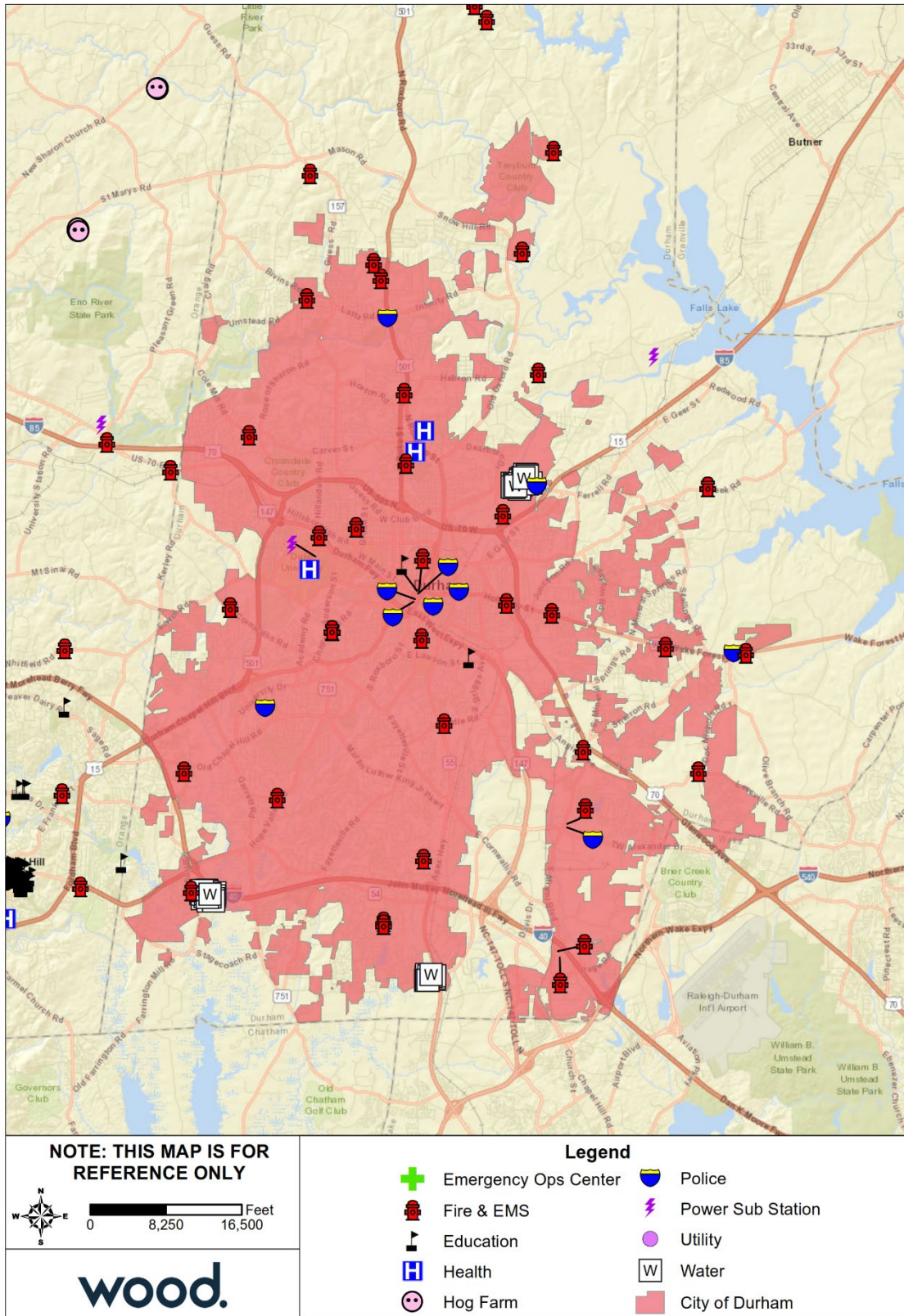
**Table L.9 – Parcels Development Not Included in IRISK, November 2019**

Jurisdiction	Improved Parcel Count	Total Improved Value
Durham	10,417	\$3,803,326,892

Source: County parcel data, retrieved November 2019; IRISK database building footprints



Figure L.1 – Critical Facilities, City of Durham



Source: NCEM IRISK Database, GIS Analysis

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2020

### L.3.1 Dam Failure

Table L.10 lists the high hazard dams in the City of Durham identified by the North Carolina Dam Inventory as of July 2018. All dam locations throughout Durham are shown in Figure L.2.

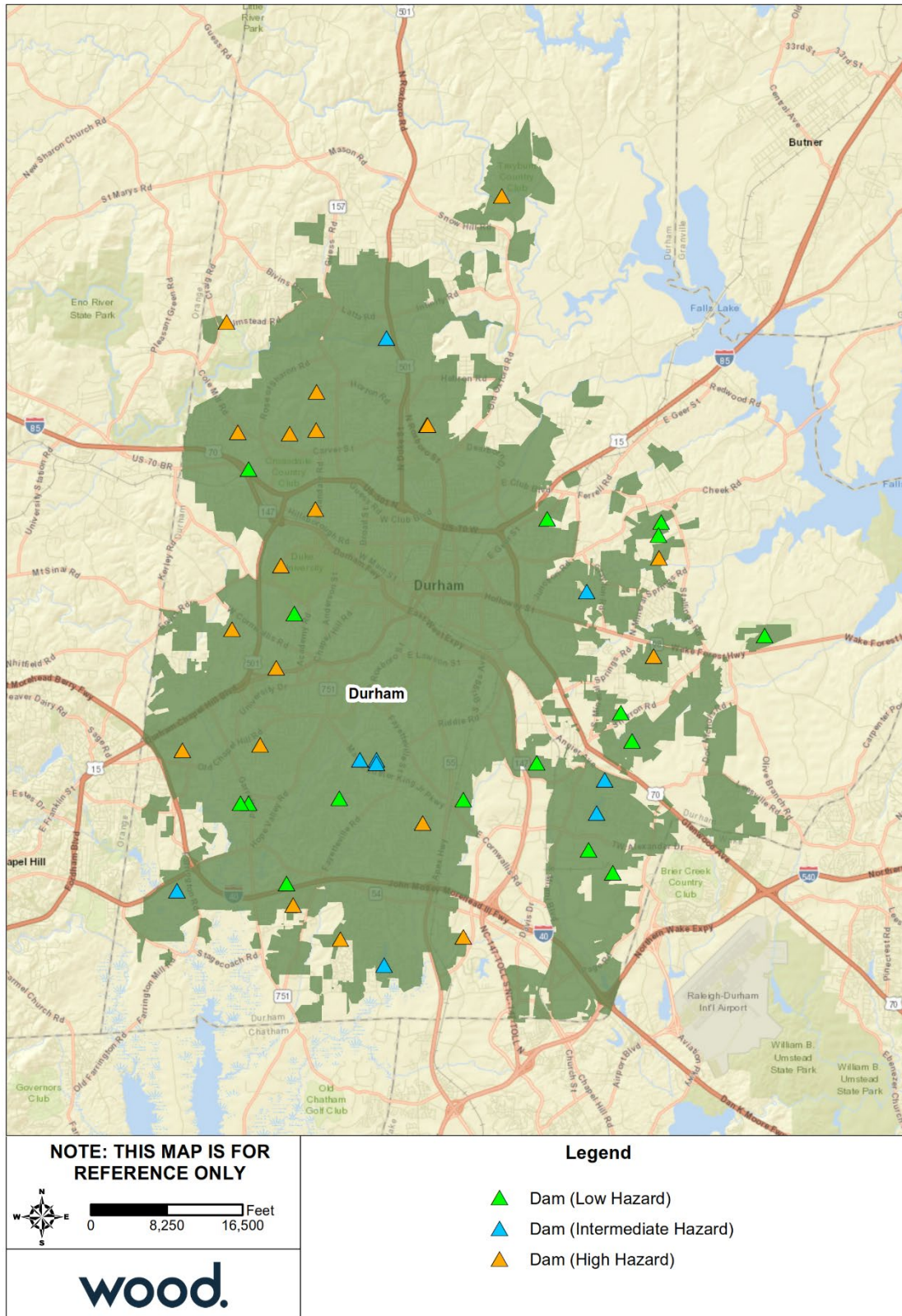
**Table L.10 – High Hazard Dams in City of Durham**

Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
Crystal Lake Dam	NC01021	Satisfactory	100	Durham (Hillandale Rd)
Newcomb Lake Dam	NC01023	Fair	94	Durham (Umstead Rd.)
Lake Elton Dam	NC01037	Satisfactory	155	Parkwood
Lakehurst S/D Dam	NC01039	Satisfactory	145	Farrington
Cole Lake Dam	NC01049	Fair	81	Huckleberry Springs (Fleming Dr)
Van Trine Lake Dam	NC01337			Durham
Dairy Pond Dam	NC02270	Satisfactory	31.2	Durham
Boles Lake Dam	NC05046	Satisfactory	60.2	Durham
Little River Dam	NC05143	Satisfactory	18,000	Falls
Georgiade Dam	NC02273	Not Rated	12	Durham
Stone Throw Apartments Pond Dam	NC02317	Fair	1	
Grove Park Dam	NC02323	Satisfactory	302	
Hock Dam	NC05112	Satisfactory	8	William Penn Plaza Rd
Oxford Commons Dam	NC02324	Satisfactory	24	William Penn Plaza Rd
Ridgefield Subdv. SWDP Dam 14	NC05629	Fair	6	Durham
The Streets at Southpoint Mall Dam	NC05653	Satisfactory	51	
Patterson Place Dam	NC05819	Satisfactory	82	
Forest at Duke Dam	NC06117	Satisfactory	-	
Williams Terminal Reservoir Dam	NC06139	Fair	-	Durham
Duke Water Harvesting Pond Dam	NC06146	Satisfactory	70	Durham

Source: NC Dam Inventory, July 2018



Figure L.2 – Dam Locations, City of Durham



Source: NC Dam Inventory, July 2018

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### L.3.2 Flood

Table L.11 details the acreage of the City of Durham by flood zone on the effective DFIRM. Per this assessment, over 11 percent of Durham falls within the mapped 1%-annual-chance floodplains.

**Table L.11 – Flood Zone Acreage in the City of Durham**

Flood Zone	Acreage	Percent of Total (%)
Zone A	15.0	0.0
Zone AE	8,208.5	11.4
Zone X (500-year)	253.2	0.4
Zone X Unshaded	63,742.2	88.3
<b>Total</b>	<b>72,218.9</b>	<b>--</b>

Source: FEMA Effective DFIRM

Figure L.3 reflects the effective mapped flood hazard zones for the City of Durham, and Figure L.4 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the region, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below and compared to total recent development counts and values. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. Additionally, this assessment does not evaluate flood impacts or provide damage estimates. According to this assessment, 1.6 percent of recent development in Durham is located in or near the SFHA.

**Table L.12 – Recent Development at Risk to Flood, City of Durham**

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
166	\$360,200,028	1.6%	9.5%

Source: Parcel data retrieved November 2019; FEMA Effective DFIRM

Table L.13 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector and flood event in unincorporated Durham County. Table L.14 summarizes high potential loss property vulnerability by sector and flood event.

**Table L.13 – Critical Facilities Exposed to Flooding, City of Durham**

Sector	Event	Number of Buildings at Risk	Estimated Damages
Banking and Finance	10 Year	2	\$12,594
	25 Year	3	\$33,628
	50 Year	5	\$100,266
	100 Year	7	\$316,812
	500 Year	17	\$3,530,526
Commercial Facilities	10 Year	19	\$182,112
	25 Year	25	\$275,445
	50 Year	31	\$515,745
	100 Year	37	\$1,250,481
	500 Year	53	\$5,155,540
Critical Manufacturing	10 Year	5	\$74,326

Sector	Event	Number of Buildings at Risk	Estimated Damages
	25 Year	11	\$398,450
	50 Year	13	\$837,684
	100 Year	16	\$3,226,966
	500 Year	21	\$6,873,537
Emergency Services	500 Year	1	\$11,856
Government Facilities	10 Year	3	\$47,197
	25 Year	3	\$113,253
	50 Year	4	\$161,538
	100 Year	4	\$208,035
	500 Year	6	\$432,213
Healthcare and Public Health	25 Year	1	\$48,401
	50 Year	1	\$76,423
	100 Year	2	\$223,908
	500 Year	2	\$430,159
Water	10 Year	2	\$6,043
	25 Year	2	\$24,252
	50 Year	6	\$90,667
	100 Year	9	\$431,979
	500 Year	10	\$928,584
All Categories	10 Year	31	\$322,272
	25 Year	45	\$893,429
	50 Year	60	\$1,782,323
	100 Year	75	\$5,658,181
	500 Year	110	\$17,362,415

Source: NCEM Risk Management Tool

Table L.14 – High Potential Loss Properties Exposed to Flooding, City of Durham

Category	Event	Number of Buildings at Risk	Estimated Damages
Commercial	25 Year	1	\$48,401
	50 Year	1	\$76,423
	100 Year	3	\$311,111
	500 Year	9	\$5,454,333
Government	10 Year	1	\$29,249
	25 Year	1	\$94,497
	50 Year	1	\$140,845
	100 Year	1	\$185,619
	500 Year	1	\$308,465
Industrial	25 Year	2	\$74,381
	50 Year	2	\$346,213
	100 Year	3	\$1,764,791
	500 Year	4	\$3,436,398
Residential	500 Year	2	\$86,154
Utilities	100 Year	2	\$205,432
	500 Year	3	\$492,882
All Categories	25 Year	4	\$217,279
	50 Year	4	\$563,481
	100 Year	9	\$2,466,953



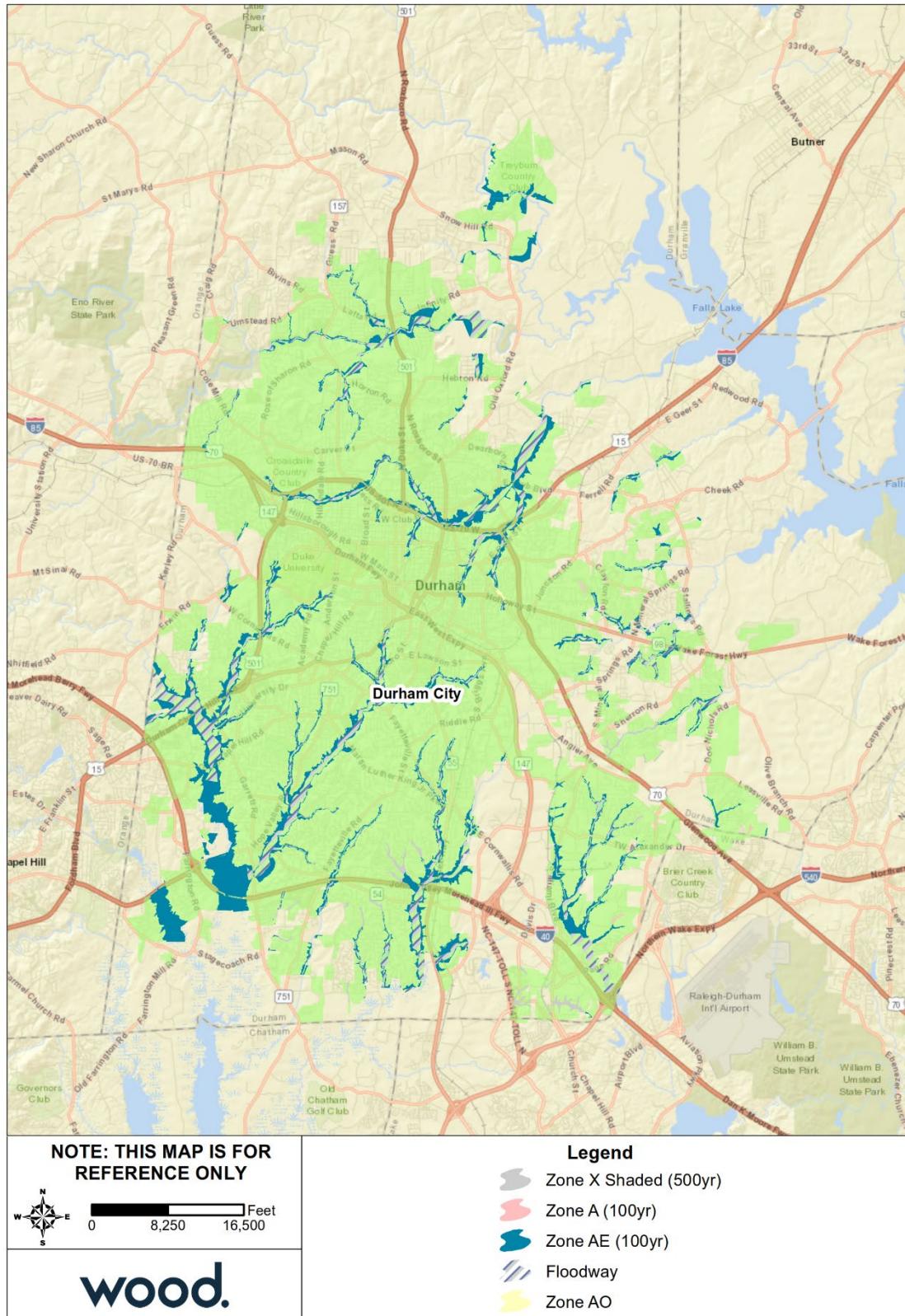
## ANNEX L: CITY OF DURHAM

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Category	Event	Number of Buildings at Risk	Estimated Damages
	500 Year	19	\$9,778,232
	10 Year	1	\$29,249

Source: NCEM Risk Management Tool

Figure L.3 – FEMA Flood Hazard Areas, City of Durham

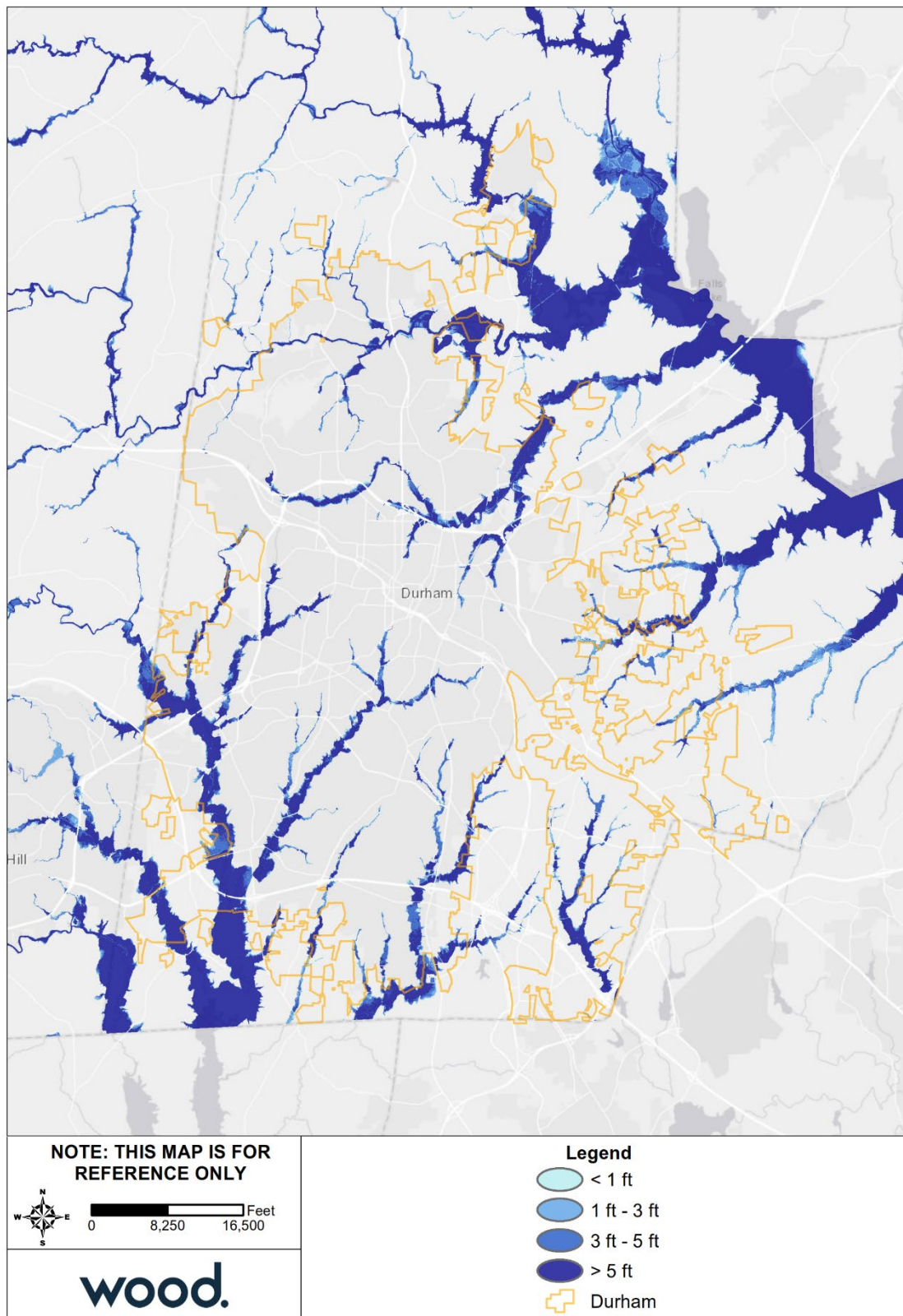


Source: FEMA Effective DFIRM

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Figure L.4 – Flood Depth, 1%-Annual-Chance Floodplain, City of Durham



Source: FEMA Effective DFIRM



### L.3.3 Wildfire

Table L.15 summarizes the acreage in the City of Durham that falls within the Wildland Urban Interface (WUI), categorized by housing density. Areas in the WUI are those where development may intermix with flammable vegetation. Nearly 17 percent of the City of Durham is not included in the WUI.

**Table L.15 – Wildland Urban Interface Acreage, City of Durham**

	Housing Density	Total Acreage	Percent of Total Acreage
	<i>Not in WUI</i>	12,153.62	16.9%
	LT 1hs/40ac	2,574.32	3.6%
	1hs/40ac to 1hs/20ac	1,783.33	2.5%
	1hs/20ac to 1hs/10ac	2,314.80	3.2%
	1hs/10ac to 1hs/5ac	3,262.30	4.5%
	1hs/5ac to 1hs/2ac	6,980.29	9.7%
	1hs/2ac to 3hs/1ac	36,381.59	50.5%
	GT 3hs/1ac	6,629.32	9.2%
	<b>Total</b>	<b>72,079.57</b>	

Source: Southern Wildfire Risk Assessment

Figure K.5 depicts the WUI for all of Durham County. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure K.6 depicts Burn Probability based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Figure L.5 depicts the Fire Intensity Scale; which indicates the potential severity of fire based on fuel loads, topography, and other factors; in order to detail potential wildfire extent in the City of Durham. Potential fire intensity is highest in the southeastern outskirts of the City of Durham; however, burn probability is low throughout the entire City. Overall, 10 percent of the City has a Class 3 fire intensity rating, while 3.5 percent has a Class 4 rating.

Table L.16 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table L.17 provides counts and estimated damages for High Potential Loss Properties in the City of Durham.

**Table L.16 – Critical Facilities Exposed to Wildfire, City of Durham**

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	2	\$9,519,672
Commercial Facilities	12	\$48,558,919
Critical Manufacturing	1	\$176,853
Government Facilities	3	\$49,434,268
Healthcare and Public Health	3	\$16,452,990
<b>All Categories</b>	<b>21</b>	<b>\$124,142,702</b>

Source: NCEM Risk Management Tool

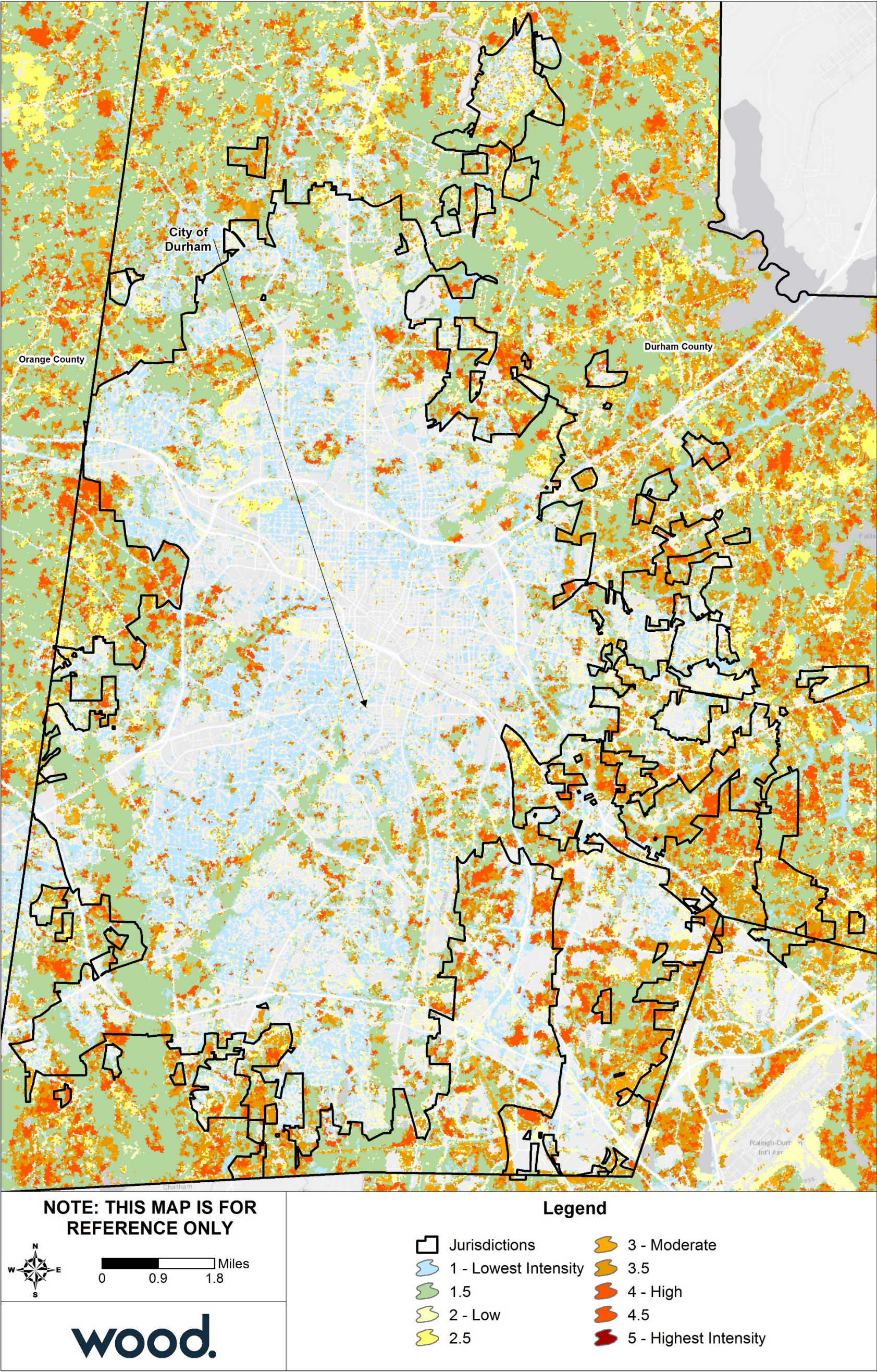
**Table L.17 – High Potential Loss Properties Exposed to Wildfire, City of Durham**

Category	Number of Buildings at Risk	Estimated Damages
Commercial	8	\$69,026,004
Government	3	\$49,434,268
Residential	1	\$26,669,008
<b>All Categories</b>	<b>12</b>	<b>\$145,129,280</b>

Source: NCEM Risk Management Tool



Figure L.5 – Fire Intensity Scale, City of Durham



Source: Southern Wildfire Risk Assessment



## L.4 CAPABILITY ASSESSMENT

### L.4.1 Overall Capability

Details on the tools and resources in place and available to the City of Durham were provided by the City's HMPC representatives and are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Durham has an overall capability rating of High. The City could improve regulatory capability by developing a Post-Disaster Redevelopment Ordinance to plan and set mitigation requirements for post-disaster reconstruction. The City has strong administrative, fiscal, and outreach capability as well as structural mitigation experience.

### L.4.2 Floodplain Management

The City of Durham joined the NFIP through emergency entry in 1973 and has been a regular participant since January 1979. The City of Durham is also a participant in the CRS program and is currently rated a Class 7 community. The following tables reflect NFIP policy and claims data for the City categorized by structure type, flood zone, Pre-FIRM and Post-FIRM.

**Table L.18 – NFIP Policy and Claims Data by Structure Type**

Structure Type	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
Single Family	1,049	\$597,687	\$270,277,500	203	\$1,906,275.83
2-4 Family	30	\$19,417	\$6,624,700	8	\$41,330.63
All Other Residential	80	\$177,392	\$31,798,500	21	\$864,936.75
Non Residential	83	\$199,402	\$38,160,700	26	\$894,288.51
<b>Total</b>	<b>1,242</b>	<b>\$993,898</b>	<b>\$346,861,400</b>	<b>258</b>	<b>\$3,706,831.72</b>

Source: FEMA Community Information System, accessed May 2020

**Table L.19 – NFIP Policy and Claims Data by Flood Zone**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	444	\$636,817	\$115,153,500	126	\$1,730,746.30
A Zones	1	\$600	\$71,000	10	\$24,703.74
B, C & X Zone					
Standard	118	\$85,381	\$32,337,900	44	\$874,350.54
Preferred	675	\$269,108	\$197,299,000	74	\$756,410.10
<b>Total</b>	<b>1,238</b>	<b>\$991,906</b>	<b>\$344,861,400</b>	<b>254</b>	<b>\$3,386,210.68</b>

Source: FEMA Community Information System, accessed May 2020

**Table L.20 – NFIP Policy and Claims Data Pre-FIRM**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	217	\$406,864	\$51,178,100	103	\$1,511,780.26
A Zones	1	\$600	\$71,000	10	\$24,703.74
B, C & X Zone	230	\$96,202	\$67,401,700	78	\$1,162,552.94
Standard	34	\$18,600	\$10,520,700	34	\$734,172.84
Preferred	196	\$77,602	\$56,881,000	45	\$487,674.33
<b>Total</b>	<b>448</b>	<b>\$503,666</b>	<b>\$118,650,800</b>	<b>191</b>	<b>\$2,699,036.94</b>

Source: FEMA Community Information System, accessed May 2020

**Table L.21 – NFIP Policy and Claims Data Post-FIRM**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	227	\$229,953	\$63,975,400	23	\$218,966.04
B, C & X Zone	563	\$258,287	\$162,235,200	39	\$408,913.47
Standard	84	\$66,781	\$21,817,200	10	\$140,177.70
Preferred	479	\$191,506	\$140,418,000	29	\$268,735.77
<b>Total</b>	<b>790</b>	<b>\$488,240</b>	<b>\$226,210,600</b>	<b>62</b>	<b>\$627,879.51</b>

Source: FEMA Community Information System, accessed May 2020

L.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Implement a Stormwater Utility Fee for all properties within the unincorporated areas of Durham County.	All Hazards	1.2	High	County Engineering and Environmental Services	Fee funded, staff time; estimated cost \$300,000	August 2020	New	The County will implement a stormwater utility fee to collect funds to ensure the County has resources to implement projects throughout the unincorporated areas of the County to meet the future Falls Lake and Jordan Lake rules. Estimated cost includes consultant costs for data development, rate development, public education, and full implementation of the new fee.
Property Protection									
PP-1	Seek funding to install backup generators or quick connect hook ups for mobile generators on any newly constructed County or City critical facilities	All Hazards	4.2	Moderate	Buildings and Inspections Department, Planning Department, Emergency Services	Local, State grants, UHMA grants, other federal grants	2020-2025	Carried forward	No new generators installed in last five years due to competing priorities.
Natural Resource Protection									
NRP-1	Identify and obtain additional properties to increase protected open space as a land-use tool to reduce adverse impacts from floods.	Flood	1.2	Moderate	City-County Planning Department	HMGP or PDM with local or State match	2020-2025	Carried forward	Acquisition and elevation projects are in progress in the City. City and County will work to identify more properties to pursue additional acquisitions.
Structural Projects									
SP-1	Seek funding to retrofit critical facilities and City- and County-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, 320 or 361 compliant safe rooms, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	4.2	Moderate	Buildings and Inspections Department, Planning Department, Emergency Services	Local, State grants, UHMA grants, other federal grants	2020-2025	Carried forward	No retrofits were completed due to competing priorities and funding limitations. A new police department headquarters and emergency communications center was completed and opened in 2018 and incorporated resilient design including hurricane-resistant glass and low energy consumption features. City and County will work to identify existing facilities in need of retrofits.

## Annex M Orange County

### M.1 PLANNING PROCESS

The table below lists the HMPC members who represented Orange County.

**Table M.1 – HMPC Members**

Representative	Position or Title
Kirby Saunders	EM Coordinator
Sarah Pickhardt	EM Planner
Brennan Bouma	Sustainability Coordinator
Michael Harvey	Planning and Zoning Supervisor
Perdita Holtz	Planning Systems Coordinator
Sasha Godwin	EM Intern
Ashley Moncado	Orange County Planning
Darrell Jeter	UNC Director of Emergency Management and Planning
Thomas Gambill	CERT Council Member
Kelly Ferrell	American Red Cross
Danielle Stone	American Red Cross
Jeanne Van Vlandren	American Red Cross
Meredith McMonigle	Family Success Alliance

### M.2 COMMUNITY PROFILE

#### Geography

Orange County is located in the north-central portion of the Piedmont of North Carolina. It is neighbored by Caswell and Person Counties to the north, Durham County to the east, Chatham County to the south, and Alamance County to the west. Orange County is included in the Durham-Chapel Hill, NC Metropolitan Statistical Area, which is also included in the Raleigh-Durham-Chapel Hill, NC Combined Statistical Area. Orange County comprises a total land area of 397.4 square miles.

The county was formed in 1752 from parts of Bladen County, Granville County, and Johnston County. It was named for the infant William V of Orange, whose mother Anne, daughter of King George II of Great Britain, was then regent of the Dutch Republic. In 1771, Orange County was greatly reduced in area. The western part of the county was combined with the eastern part of Rowan County to form Guilford County. Another part was combined with parts of Cumberland County and Johnston County to form Wake County. The southern part of what remained became Chatham County. In 1777, the northern half of what was left of Orange County became Caswell County. In 1849, the western third of the still shrinking county became Alamance County. Finally, in 1881 the eastern half of the county's remaining territory was combined with part of Wake County to form Durham County. Some of the first settlers of the county were English Quakers, who settled along the Haw and Eno Rivers.

#### Population and Demographics

Table M.2 provides population counts and growth estimates for Orange County unincorporated areas as compared to the county and the region overall.

**Table M.2 – Population Counts, Unincorporated Orange County, 2010-2018**

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
Unincorporated Orange County	47,284	41,342	55,078	13,736	33.2%
<b>Orange County</b>	<b>118,227</b>	<b>124,244</b>	<b>142,938</b>	<b>18,694</b>	<b>15.0%</b>
<b>Region Total</b>	<b>507,964</b>	<b>567,634</b>	<b>649,276</b>	<b>81,642</b>	<b>14.4%</b>

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

Note: Unincorporated areas statistics calculated by subtracting jurisdiction counts from the county total. The total population of Chapel Hill includes population residing in Durham County.

### Housing

The table below details housing unit counts for Orange County unincorporated areas as compared to the county overall. Overall, housing unit estimates increased more in unincorporated Orange County. However, these counts are calculated by subtracting the estimates of the incorporated area from the county total estimate, which may skew these numbers.

**Table M.3 – Housing Statistics, Unincorporated Orange County, 2010-2018**

Housing Characteristics	Orange County	Unincorporated Orange County
Housing Units (2010)	55,597	21,492
Housing Units (2018)	57,502	23,064
Housing Units Percent Change (2010-2018)	3.4%	7.3%

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2014-2018 5-Year Estimates

## M.3 RISK ASSESSMENT

This section contains a summary of the County's asset inventory as well as hazard profile and vulnerability assessment for those hazards that are spatially defined and have variations in risk that could be evaluated quantitatively on a jurisdictional level. The hazards included in this section are: Dam Failure, Flood, and Wildfire.

### Asset Inventory

The following tables summarize the asset inventory from IRISK for unincorporated Orange County in order to estimate the total physical exposure to hazards in this area. Note that the Critical Infrastructure & Key Resources counts are by building; where a critical facility comprises a cluster of buildings, each building is counted.

Building counts are provided based on data from the NCEM IRISK database, and supplemental parcel exposure is based on November 2019 county parcel data.

Due to the age of the IRISK data, Orange County HMPC representatives decided not to include the mapped IRISK facilities in this plan. Instead, Orange County Emergency Management has provided its own updated map of critical facilities, shown in Figure M.1.



Table M.4 – Critical Infrastructure &amp; Key Resources by Type

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	Defense	Government Facilities	Healthcare	IT	National Monuments and Icons	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Unincorporated Orange County	1,790	0	0	567	0	269	0	58	31	0	0	0	0	170	5	10	5	2,905

Source: NCEM Risk Management Tool

Table M.5 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Unincorporated Orange County	37	6	4	0	0	8	4	59

Source: NCEM Risk Management Tool

Table M.6 – IRISK Inventory of Building Counts and Values

Jurisdiction	Building Count	Building Value
Unincorporated Orange County	24,533	\$3,203,843,233

Source: NCEM Risk Management Tool

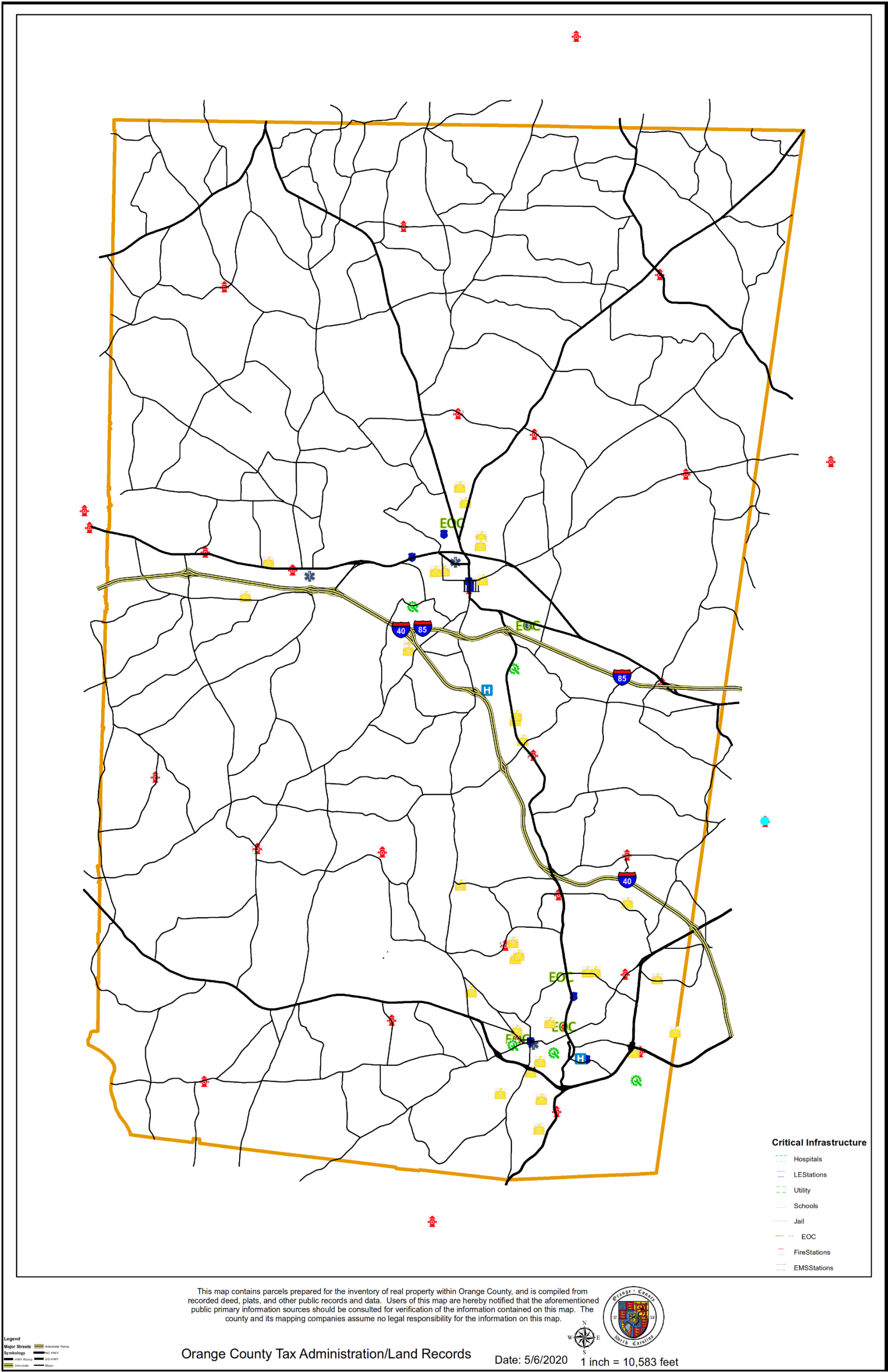
To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Eno-Haw Region, current parcel data was evaluated to identify recent development that was not included in NCEM's IRISK database. The building footprint layer from IRISK was compared to current parcel data; any parcels with an improved value that did not already have a building in IRISK were summarized in the table below. This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

Table M.7 – Parcels Development Not Included in IRISK, November 2019

Jurisdiction	Improved Parcel Count	Total Improved Value
Unincorporated Orange County	3,291	\$771,519,650

Source: County parcel data, retrieved November 2019; IRISK database building footprints

Figure M.1 – Critical Facilities, Orange County



**M.3.1 Dam Failure**

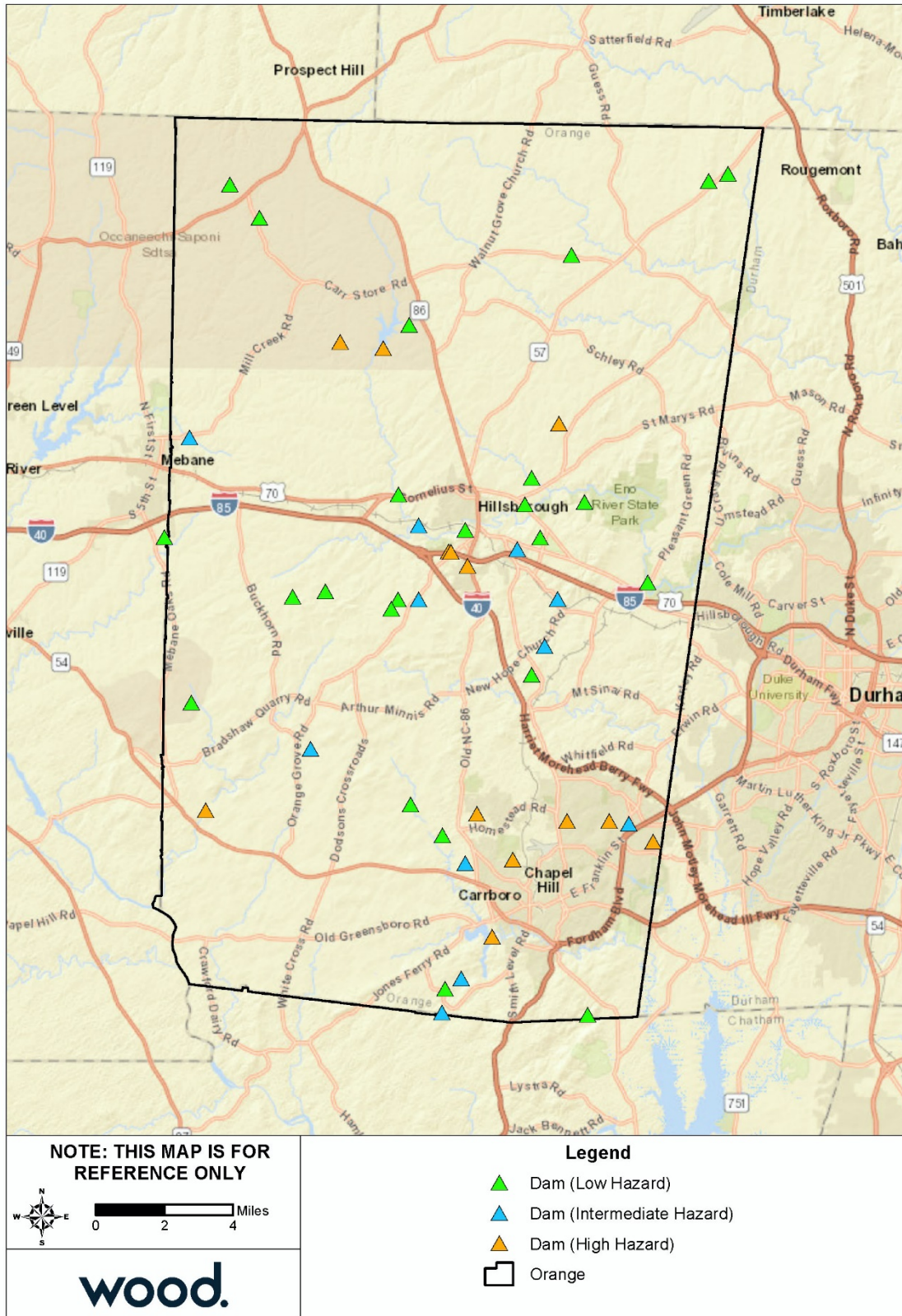
Table M.8 lists the high hazard dams in unincorporated Orange County identified by the North Carolina Dam Inventory as of July 2018. All dam locations throughout Orange County are shown in Figure M.2.

**Table M.8 – High Hazard Dams in Unincorporated Orange County**

Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
Lake Orange Dam	NC00773	Satisfactory	1,640	Hillsborough
Cane Creek Reservoir Dam	NC00779	Satisfactory	19,079	
University Lake Dam	NC00782	Satisfactory	4,836	Carrboro
Hillsborough Water Supply Dam	NC05793	Satisfactory	24,061	Hillsborough (N. Elland Cedar)
Randy Fox Dam	NC05715	Satisfactory	68	Hillsborough
Occoneechee Upper Dam	NC05776	Satisfactory	-	Virginia Cates Rd.
Occoneechee Lower Dam	NC05777	Satisfactory	5	Virginia Cates Rd.

Source: NC Dam Inventory, July 2018

Figure M.2 – Dam Locations, Orange County



Source: NC Dam Inventory, July 2018

Eno-Haw

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2020



### M.3.2 Flood

Table M.9 details the acreage of unincorporated Orange County by flood zone on the effective DFIRM. Per this assessment, nearly 5 percent of unincorporated Orange County falls within the mapped 1%-annual-chance floodplains.

**Table M.9 – Flood Zone Acreage in Unincorporated Orange County**

Flood Zone	Acreage	Percent of Total (%)
Zone AE	11,652.8	4.6
Zone X (500-year)	869.2	0.4
Zone X Unshaded	242,719.4	95.1
<b>Total</b>	<b>255,241.4</b>	<b>--</b>

Source: FEMA Effective DFIRM

Figure M.3 reflects the effective mapped flood hazard zones for Orange County, and Figure M.4 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the region, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below and compared to total recent development counts and values. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. Additionally, this assessment does not evaluate flood impacts or provide damage estimates. According to this assessment, 7.7 percent of recent development in unincorporated Orange County is located in or near the SFHA.

**Table M.10 – Recent Development at Risk to Flood, Unincorporated Orange County**

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
253	\$54,794,200	7.7%	7.1%

Source: Parcel data retrieved November 2019; FEMA Effective DFIRM

Table M.11 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector and flood event in unincorporated Orange County. There are no High Potential Loss Facilities with estimated flood damages in unincorporated Orange County.

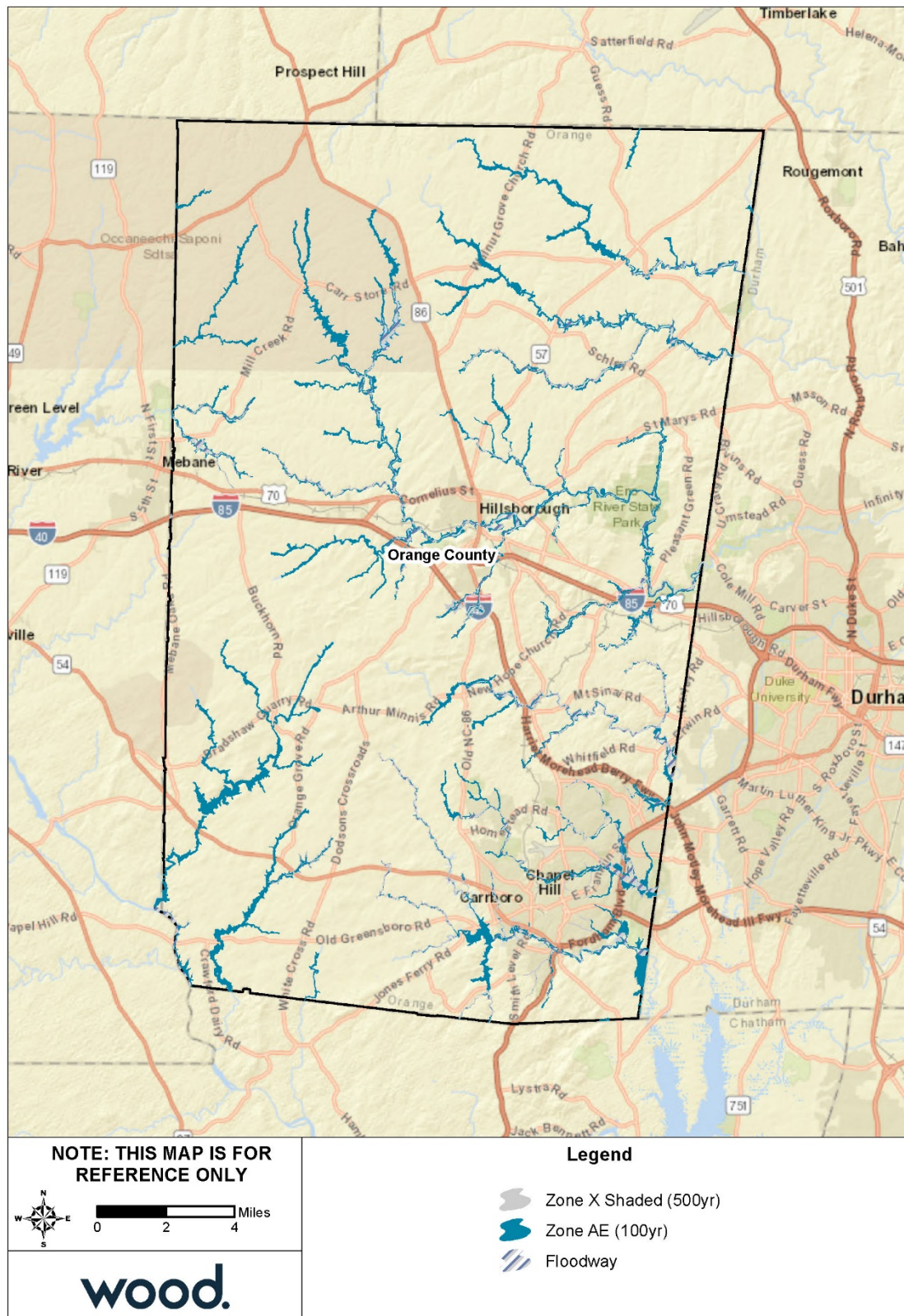
**Table M.11 – Critical Facilities Exposed to Flooding, Unincorporated Orange County**

Sector	Event	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	50 Year	1	\$545
	100 Year	1	\$1,389
	500 Year	1	\$5,626
Food & Agriculture	50 Year	1	\$14,435
	100 Year	1	\$27,811
	500 Year	2	\$29,929
<b>All Categories</b>	<b>50 Year</b>	<b>2</b>	<b>\$14,980</b>
	<b>100 Year</b>	<b>2</b>	<b>\$29,200</b>
	<b>500 Year</b>	<b>3</b>	<b>\$35,555</b>

Source: NCEM Risk Management Tool



Figure M.3 – FEMA Flood Hazard Areas, Orange County



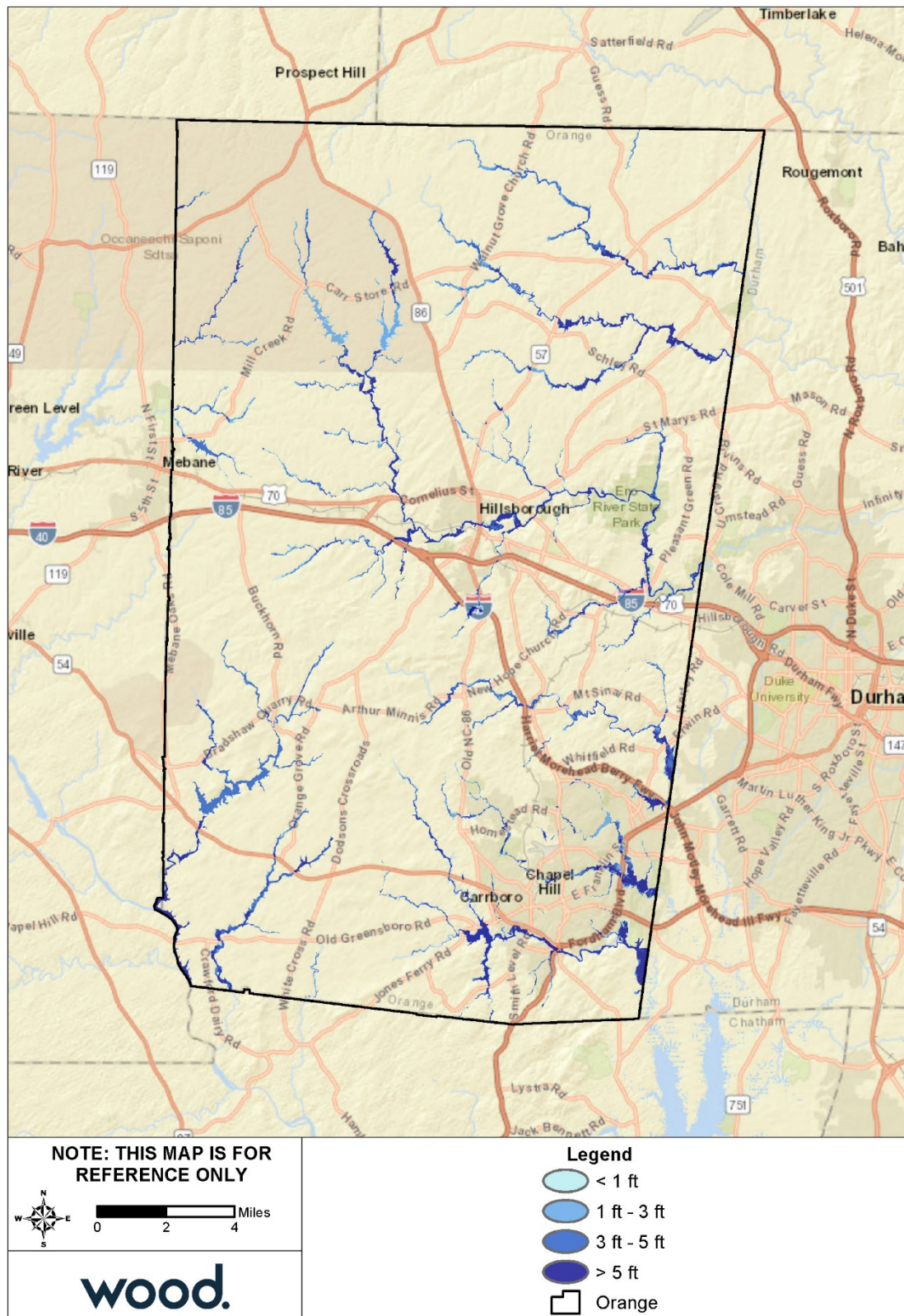
Source: FEMA Effective DFIRM

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2020



Figure M.4 – Flood Depth, 1%-Annual-Chance Floodplain, Orange County



Source: FEMA Effective DFIRM

Eno-Haw

Regional Hazard Mitigation Plan  
2020

### M.3.3 Wildfire

Table M.12 summarizes the acreage in unincorporated Orange County that falls within the Wildland Urban Interface (WUI), categorized by housing density. Areas in the WUI are those where development may intermix with flammable vegetation. Nearly 33 percent of unincorporated Orange County is not included in the WUI.

**Table M.12 – Wildland Urban Interface Acreage, Orange County**

	Housing Density	Total Acreage	Percent of Total Acreage
	<i>Not in WUI</i>	76,543.72	32.6%
	LT 1hs/40ac	34,368.03	14.6%
	1hs/40ac to 1hs/20ac	24,832.92	10.6%
	1hs/20ac to 1hs/10ac	37,043.05	15.8%
	1hs/10ac to 1hs/5ac	32,448.39	13.8%
	1hs/5ac to 1hs/2ac	21,391.90	9.1%
	1hs/2ac to 3hs/1ac	8,083.63	3.4%
	GT 3hs/1ac	48.62	0.0%
	<b>Total</b>	<b>234,760.26</b>	

Source: Southern Wildfire Risk Assessment

Figure K.5 depicts the WUI for all of Orange County. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure K.6 depicts Burn Probability for the County based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Fire Intensity Scale, which indicates the potential severity of fire based on fuel loads, topography, and other factors, is depicted for Orange County in Section 4 of this plan and detailed for incorporated areas in each jurisdiction's annex.

WUI areas are distributed throughout the county with larger gaps in the northern portion of the County. Burn probability is low throughout the majority of the county with only a few small clusters of moderate burn probability in northern and southwestern Orange County. A small portion, approximately 4.6 percent, of Orange County may experience up to a Class 4 Fire Intensity, which poses significant harm or damage to life and property. An additional 13.8 percent of the County may experience Class 3 Fire Intensity, which has potential for harm to life and property but is easier to suppress with dozer and plows. The remainder of the region is either non-burnable (12.5%) or would face a Class 1 or Class 2 Fire Intensity, which are easily suppressed.

Table M.13 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table M.14 provides counts and estimated damages for High Potential Loss Properties in unincorporated Orange County.

**Table M.13 – Critical Facilities Exposed to Wildfire, Unincorporated Orange County**

Sector	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	69	\$72,542,701
Critical Manufacturing	29	\$17,616,497
Emergency Services	2	\$1,326,061
Energy	1	\$30,347,418
Food and Agriculture	479	\$32,497,093
Government Facilities	2	\$11,805,083
Transportation Systems	17	\$11,312,826
<b>All Categories</b>	<b>599</b>	<b>\$177,447,679</b>

Source: NCEM Risk Management Tool

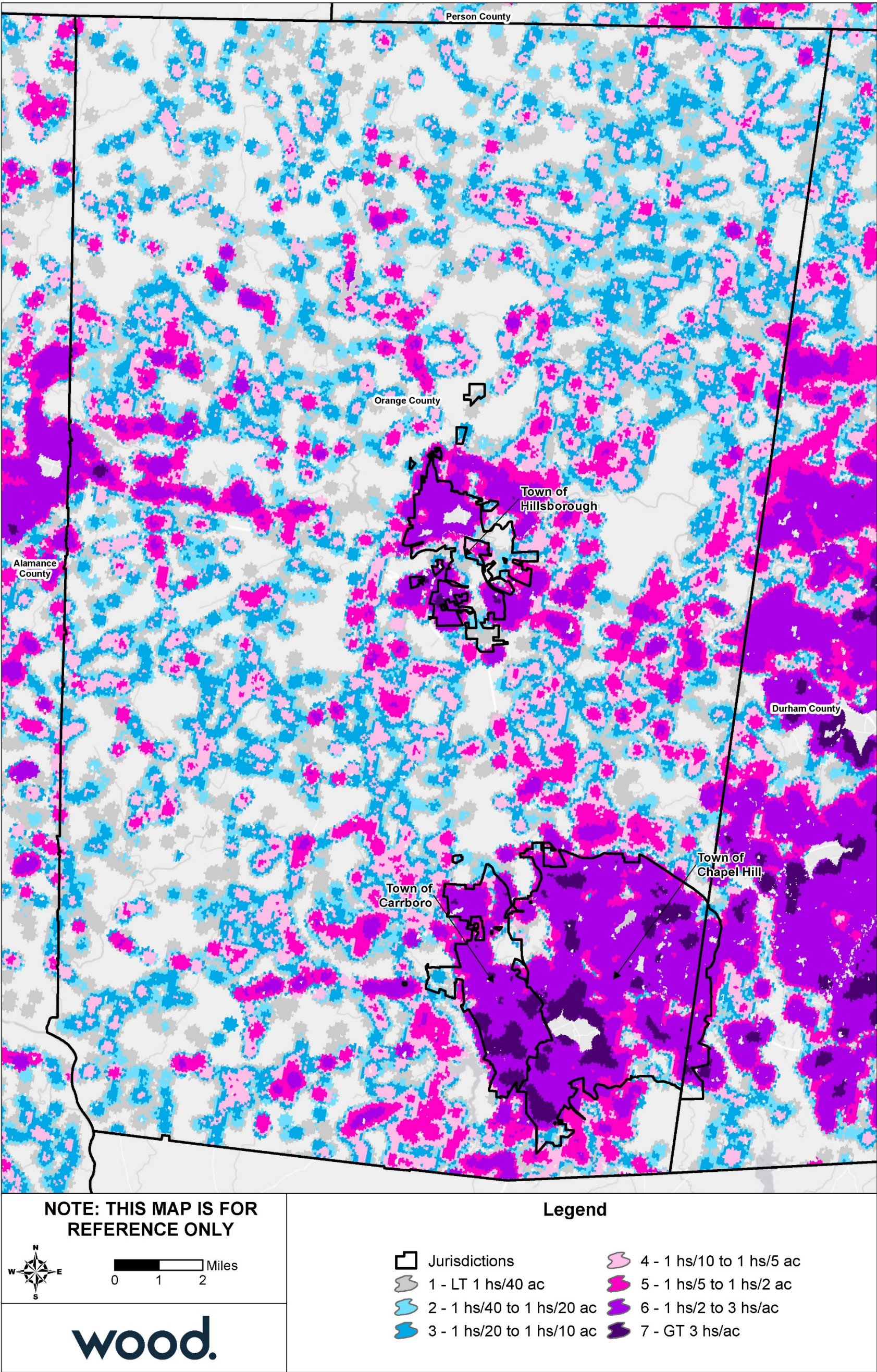
**Table M.14 – High Potential Loss Properties Exposed to Wildfire, Unincorporated Orange County**

Category	Number of Buildings at Risk	Estimated Damages
Residential	6	\$8,467,339
<b>All Categories</b>	<b>6</b>	<b>\$8,467,339</b>

Source: NCEM Risk Management Tool



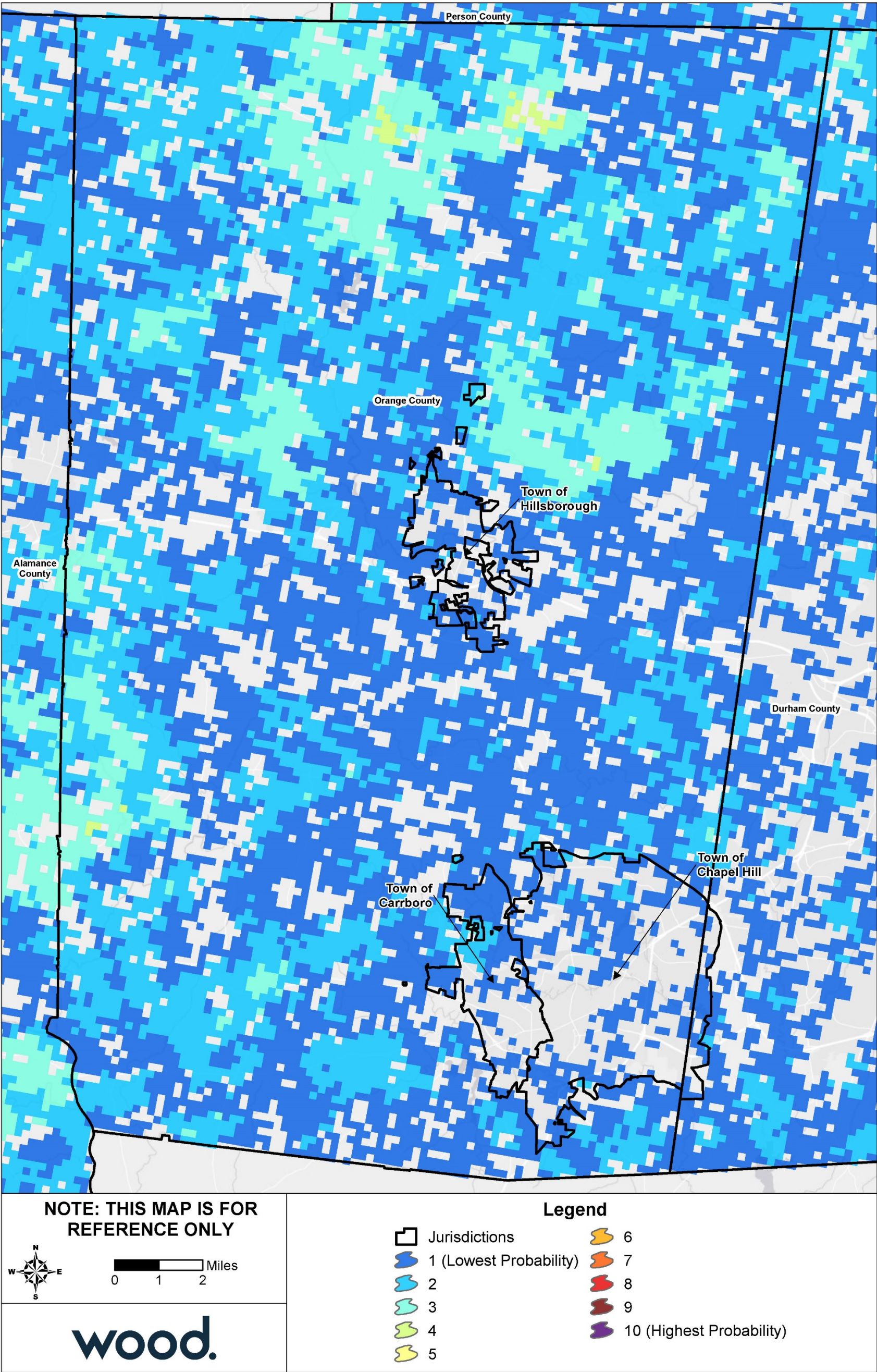
Figure M.5 – Wildland Urban Interface, Orange County



Source: Southern Wildfire Risk Assessment



Figure M.6 – Burn Probability, Orange County



Source: Southern Wildfire Risk Assessment



## M.4 CAPABILITY ASSESSMENT

### M.4.1 Overall Capability

Details on the tools and resources in place and available to Orange County were provided by the County's HMPC representatives and are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Orange County has an overall capability rating of High. The County could improve regulatory capability by developing a Continuity of Operations Plan and/or an Evacuation Plan to support emergency preparedness and response. The County could also develop a Post-Disaster Redevelopment Ordinance to plan and set mitigation requirements for post-disaster reconstruction. The County has strong administrative, fiscal, and outreach capability as well as structural mitigation experience.

### M.4.2 Floodplain Management

Orange County joined the NFIP through emergency entry in August 1974 and has been a regular participant since July 1978. Orange County also participates in the CRS program and is currently rated as a Class 6 community. The following tables reflect NFIP policy and claims data for the County categorized by structure type, flood zone, Pre-FIRM and Post-FIRM.

**Table M.15 – NFIP Policy and Claims Data by Structure Type**

Structure Type	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
Single Family	119	\$53,006	\$37,320,800	19	\$225,163.96
2-4 Family	1	\$761	\$91,500	1	\$31,837.94
All Other Residential	0	\$0	\$0	0	\$0.00
Non Residential	1	\$2,489	\$500,000	0	\$0.00
<b>Total</b>	<b>121</b>	<b>\$56,256</b>	<b>\$37,912,300</b>	<b>20</b>	<b>\$257,001.90</b>

Source: FEMA Community Information System, accessed May 2020

**Table M.16 – NFIP Policy and Claims Data by Flood Zone**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	10	\$11,231	\$2,916,300	3	\$32,565.51
A Zones	0	\$0	\$0	3	\$66,352.11
B, C & X Zone					
Standard	13	\$5,833	\$4,410,000	6	\$30,296.04
Preferred	98	\$39,192	\$30,586,000	8	\$127,788.24
<b>Total</b>	<b>121</b>	<b>\$56,256</b>	<b>\$37,912,300</b>	<b>20</b>	<b>\$257,001.90</b>

Source: FEMA Community Information System, accessed May 2020

**Table M.17 – NFIP Policy and Claims Data Pre-FIRM**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	5	\$8,003	\$1,310,900	2	\$19,583.26
A Zones	0	\$0	\$0	3	\$66,352.11
AO Zones	0	\$0	\$0	0	\$0.00
AH Zones	0	\$0	\$0	0	\$0.00

**ANNEX M: ORANGE COUNTY UNINCORPORATED AREAS**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
AR Zones	0	\$0	\$0	0	\$0.00
A99 Zones	0	\$0	\$0	0	\$0.00
V01-30 & VE Zones	0	\$0	\$0	0	\$0.00
V Zones	0	\$0	\$0	0	\$0.00
D Zones	0	\$0	\$0	0	\$0.00
B, C & X Zone	36	\$13,944	\$11,137,000	9	\$123,074.64
Standard	9	\$4,046	\$3,080,000	4	\$16,078.56
Preferred	27	\$9,898	\$8,057,000	5	\$106,996.08
<b>Total</b>	<b>41</b>	<b>\$21,947</b>	<b>\$12,447,900</b>	<b>14</b>	<b>\$209,010.01</b>

Source: FEMA Community Information System, accessed May 2020

**Table M.18 – NFIP Policy and Claims Data Post-FIRM**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	5	\$3,228	\$1,605,400	1	\$12,982.25
A Zones	0	\$0	\$0	0	\$0.00
AO Zones	0	\$0	\$0	0	\$0.00
AH Zones	0	\$0	\$0	0	\$0.00
AR Zones	0	\$0	\$0	0	\$0.00
A99 Zones	0	\$0	\$0	0	\$0.00
V01-30 & VE Zones	0	\$0	\$0	0	\$0.00
V Zones	0	\$0	\$0	0	\$0.00
D Zones	0	\$0	\$0	0	\$0.00
B, C & X Zone	75	\$31,081	\$23,859,000	5	\$35,009.64
Standard	4	\$1,787	\$1,330,000	2	\$14,217.48
Preferred	71	\$29,294	\$22,529,000	3	\$20,792.16
<b>Total</b>	<b>80</b>	<b>\$34,309</b>	<b>\$25,464,400</b>	<b>6</b>	<b>\$47,991.89</b>

Source: FEMA Community Information System, accessed May 2020

M.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Continue implementation of the Orange County 2030 Comprehensive Plan	All Hazards	1.1	Moderate	Orange County Planning and Inspections Department	General Fund (existing staff salaries)	2020-2025	Carried Forward	This action is in progress and Orange County Planning staff continues to implement the 2030 Comprehensive Plan. Updates to the Comprehensive Plan may take place within the next 5 years or may result from the 2020 Census, however, at this time staff is not positive if/when that may actually occur.
P-2	Continue participation in the Community Rating System (CRS) and annual recertification in order to increase public safety, reduce property damage, avoid economic loss, and allow for a decrease in flood insurance premiums for Orange County residents.	Flood, Hurricane and Tropical Storm	1.1	High	Orange County Planning and Inspections Department	General Fund (existing staff salaries)	2020-2025	Carried Forward	For 2015 the Orange County CRS rating was an 8. Since 2016 the CRS rating for Orange County has been a 6. Last recertification date was September 16, 2019.
P-3	Continue to enforce floodplain regulations through the county's Special Flood Hazard Area (SFHA) Overlay District contained within the Orange County Unified Development Ordinance and continue training efforts for the Certified Floodplain Manager (CFM).	Flood, Hurricane and Tropical Storm	1.2	High	Orange County Planning and Inspections Department	General Fund (existing staff salaries)	2020-2025	Carried Forward	Orange county continues to enforce floodplain regulations through the County's Special Flood hazard Area Overlay District contained within the Orange county Unified Development ordinance. Michael Harvey is the Orange County Floodplain Manager and he is credentialed as a Certified Floodplain Manager (CFM) as of 2009.
P-4	Continue to collaborate and support municipal mitigation strategies	All Hazards	3.2	Moderate	Orange County Emergency Services	General Fund (existing staff salaries)	2020-2025	New	
P-5	Engage in assessments of local supply chain resiliency for critical commodities	Drought	3.1	Moderate	Orange County Emergency Services; Orange County Sustainability	General Fund (existing staff salaries)	2020-2025	New	
P-6	Continue to develop, review, update, and implement recommendations in local and regional plans to improve the reliability, redundancy, and resiliency of water resources (water, wastewater, reclaimed water).	All Hazards	3.1	Moderate	OWASA, Orange County Planning and Inspections Department	CIP and Operating Budgets	2020-2025	New	
Property Protection									
PP-1	Continue enforcement of the North Carolina State Building Code.	All Hazards	1.2	High	Orange County Planning and Inspections Department	General Fund (existing staff salaries)	2020-2025	Carried Forward	Currently operating under the 2018 edition of the NC State Building Codes and 2017 edition of the National Electrical Code. Updated every 6 years and next scheduled update is January 2025.
PP-2	Continue participation in the National Flood Insurance Program (NFIP) to reduce the impact of a future flood event, mitigate effects of flooding, and allow citizens to be eligible for affordable flood insurance.	Flood, Hurricane and Tropical Storm	1.2	High	Orange County Planning and Inspections Department	General Fund (existing staff salaries)	2020-2025	Carried Forward	Orange County has expanded its mapping and public outreach program. We will prohibit development in the floodway/special flood hazard area and require buffers (Per Section 6.13 of the UDO) from the 1% annual area of inundation (buffers range from 65ft to 80ft based on slope. No setbacks have been noted.
PP-3	Identify potential flood hazards of critical infrastructure and mitigation measures to address.	Flood, Hurricane, Tropical Storm	4.2	High	OWASA	CIP and Operating Budgets	2020-2025	New	

ANNEX M: ORANGE COUNTY UNINCORPORATED AREAS

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
PP-4	Explore expanding situational awareness tools and strategies for increased monitoring of local hazards such as installation of additional stream gauges	All Hazards	2.2	Moderate	Emergency Services, OWASA	General Fund (existing staff salaries)	2020-2025	New	
Natural Resource Protection									
NRP-1	Strive to ensure future development occurs in a manner that protects floodplains, streams, wetlands, and other natural features which work to reduce flood hazard susceptibility and continue to enforce existing regulations pertaining to stormwater management and erosion control standards contained within the Orange county Unified Development Ordinance.	Flood, Hurricane and Tropical Storm	1.1	High	Orange County Planning and Inspections Department	General Fund (existing staff salaries)	2020-2025	Carried Forward	<p>The County enforces floodplain development regulations and riparian/floodplain buffers standards exceeding minimum FEMA model ordinance and State riparian buffer requirements.</p> <p>The County prevents development activities (i.e. grading, placement of fill material, etc.) within SFHAs and requires preservation of a floodplain buffer, measured from the edge of the 1%-annual area of inundation. This ‘floodplain buffer’ is required to be preserved in its natural state to assist with the natural infiltration of storm water runoff and serve as an overall flood control measure. The size of the buffer, which is based on the slope of the subject property, can range anywhere from 65 ft. to 80 ft.</p> <p>With respect to the County’s storm water and erosion control programs, the County pushes development projects to adhere to low impact storm water design principles where practical and design erosion control basins in key critical watershed areas to the 25 year storm event.</p>
Structural Projects									
SP-1	Explore the possibility of retrofitting critical facilities to harden against high winds and lightening.	All Hazards	4.2	Moderate	Emergency Services, Asset Management	Unified hazard Mitigation Assistance (UHMA)	2020-2025	Carried Forward	Asset Management (AMS) staff worked with an architect (Jim Stumbo) in the Spring of 2018 and before to explore hardening the ES center. This produced drawings and specs which formed the basis for a grant application to the NC 9-1-1 Board for funding to create a hardened, updated, and more secure "Orange County Resilient PSAP" built to withstand wind speeds of up to 150 MPH. This was submitted on June 15th, 2018 but was not funded. AMS staff is currently exploring the possibility of hardening a new Emergency Services Substation in Efland.
SP-2	Conduct a cost-benefit review during the planning and design phase of construction of new government owned facilities or critical facilities to determine the feasibility of equipping the facility with back-up generators, lightening protection, high wind protection, and/or 361 compliant tornado shelters.	All Hazards	4.2	Moderate	Emergency Services, Asset Management	Unified hazard Mitigation Assistance (UHMA)	2020-2025	Carried Forward	This is being completed on a case-by-case basis with each new facility and major retrofit.
SP-3	Continue to identify and explore possibility of improving or retrofitting existing critical facilities with on site energy generation.	All Hazards	4.2	Moderate	Emergency Services, Asset Management, OWASA	Unified hazard Mitigation Assistance (UHMA)	2020-2025	New	



ANNEX M: ORANGE COUNTY UNINCORPORATED AREAS

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Emergency Services									
ES-1	Identify and implement strategies to increase swift water rescue capacity.	Flooding, Severe Weather, Hurricane and Tropical Storm	2.2	Moderate	Emergency Services	Emergency Management Performance Grant (EMPG)	2020-2025	New	
ES-2	Engage with regional stakeholders in comprehensive emergency response planning including Complex Coordinated Terror Attack response and Mass Casualty Incident response planning.	All Hazards	3.2	Moderate	Emergency Services	General Fund (existing staff salaries)	2020-2025	New	
Public Education & Awareness									
PEA-1	Provide education and outreach to Orange County residents in multiple languages in order to increase awareness of natural hazard potential in the county and maintain a link to the Eno-Haw Regional Hazard Mitigation Plan on Orange County's Website.	All Hazards	2.1	Moderate	Orange County Planning and Inspections Department; Emergency Services	General Fund (existing staff salaries)	2020-2025	Carried Forward	Revised to pursue outreach in multiple languages. Orange County continues to host and sponsor the Community Emergency Response Team (CERT) training. Since 2015, Orange County has hosted 8 CERT Basic Training Courses. In 2018, Orange County hosted a FEMA Community Mitigation Workshop to educate residents about mitigation options. In 2018-2019, Emergency Services staff worked with both Chamber of Commerces to develop and host 6 business emergency preparedness workshops. Also in 2018, the Orange County Health and Emergency Services Departments partnered to deliver 4 preparedness workshops to the limited English proficiency community. These workshops included take home preparedness kits for participants. Orange County EM continues to utilize social media and other platforms to inform and educate residents of natural hazards.
PEA-2	Engage in regional events, activities, and training opportunities related to natural hazards in order to improve communication, enhance, partnerships, and improve planning efforts with other local jurisdictions.	All Hazards	3.2	Moderate	Emergency Services	General Fund (existing staff salaries)	2020-2025	Carried Forward	Orange County participated in the Triangle Regional Resilience Assessment-2018
PEA-3	Strive to improve communication and outreach in multiple languages to Orange County residents before, during, and after hazard weather event with the county's website, press releases, social media accounts, and the OC Alerts system in order to keep residents informed and improve public safety in and around the county.	All Hazards	2.1	Moderate	Emergency Services	General Fund (existing staff salaries)	2020-2025	Carried Forward	Revised to pursue outreach in multiple languages. Orange County upgraded the website hosting and design vendor in August of 2018 from Revive to CivicPlus. Distribution of press releases was also changed from IContact to CivicSend in August 2018. Participating in Nextdoor, text 911, implemented citizen self reporting, hosted a FEMA Community Mitigation Workshop, Continually holding CERT classes and assisting in facilitating their success.
PEA-4	Provide staff support and information on Orange County's website to provide education and assistance to residents experiencing floodplain, stormwater, and erosion control issues.	Flood, Hurricane and Tropical Storm	2.1	Moderate	Orange County Planning and Inspections Department; Emergency Services	General Fund (existing staff salaries)	2020-2025	Carried Forward	Updated information was posted at <a href="http://www.orangecountync.gov/1309/Floodplain-Information">http://www.orangecountync.gov/1309/Floodplain-Information</a>

## Annex N Town of Carrboro

### N.1 PLANNING PROCESS

The table below lists the HMPC members who represented the Town of Carrboro.

**Table N.1 – HMPC Members**

Representative	Position or Title
Susanna Williams	Fire Chief/Emergency Manager
Patricia McGuire	Planning Director
Marty Roupe	Development Review Administrator
Laura Janway	Environmental Planner
Ray Enoch	Deputy Fire Chief
David Schmidt	Fire Chief

### N.2 COMMUNITY PROFILE

#### Geography

The Town of Carrboro is located in southeastern Orange County. It is neighbored by the Town of Chapel Hill to the east. The Town is part of the Durham-Chapel Hill, NC Metropolitan Statistical Area. Carrboro comprises a total land area of 6.5 square miles.

#### Population and Demographics

Table N.2 provides population counts and growth estimates for the Town of Carrboro as compared to Orange County and the Eno-Haw region overall. Table N.3 provides demographic information for Carrboro as compared to the county and the state.

**Table N.2 – Population Counts, Carrboro, 2010-2018**

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
Town of Carrboro	16,782	19,582	21,216	1,634	8.3%
<b>Orange County</b>	<b>118,227</b>	<b>124,244</b>	<b>142,938</b>	<b>18,694</b>	<b>15.0%</b>
<b>Region Total</b>	<b>507,964</b>	<b>567,634</b>	<b>649,276</b>	<b>81,642</b>	<b>14.4%</b>

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

**Table N.3 – Demographic and Social Characteristics, Carrboro, 2018**

Demographic & Social Characteristics	Carrboro	Orange County	North Carolina
Median Age	33.2	34.7	38.6
% of Population Under 5 years old	4.1	4.6	5.9
% of population Over 65 years old	9.7	12.8	15.5
% of Population Over 25 with high school diploma	94.5%	92.7%	87.4%
% of Population Over 25 with bachelor's degree or higher	68.2%	57.6%	30.5%
% with Disability	8.5%	8.8	13.6
% Speak English less than "very well"	7.6%	5.9	4.6

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

## Housing

The table below details key housing statistics for Carrboro as compared to the County overall.

**Table N.4 – Housing Statistics, Carrboro, 2010-2018**

Housing Characteristics	Carrboro	Orange County
Housing Units (2010)	9,258	55,597
Housing Units (2018)	9,781	57,502
Housing Units Percent Change (2010-2018)	5.6%	3.4%
Housing Occupancy Rate	94.1	91.4%
% Owner-Occupied	42.9	61.9%
Average Household Size	2.30	2.51
% of Housing Units with no Vehicles Available	8.5	5.0%
% of Housing Units that are mobile homes	0.9	8.3%
Median Home Value	\$350,800	\$292,500

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2014-2018 5-Year Estimates

## Economy

The following tables present key economic statistics for Carrboro as compared to the county and the state.

**Table N.5 – Economic Statistics, Carrboro, 2018**

Demographic & Social Characteristics	Carrboro	Orange County	North Carolina
Median Household Income	59,202	\$68,211	\$52,413
Per Capita Income	40,911	\$40,650	\$29,456
Unemployment Rate	4.1%	4.4%	6.3%
% of Individuals Below Poverty Level	14.5	13.4	15.4
% Without Health Insurance	9.4	7.2	11.1

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

## N.3 RISK ASSESSMENT

This section contains a summary of the Town's asset inventory as well as hazard profile and vulnerability assessment for those hazards that are spatially defined and have variations in risk that could be evaluated quantitatively on a jurisdictional level. The hazards included in this section are: Dam Failure, Flood, and Wildfire.

### Asset Inventory

The following tables summarize the asset inventory for the Town of Carrboro in order to estimate the total physical exposure to hazards in this area. The locations of critical facilities are shown in Figure N.1. Critical facilities are a subset of identified assets from the Critical Infrastructure & Key Resources (CIKR) dataset. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted and displayed. Additionally, this map does not include newer facilities identified by Orange County Emergency Management. See Figure M.1 for a map of updated critical facilities in Orange County.

Building counts are provided based on data from the NCEM IRISK database, and supplemental parcel exposure is based on November 2019 county parcel data.

Table N.6 – Critical Infrastructure &amp; Key Resources by Type

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	Defense	Government Facilities	Healthcare	IT	National Monuments and Icons	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Carrboro	45	5	0	145	0	34	0	23	21	0	0	0	0	30	8	2	9	322

Source: NCEM Risk Management Tool

Table N.7 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Carrboro	47	15	1	1	0	0	9	73

Source: NCEM Risk Management Tool

Table N.8 – IRISK Inventory of Building Counts and Values

Jurisdiction	Building Count	Building Value
Town of Carrboro	5,782	\$1,446,024,246

Source: NCEM Risk Management Tool

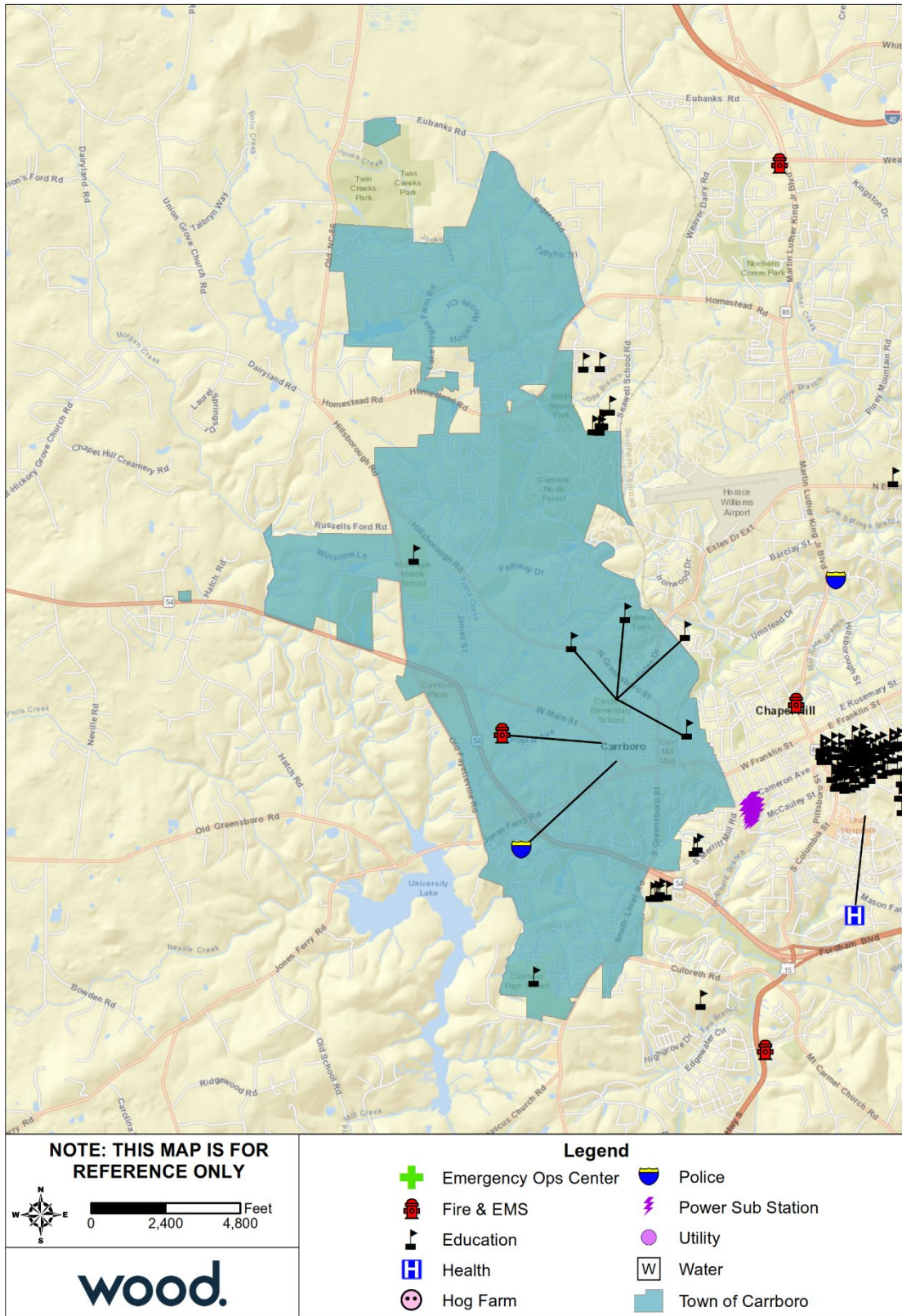
To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Eno-Haw Region, current parcel data was evaluated to identify recent development that was not included in NCEM's IRISK database. The building footprint layer from IRISK was compared to current parcel data; any parcels with an improved value that did not already have a building in IRISK were summarized in the table below. This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

Table N.9 – Parcels Development Not Included in IRISK, November 2019

Jurisdiction	Improved Parcel Count	Total Improved Value
Carrboro	545	\$172,753,800

Source: County parcel data, retrieved November 2019; IRISK database building footprints

Figure N.1 – Critical Facilities, Town of Carrboro



Source: NCEM IRISK Database, GIS Analysis

Eno-Haw

Regional Hazard Mitigation Plan  
2020



### N.3.1 Dam Failure

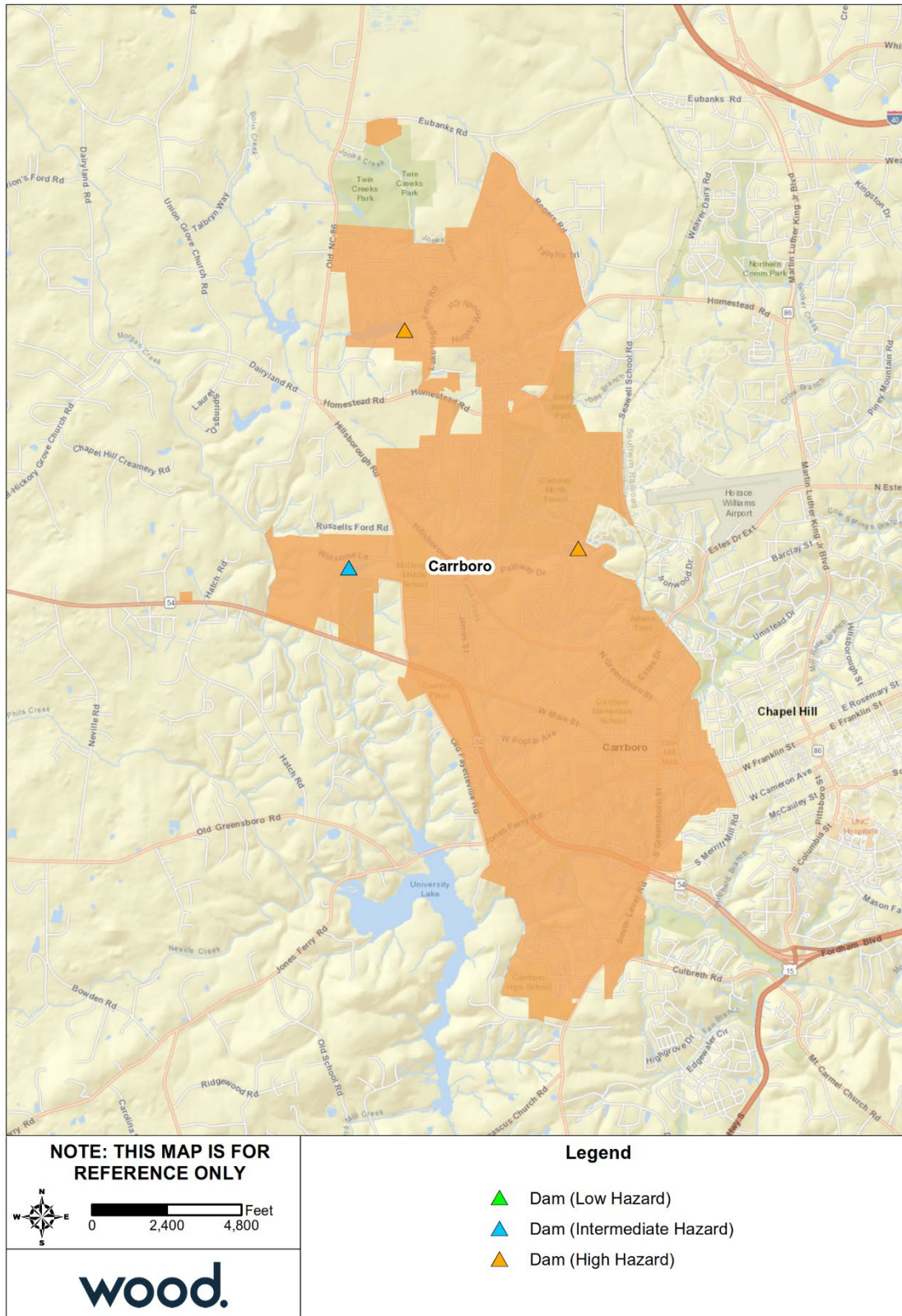
Table N.10 lists the high hazard dams in the Town of Carrboro identified by the North Carolina Dam Inventory as of July 2018. All dam locations throughout Carrboro are shown in Figure N.2. Additionally, Carrboro is the nearest downstream location to University Lake Dam in unincorporated Orange County.

**Table N.10 – High Hazard Dams in Town of Carrboro**

Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
Hogan Farms Dam	NC00770	Satisfactory	160	Chapel Hill
Spring Valley Dam	NC04994	Satisfactory	22	

Source: NC Dam Inventory, July 2018

Figure N.2 – Dam Locations, Town of Carrboro



Source: NC Dam Inventory, July 2018

Eno-Haw

Regional Hazard Mitigation Plan  
2020

### N.3.2 Flood

Table N.11 details the acreage of the Town of Carrboro by flood zone on the effective DFIRM. Per this assessment, over 6 percent of Carrboro falls within the mapped 1%-annual-chance floodplains.

**Table N.11 – Flood Zone Acreage in the Town of Carrboro**

Flood Zone	Acreage	Percent of Total (%)
Zone AE	262.0	6.3
Zone X (500-year)	23.7	0.6
Zone X Unshaded	3,867.6	93.1
<b>Total</b>	<b>4,153.3</b>	<b>--</b>

Source: FEMA Effective DFIRM

Figure N.3 reflects the effective mapped flood hazard zones for the Town of Carrboro, and Figure N.4 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the region, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below and compared to total recent development counts and values. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. Additionally, this assessment does not evaluate flood impacts or provide damage estimates. According to this assessment, less than one percent of recent development in Carrboro is located in or near the SFHA.

**Table N.12 – Recent Development at Risk to Flood, Town of Carrboro**

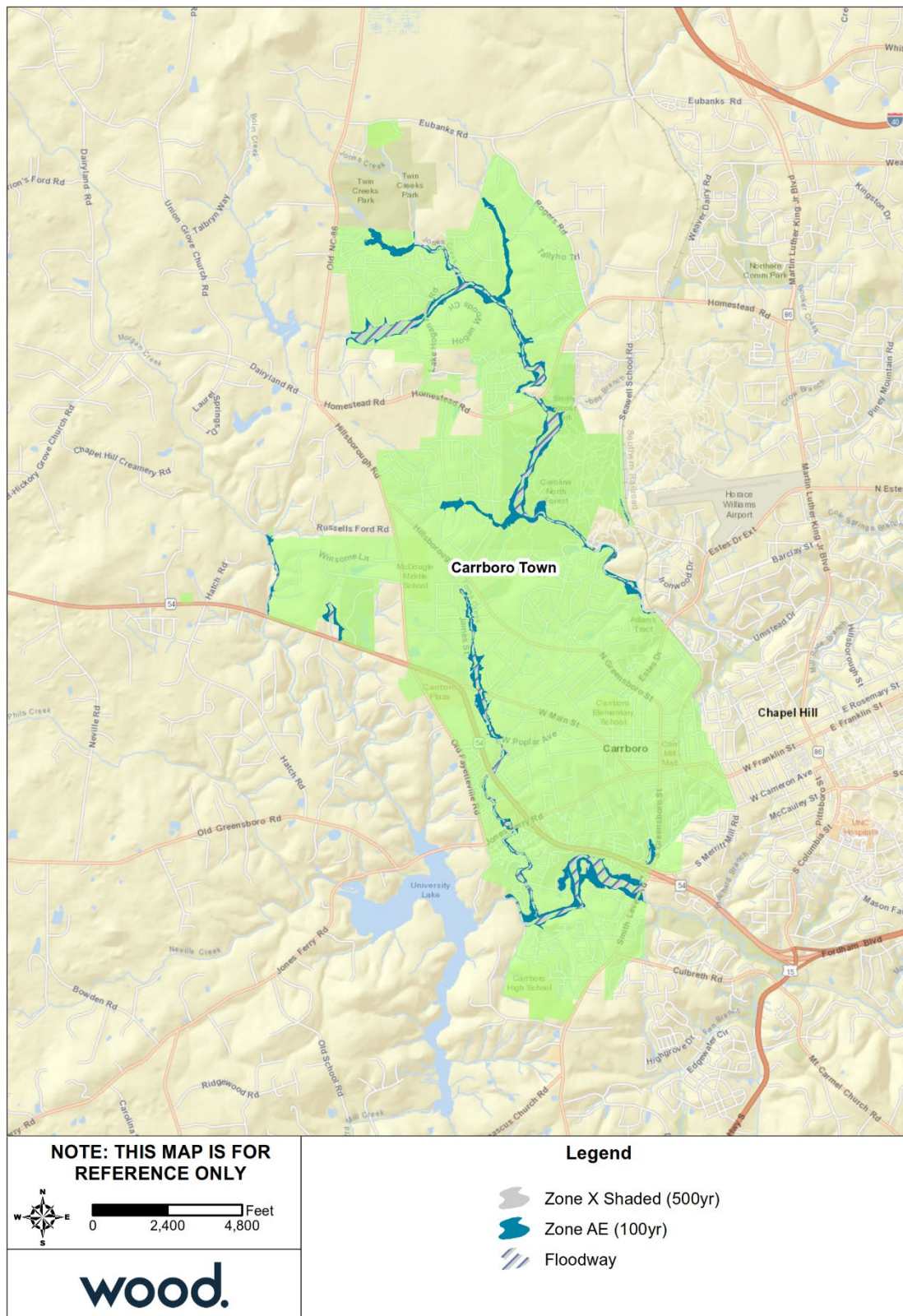
Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
3	\$1,745,700	0.6%	1.0%

Source: Parcel data retrieved November 2019; FEMA Effective DFIRM

There are no estimated damages to critical facilities or high potential loss facilities due to flooding in the Town of Carrboro.



Figure N.3 – FEMA Flood Hazard Areas, Town of Carrboro

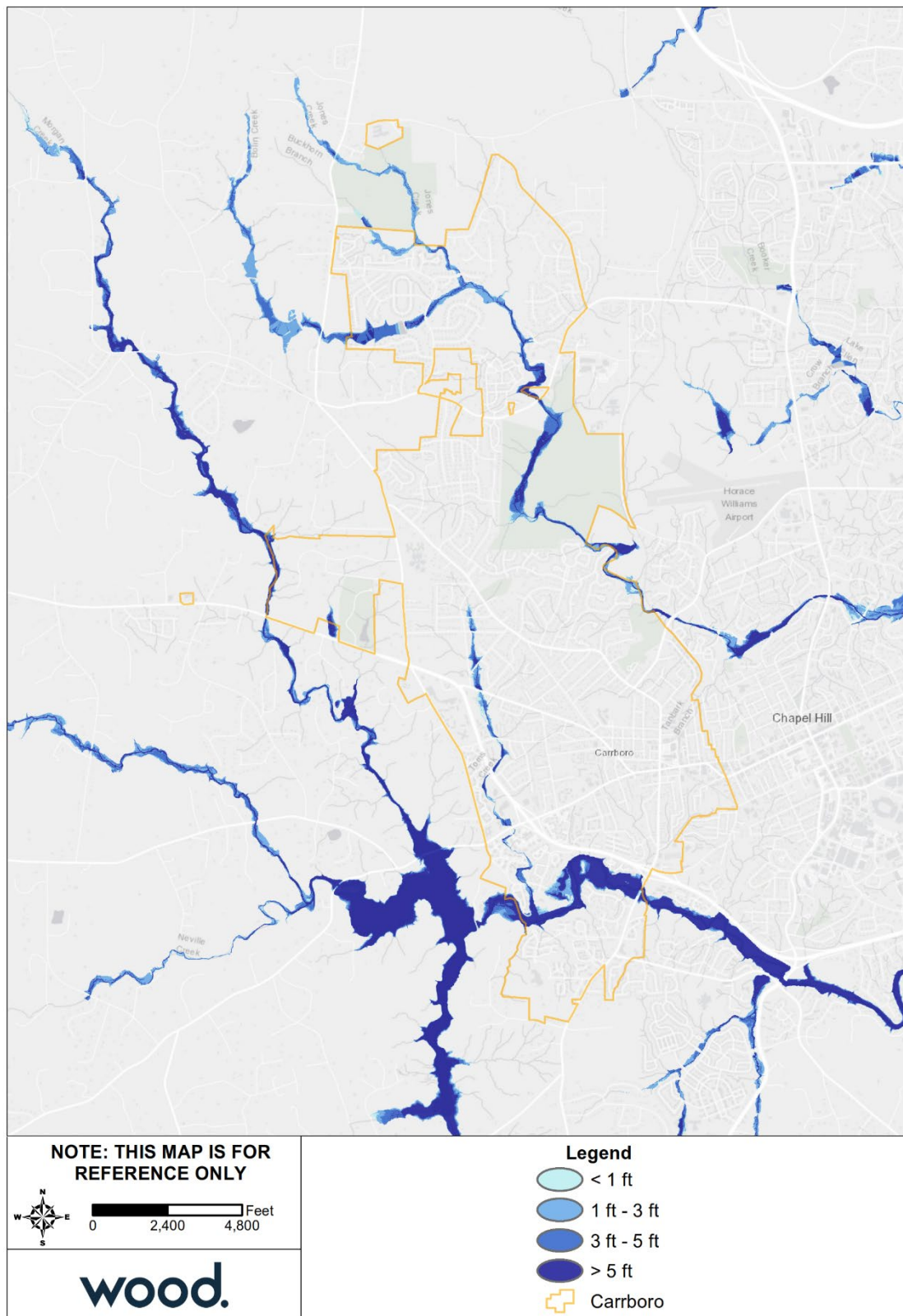


Source: FEMA Effective DFIRM

Eno-Haw

Regional Hazard Mitigation Plan  
2020

Figure N.4 – Flood Depth, 1%-Annual-Chance Floodplain, Town of Carrboro



Source: FEMA Effective DFIRM

Eno-Haw

Regional Hazard Mitigation Plan  
2020



### N.3.3 Wildfire

Table N.13 summarizes the acreage in the Town of Carrboro that falls within the Wildland Urban Interface (WUI), categorized by housing density. Areas in the WUI are those where development may intermix with flammable vegetation. Over 7 percent of the Town of Carrboro is not included in the WUI.

**Table N.13 – Wildland Urban Interface Acreage, Town of Carrboro**

	Housing Density	Total Acreage	Percent of Total Acreage
	<i>Not in WUI</i>	294.92	7.1%
	LT 1hs/40ac	99.94	2.4%
	1hs/40ac to 1hs/20ac	70.64	1.7%
	1hs/20ac to 1hs/10ac	163.50	3.9%
	1hs/10ac to 1hs/5ac	153.22	3.7%
	1hs/5ac to 1hs/2ac	250.41	6.0%
	1hs/2ac to 3hs/1ac	2,442.85	58.8%
	GT 3hs/1ac	677.77	16.3%
	<b>Total</b>	<b>4,153.25</b>	

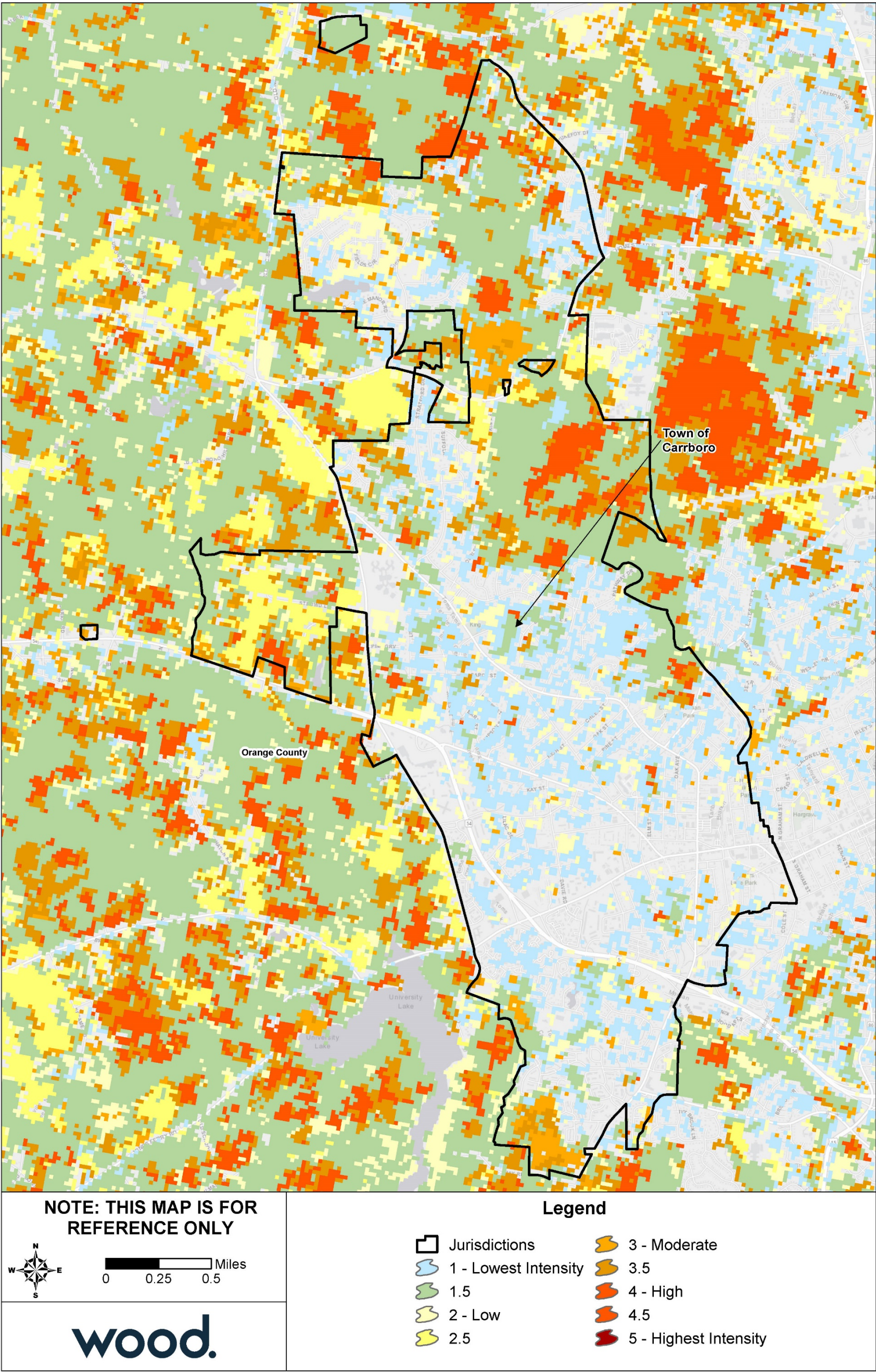
Source: Southern Wildfire Risk Assessment

Figure K.5 depicts the WUI for all of Orange County. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure K.6 depicts Burn Probability for the County based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Figure N.5 depicts the Fire Intensity Scale; which indicates the potential severity of fire based on fuel loads, topography, and other factors; in order to detail potential wildfire extent in the Town of Carrboro. There are clusters of moderate and high potential fire intensity in the northeastern portion of the Town; however several of these area are outside the WUI and all have low burn probability.

There are no estimated damages to critical facilities or high potential loss facilities in the Town of Carrboro.



Figure N.5 – Fire Intensity Scale, Town of Carrboro



Source: Southern Wildfire Risk Assessment



## N.4 CAPABILITY ASSESSMENT

### N.4.1 Overall Capability

Details on the tools and resources in place and available to the Town of Carrboro are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Carrboro has an overall capability rating of High. The Town could improve regulatory capability by developing a Continuity of Operations Plan and/or an Evacuation Plan to support emergency preparedness and response. The Town could also develop a Post-Disaster Redevelopment Ordinance to plan and set mitigation requirements for post-disaster reconstruction. The Town has strong administrative and outreach capability, moderate fiscal capability and extensive structural mitigation experience.

### N.4.2 Floodplain Management

The Town of Carrboro joined the NFIP through emergency entry in 1975 and has been a regular participant since June 1976. The following tables reflect NFIP policy and claims data for the Town categorized by structure type, flood zone, Pre-FIRM and Post-FIRM.

**Table N.14 – NFIP Policy and Claims Data by Structure Type**

Structure Type	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
Single Family	100	\$48,423	\$29,581,400	17	\$171,494.16
2-4 Family	1	\$143	\$42,000	0	\$0.00
All Other Residential	7	\$18,092	\$2,094,000	0	\$0.00
Non Residential	2	\$3,562	\$1,400,000	1	\$0.00
<b>Total</b>	<b>110</b>	<b>\$70,220</b>	<b>\$33,117,400</b>	<b>18</b>	<b>\$171,494.16</b>

Source: FEMA Community Information System, accessed May 2020

**Table N.15 – NFIP Policy and Claims Data by Flood Zone**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	27	\$35,378	\$8,547,400	10	\$109,576.28
A Zones	0	\$0	\$0	3	\$8,183.31
B, C & X Zone					
Standard	10	\$6,232	\$2,856,000	3	\$38,353.32
Preferred	73	\$28,610	\$21,714,000	2	\$15,381.25
<b>Total</b>	<b>110</b>	<b>\$70,220</b>	<b>\$33,117,400</b>	<b>18</b>	<b>\$171,494.16</b>

Source: FEMA Community Information System, accessed May 2020

**Table N.16 – NFIP Policy and Claims Data Pre-FIRM**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	11	\$24,273	\$3,510,300	5	\$77,659.06
A Zones	0	\$0	\$0	1	\$2,000.00
B, C & X Zone	18	\$7,203	\$4,670,000	5	\$53,734.57
Standard	4	\$2,616	\$1,206,000	3	\$38,353.32
Preferred	14	\$4,587	\$3,464,000	2	\$15,381.25
<b>Total</b>	<b>29</b>	<b>\$31,476</b>	<b>\$8,180,300</b>	<b>11</b>	<b>\$133,393.63</b>

Source: FEMA Community Information System, accessed May 2020

Table N.17 – NFIP Policy and Claims Data Post-FIRM

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	16	\$11,105	\$5,037,100	5	\$31,917.22
A Zones	0	\$0	\$0	2	\$6,183.31
B, C & X Zone	65	\$27,639	\$19,900,000	0	\$0.00
Standard	6	\$3,616	\$1,650,000	0	\$0.00
Preferred	59	\$24,023	\$18,250,000	0	\$0.00
<b>Total</b>	<b>81</b>	<b>\$38,744</b>	<b>\$24,937,100</b>	<b>7</b>	<b>\$38,100.53</b>

Source: FEMA Community Information System, accessed May 2020

N.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	The Town of Carrboro, as a member of the Orange County hazard Mitigation Planning Team, will coordinate with Orange County to reevaluate and update its hazard mitigation planning component at least once every five years or sooner as deemed appropriate by the Orange County Planning Director	All Hazards	1.2	High	Orange County, Town of Carrboro	Self-funded	2025	Carried Forward	Participating in update process with local government partners in Eno-Haw Region.
P-2	The Town of Carrboro intends to submit a Community Rating System (CRS) application to the ISO for a flood insurance rating that will benefit owners of flood-prone properties	Flood	1.2	Moderate	Town of Carrboro Planning Department	N/A	2020-2025	Carried Forward	The Town has not yet pursued CRS participation due to limited funding and administrative resources. Moving forward, the Town will continue to reevaluate the cost-benefit ration of this action. Specific exploration will occur as part of comprehensive planning process which is in progress.
P-3	The Town of Carrboro will continue to monitor ongoing efforts by the State and the US Army Corps of Engineers to complete new floodplain mapping for the planning area. Local staff resources will be needed to implement and encourage the completion of these activities.	Flood	1.1	High	Town of Carrboro Planning Department; Town Engineer; Town of Carrboro Stormwater Utility; Town of Chapel Hill Engineering Department	N/A	2023	Carried forward	New maps were adopted in 2017. Updates are currently expected to take place in 2023. Stormwater utility established in 2017.
P-4	Establish comprehensive framework for plans, policies, and regulations pertaining to land use, generally, and the relationship to natural hazard mitigation	All Hazards	1.2	Moderate	Town of Carrboro Planning Department	Self-funded	2020-2025	Carried Forward	To be incorporated into Townwide Comprehensive planning process, which is in progress as of late May 2020.
P-5	Establish framework for assessing urban wildfire risk, communicating with the public on measures that can reduce risk.	Wildfire	2.1	Moderate	Town of Carrboro Fire Rescue; Town of Carrboro Planning	Self-funded; outside grants if available	2020-2025	New	
Property Protection									
PP-1	Seek funding to retrofit critical facilities and Town-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, backup generators, ignition-resistant materials, 320 or 361 compliant safe rooms, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	4.2	Moderate	Town of Carrboro Planning Department; Town of Carrboro Stormwater Utility; Town of Carrboro Fire-Rescue	Local, State grants, other federal grants	2020-2025	Carried Forward	The Town will continue to assess facilities and seek funding sources related to needs identified. Generators are included in the scope for the Town's 203 S. Greensboro Street project.
PP-2	The Town of Carrboro will administer a Stormwater Utility Fee to fund stormwater services/operations and provide residential and commercial assistance for stormwater related issues by expanding technical assistance, outreach, and other program components.	Flood, Hurricane & Tropical Storm, Landslide	1.2	High	Town of Carrboro Stormwater Utility	Self-funded	2020-2022	New	Stormwater utility established in 2017.



Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Natural Resource Protection									
NRP-1	The Town of Carrboro needs assistance and support for the development of greenways and parklands dedicated to public use along streams and easements. The Town will seek to secure funding from federal, state, and local sources to implement the Town's greenway system, which will in turn mitigate flood hazards.	Flood	1.1	Moderate	Town of Carrboro Planning Department; Town of Carrboro Recreation and Parks Department; Town of Carrboro Public Works	N/A	2020-2025	Carried Forward	Phase 1B/Homestead-Chapel Hill High School Multi-use Path is substantially complete. Morgan Creek and Jones Creek greenway projects expected to be complete in 2021.
NRP-2	Protect and conserve land with environmental and natural hazard mitigation value as open space.	Flood, Hurricane & Tropical Storm, Landslide	1.1	High	Town of Carrboro Planning Department	Self-funded	2020-2025	Carried Forward	Implementation underway for several projects and multiple approaches including land use regulations for developments, policy analysis/framework for comprehensive planning, and grant funding for repetitive loss properties.
Structural Projects									
SP-1	Require new developments to install electric, cable, and telephone wires underground.	Hurricane & Tropical Storm, Severe Weather, Severe Winter Weather	1.2	Moderate	Town of Carrboro Planning Department; Town of Carrboro Public Works Department; Public Utilities	N/A	2020-2025	Carried Forward	Revised. The Town of Carrboro will continue to require new developments to install electric, cable, telephone wires underground.
SP-2	Look for opportunities to mitigate repetitive loss structures	Flood	4.2	Moderate	Town of Carrboro Planning Department; Town of Carrboro Stormwater Utility; Office of the Carrboro Town Manager	N/A	2020-2025	Carried Forward	2020 In progress. Two elevations to be completed by July 2020. Applications for two additional elevations have been submitted and funding for Public Works site relocation is being explored.
Public Education & Awareness									
PEA-1	Maintenance and implementation of adopted (2017) Community Climate Action Plan	All Hazards	1.2	High	Town Manager's Office	Self-funded; grants, other revenue as available	2020-2025	New	Includes implementation of 2014 Strategic Energy Plan. Will serve as coordinating focus of actions underscoring Town's emphasis on building community resilience. Could potentially be included under Structural Projects, Prevention and Property Protection as well.
PEA-2	Create and maintain a webpage for hazard risk, mitigation, and preparedness information on the Town's website.	All Hazards	1.2	High	Town of Carrboro Planning Department	Self-funded	2020-2025	New	May be expanded in the future to included detailed flood risk information, flood gage data,

## Annex O Town of Chapel Hill

### O.1 PLANNING PROCESS

The table below lists the HMPC members who represented the Town of Chapel Hill.

**Table O.1 – HMPC Members**

Representative	Position or Title
Vence Harris	Emergency Management Coordinator
Kelly Drayton	Emergency Management Planner
Chris Roberts	Town Engineer
Sue Burke	Stormwater Manager
John Richardson	Resiliency/Sustainability Officer
Pamela Schultz	Citizens Stormwater Advisory Board Member

### O.2 COMMUNITY PROFILE

#### Geography

The Town of Chapel Hill is located in southeastern Orange County. It is neighbored by the Town of Carrboro to the west and the City of Durham to the east. The Town extends slightly into southwestern Durham County. The statistics reported here are for the entirety of the Town. Chapel Hill is part of the Durham-Chapel Hill, NC Metropolitan Statistical Area. Chapel Hill comprises a total land area of 21.3 square miles.

#### Population and Demographics

Table O.2 provides population counts and growth estimates for the Town of Chapel Hill as compared to Orange County and the Eno-Haw region overall. Table O.3 provides demographic information for Chapel Hill as compared to the county and the state.

**Table O.2 – Population Counts, Chapel Hill, 2010-2018**

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
Town of Chapel Hill	48,715	57,233	59,561	2,328	4.1%
<b>Orange County</b>	<b>118,227</b>	<b>124,244</b>	<b>142,938</b>	<b>18,694</b>	<b>15.0%</b>
<b>Region Total</b>	<b>507,964</b>	<b>567,634</b>	<b>649,276</b>	<b>81,642</b>	<b>14.4%</b>

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

Note: The total population of Chapel Hill includes population residing in Durham County.

**Table O.3 – Demographic and Social Characteristics, Chapel Hill, 2018**

Demographic & Social Characteristics	Chapel Hill	Orange County	North Carolina
Median Age	26.2	34.7	38.6
% of Population Under 5 years old	3.1	4.6	5.9
% of population Over 65 years old	11.1	12.8	15.5
% of Population Over 25 with high school diploma	96.2%	92.7%	87.4%
% of Population Over 25 with bachelor's degree or higher	74.9%	57.6%	30.5%
% with Disability	6.7%	8.8	13.6
% Speak English less than "very well"	5.9%	5.9	4.6

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

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## Housing

The table below details key housing statistics for Chapel Hill as compared to the County overall.

**Table O.4 – Housing Statistics, Chapel Hill, 2010-2018**

Housing Characteristics	Chapel Hill	Orange County
Housing Units (2010)	22,254	55,597
Housing Units (2018)	21,708	57,502
Housing Units Percent Change (2010-2018)	-2.5%	3.4%
Housing Occupancy Rate	91.5	91.4%
% Owner-Occupied	48.7	61.9%
Average Household Size	2.46	2.51
% of Housing Units with no Vehicles Available	6.5	5.0%
% of Housing Units that are mobile homes	1.1	8.3%
Median Home Value	\$409,200	\$292,500

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2014-2018 5-Year Estimates

## Economy

The following tables present key economic statistics for Chapel Hill as compared to the county and the state.

**Table O.5 – Economic Statistics, Chapel Hill, 2018**

Demographic & Social Characteristics	Chapel Hill	Orange County	North Carolina
Median Household Income	68,640	\$68,211	\$52,413
Per Capita Income	40,890	\$40,650	\$29,456
Unemployment Rate	4.1%	4.4%	6.3%
% of Individuals Below Poverty Level	18.9	13.4	15.4
% Without Health Insurance	5.1	7.2	11.1

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

## O.3 RISK ASSESSMENT

This section contains a summary of the Town's asset inventory as well as hazard profile and vulnerability assessment for those hazards that are spatially defined and have variations in risk that could be evaluated quantitatively on a jurisdictional level. The hazards included in this section are: Dam Failure, Flood, and Wildfire.

### Asset Inventory

The following tables summarize the asset inventory for the Town of Chapel Hill in order to estimate the total physical exposure to hazards in this area. The locations of critical facilities are shown in Figure O.1. Critical facilities are a subset of identified assets from the Critical Infrastructure & Key Resources (CIKR) dataset. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted and displayed. Additionally, this map does not include newer facilities identified by Orange County Emergency Management. See Figure M.1 for a map of updated critical facilities in Orange County.

Building counts are provided based on data from the NCEM IRISK database, and supplemental parcel exposure is based on November 2019 county parcel data.

Table O.6 – Critical Infrastructure &amp; Key Resources by Type

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	Defense	Government Facilities	Healthcare	IT	National Monuments and Icons	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Chapel Hill	17	35	0	420	11	39	0	326	113	0	0	0	1	66	112	6	26	1,172

Source: NCEM Risk Management Tool

Table O.7 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Chapel Hill	377	124	3	10	0	16	32	562

Source: NCEM Risk Management Tool

Table O.8 – IRISK Inventory of Building Counts and Values

Jurisdiction	Building Count	Building Value
Town of Chapel Hill	15,108	\$5,302,835,624

Source: NCEM Risk Management Tool

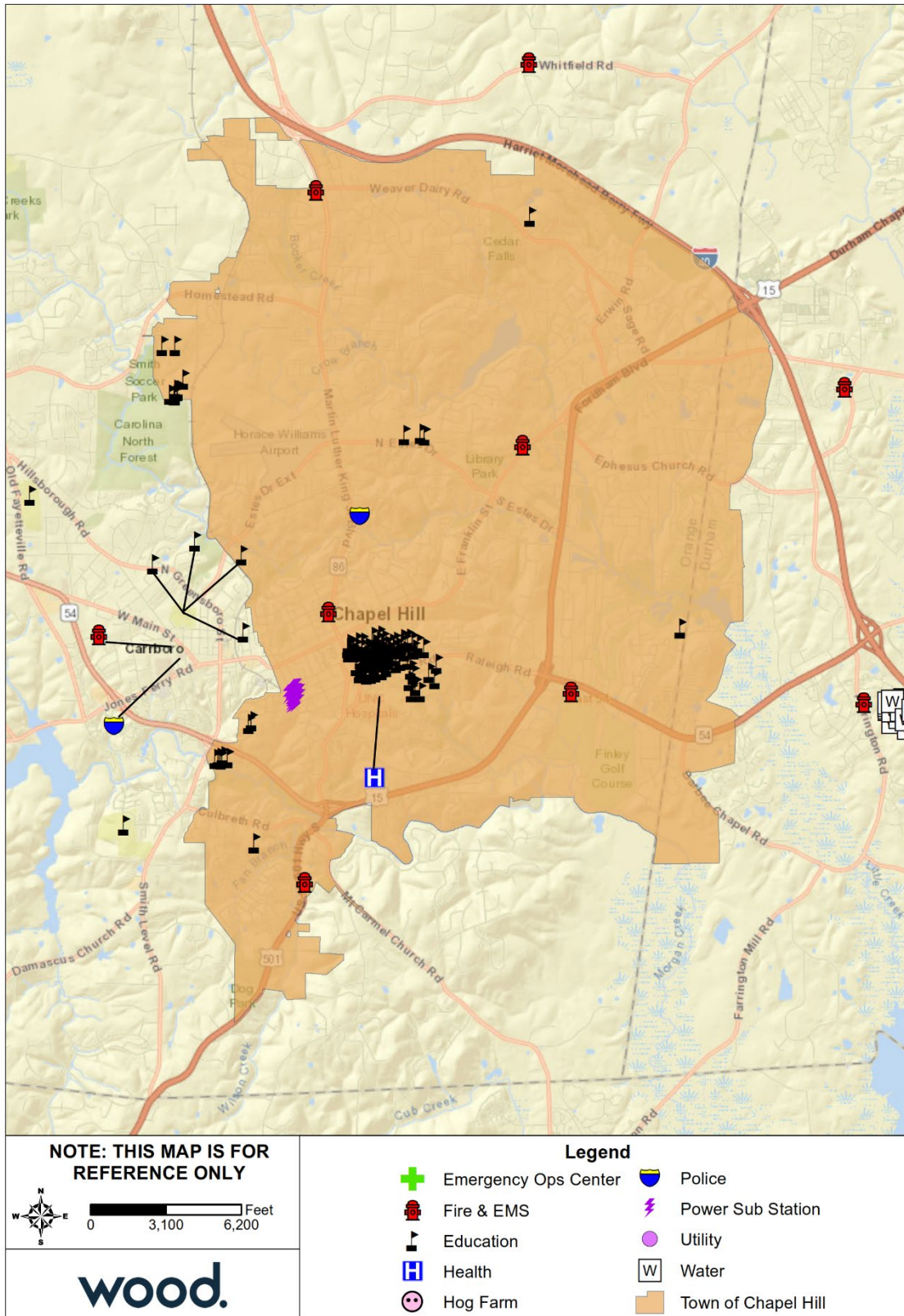
To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Eno-Haw Region, current parcel data was evaluated to identify recent development that was not included in NCEM's IRISK database. The building footprint layer from IRISK was compared to current parcel data; any parcels with an improved value that did not already have a building in IRISK were summarized in the table below. This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

Table O.9 – Parcels Development Not Included in IRISK, November 2019

Jurisdiction	Improved Parcel Count	Total Improved Value
Chapel Hill	419	\$224,217,019

Source: County parcel data, retrieved November 2019; IRISK database building footprints

Figure O.1 – Critical Facilities, Town of Chapel Hill



Source: NCEM IRISK Database, GIS Analysis

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### O.3.1 Dam Failure

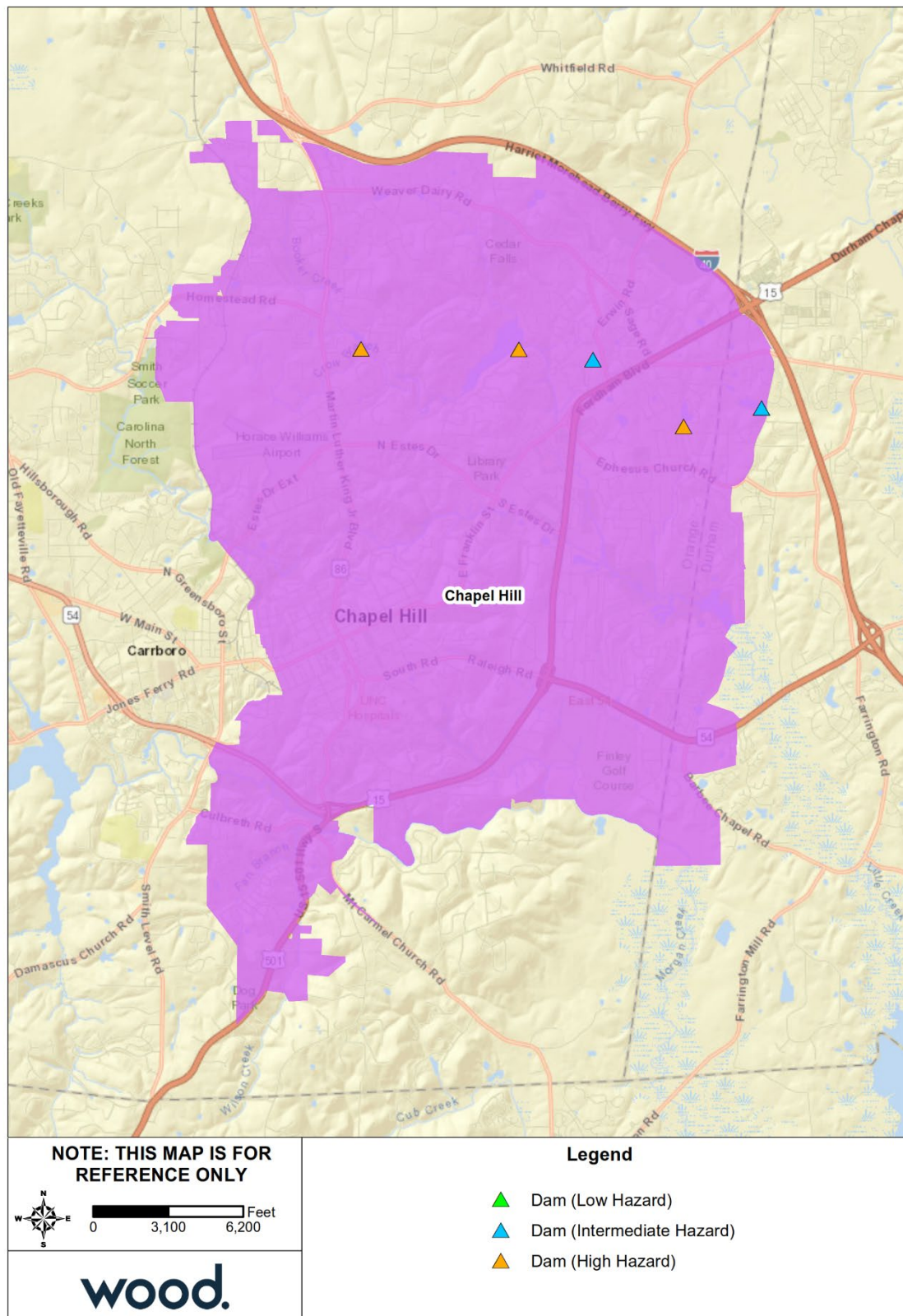
Table O.10 lists the high hazard dams in the Town of Chapel Hill identified by the North Carolina Dam Inventory as of July 2018. All dam locations throughout Chapel Hill are shown in Figure O.2. Additionally, Chapel Hill is the nearest downstream location to Hogan Farms Dam in Carrboro.

**Table O.10 – High Hazard Dams in Town of Chapel Hill**

Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
Eastwood Lake Dam	NC00781	Satisfactory	330	Chapel Hill
Lake Ellen Dam	NC01537	Fair	120	Chapel Hill
Colony Lake	NC03671	Satisfactory	48	

Source: NC Dam Inventory, July 2018

Figure O.2 – Dam Locations, Town of Chapel Hill



Source: NC Dam Inventory, July 2018

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### O.3.2 Flood

Table O.11 details the acreage of the Town of Chapel Hill by flood zone on the effective DFIRM. Per this assessment, over 7 percent of Chapel Hill falls within the mapped 1%-annual-chance floodplains.

**Table O.11 – Flood Zone Acreage in the Town of Chapel Hill**

Flood Zone	Acreage	Percent of Total (%)
Zone AE	1,309.5	9.4
Zone X (500-year)	139.2	1.0
Zone X Unshaded	12,428.8	89.6
<b>Total</b>	<b>13,877.5</b>	<b>--</b>

Source: FEMA Effective DFIRM

Figure O.3 reflects the effective mapped flood hazard zones for the Town of Chapel Hill, and Figure O.4 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the region, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below and compared to total recent development counts and values. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. Additionally, this assessment does not evaluate flood impacts or provide damage estimates. According to this assessment, 2.4 percent of recent development in Chapel Hill is located in or near the SFHA.

**Table O.12 – Recent Development at Risk to Flood, Town of Chapel Hill**

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
10	\$11,578,400	2.4%	5.2%

Source: Parcel data retrieved November 2019; FEMA Effective DFIRM

Table O.13 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector and flood event in Chapel Hill. Table O.14 summarizes estimated damages to High Potential Loss Facilities in the Town.

**Table O.13 – Critical Facilities Exposed to Flooding, Town of Chapel Hill**

Sector	Event	Number of Buildings at Risk	Estimated Damages
Banking and Finance	10 Year	3	\$208,441
	25 Year	3	\$263,651
	50 Year	3	\$266,776
	100 Year	3	\$272,510
	500 Year	3	\$316,583
Commercial Facilities	10 Year	14	\$2,818,066
	25 Year	22	\$3,429,682
	50 Year	23	\$3,631,961
	100 Year	25	\$3,901,476
	500 Year	26	\$4,759,677
Communications	10 Year	1	\$112,410
	25 Year	1	\$189,388

Sector	Event	Number of Buildings at Risk	Estimated Damages
	50 Year	1	\$213,059
	100 Year	1	\$282,992
	500 Year	1	\$282,992
Government Facilities	10 Year	1	\$186,046
	25 Year	1	\$238,637
	50 Year	1	\$240,917
	100 Year	1	\$247,944
	500 Year	1	\$250,964
Healthcare and Public Health	10 Year	2	\$244,674
	25 Year	2	\$254,556
	50 Year	2	\$257,382
	100 Year	4	\$429,292
	500 Year	4	\$372,829
Transportation Systems	10 Year	1	\$894,905
	25 Year	1	\$1,076,903
	50 Year	1	\$1,124,368
	100 Year	1	\$1,335,864
	500 Year	3	\$1,360,752
Water	10 Year	2	\$1,123,838
	25 Year	4	\$1,893,706
	50 Year	8	\$2,725,264
	100 Year	8	\$3,520,288
	500 Year	10	\$5,166,018
All Categories	10 Year	24	\$5,588,380
	25 Year	34	\$7,346,523
	50 Year	39	\$8,459,727
	100 Year	43	\$9,990,366
	500 Year	48	\$12,509,815

Source: NCEM Risk Management Tool

Table O.14 – High Potential Loss Properties Exposed to Flooding, Town of Chapel Hill

Category	Event	Number of Buildings at Risk	Estimated Damages
Commercial	10 Year	5	\$3,902,353
	25 Year	5	\$4,547,427
	50 Year	5	\$4,660,142
	100 Year	7	\$5,094,912
	500 Year	7	\$5,472,259
Government	10 Year	1	\$186,046
	25 Year	1	\$238,637
	50 Year	1	\$240,917
	100 Year	1	\$247,944
	500 Year	1	\$250,964
Residential	50 Year	1	\$207,839
	100 Year	3	\$374,406
	500 Year	4	\$3,311,593
Utilities	10 Year	2	\$1,123,838
	25 Year	3	\$1,886,452

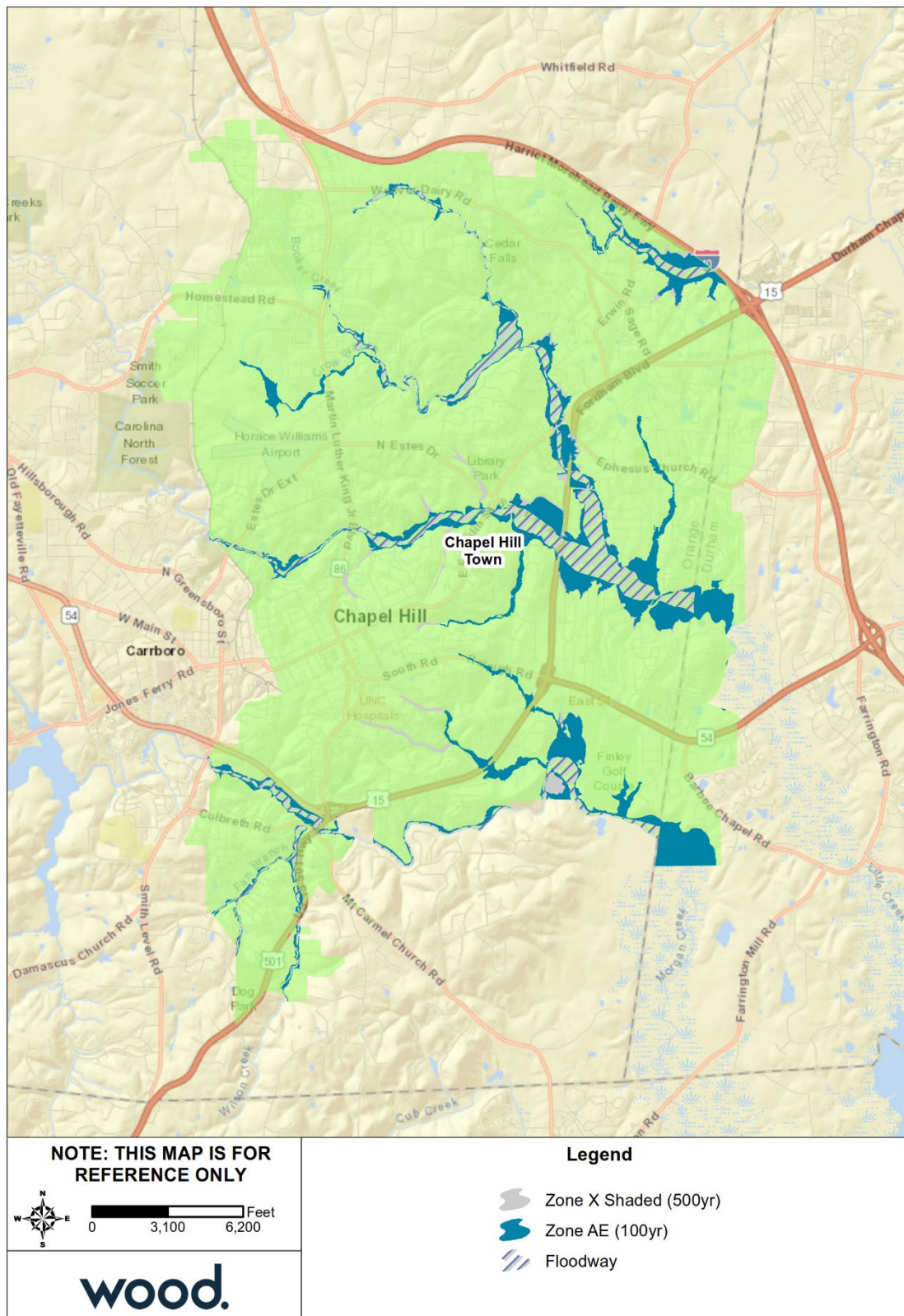
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Category	Event	Number of Buildings at Risk	Estimated Damages
	50 Year	5	\$2,670,564
	100 Year	5	\$3,416,005
	500 Year	7	\$4,993,599
All Categories	10 Year	8	\$5,212,237
	25 Year	9	\$6,672,516
	50 Year	12	\$7,779,462
	100 Year	16	\$9,133,267
	500 Year	19	\$14,028,415

Source: NCEM Risk Management Tool

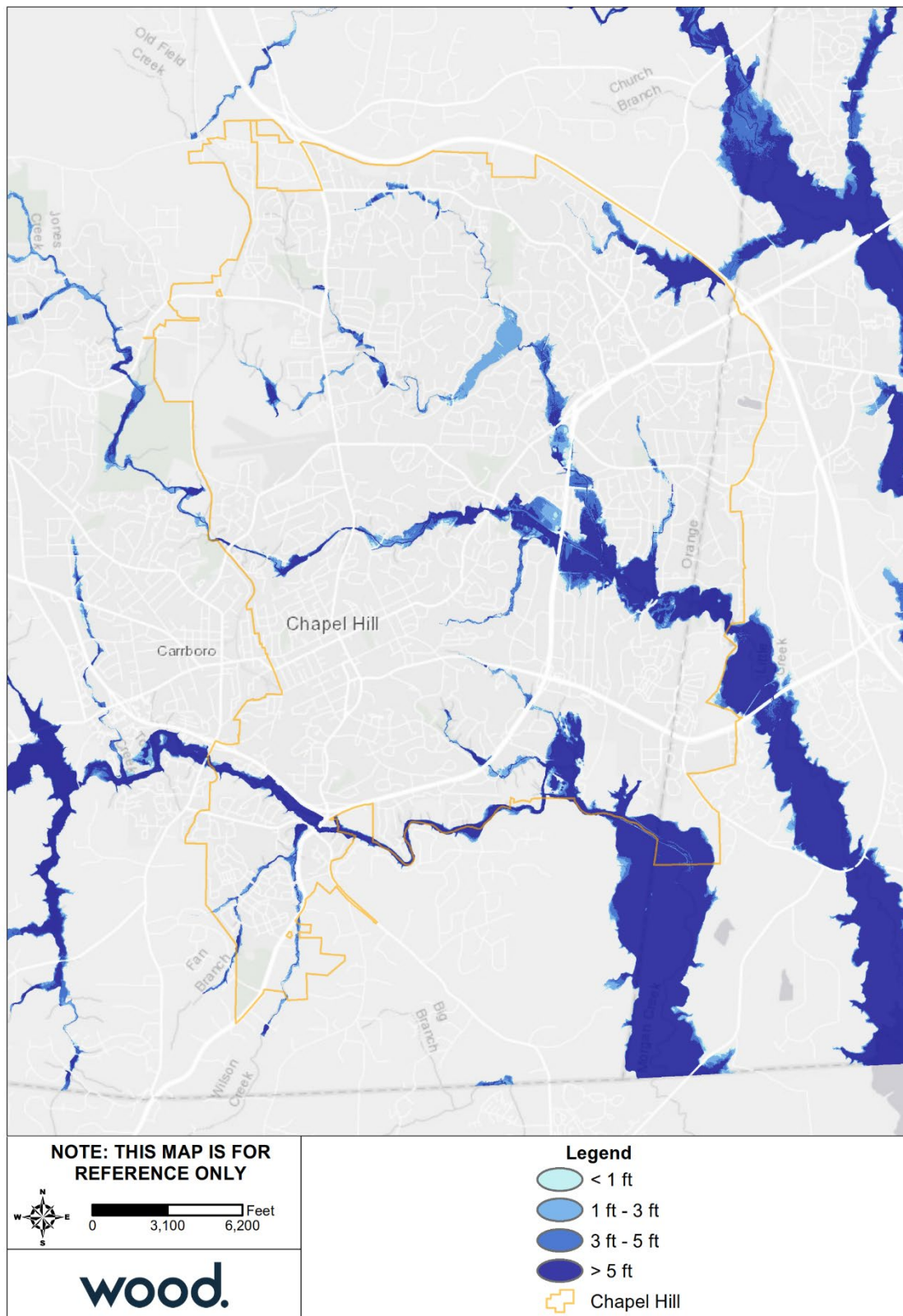


**Figure O.3 – FEMA Flood Hazard Areas, Town of Chapel Hill**



Source: FEMA Effective DFIRM

Figure O.4 – Flood Depth, 1%-Annual-Chance Floodplain, Town of Chapel Hill



Source: FEMA Effective DFIRM

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### O.3.3 Wildfire

Table O.15 summarizes the acreage in the Town of Chapel Hill that falls within the Wildland Urban Interface (WUI), categorized by housing density. Areas in the WUI are those where development may intermix with flammable vegetation. Over 7 percent of the Town of Chapel Hill is not included in the WUI.

**Table O.15 – Wildland Urban Interface Acreage, Town of Chapel Hill**

	Housing Density	Total Acreage	Percent of Total Acreage
	<i>Not in WUI</i>	1,039.08	7.5%
	LT 1hs/40ac	205.47	1.5%
	1hs/40ac to 1hs/20ac	151.21	1.1%
	1hs/20ac to 1hs/10ac	356.82	2.6%
	1hs/10ac to 1hs/5ac	495.20	3.6%
	1hs/5ac to 1hs/2ac	1,294.11	9.3%
	1hs/2ac to 3hs/1ac	8,433.59	60.8%
	GT 3hs/1ac	1,901.85	13.7%
	<b>Total</b>	<b>13,877.34</b>	

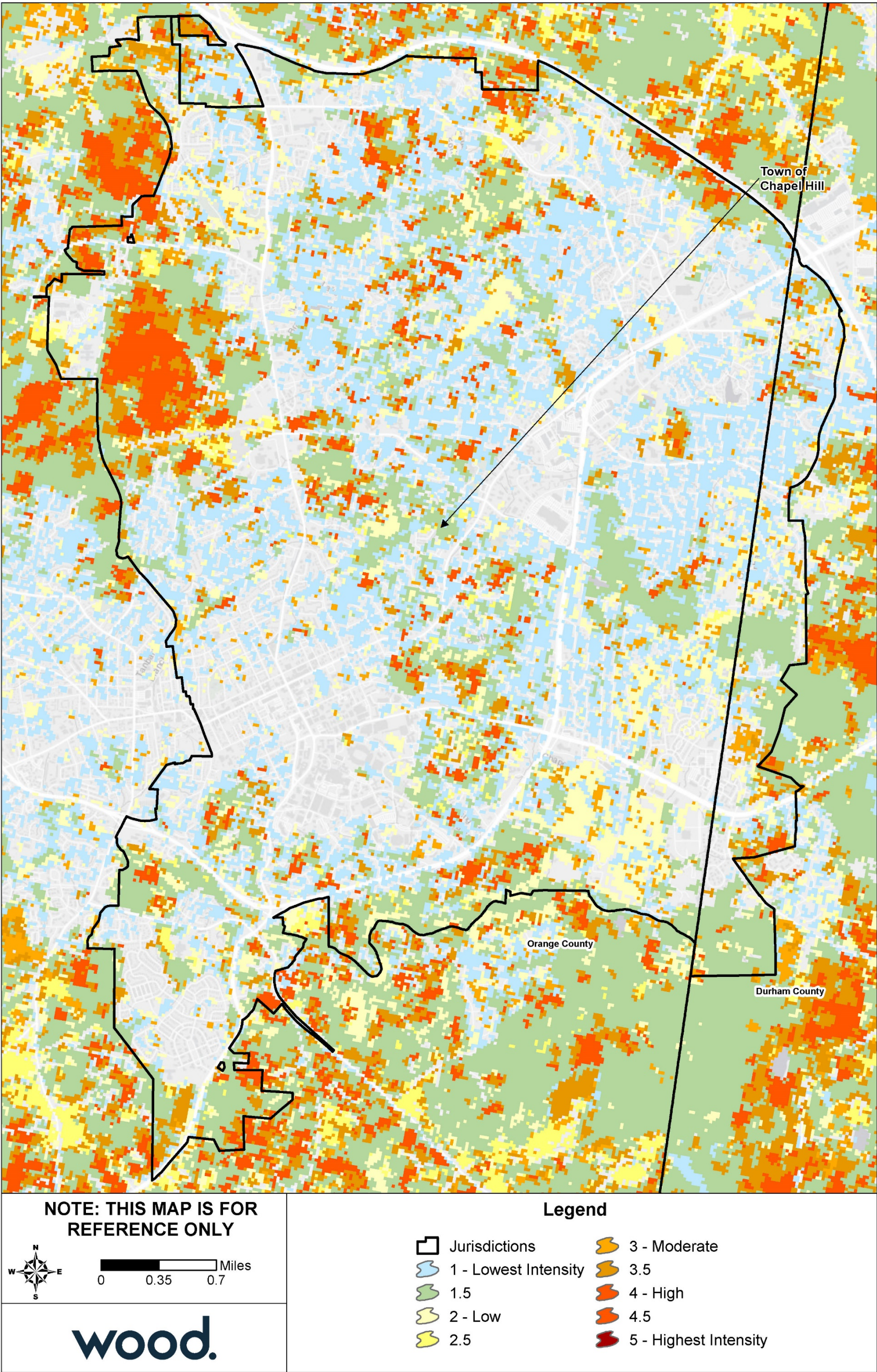
Source: Southern Wildfire Risk Assessment

Figure M.5 depicts the WUI for all of Orange County. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure M.6 depicts Burn Probability for the County based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Figure O.5 depicts the Fire Intensity Scale; which indicates the potential severity of fire based on fuel loads, topography, and other factors; in order to detail potential wildfire extent in the Town of Chapel Hill. There are areas of high potential fire intensity throughout the Town and a large cluster on the western side of the Town. Overall, 7 percent of the Town has a Class 3 fire intensity rating and 4.6 percent has a Class 4 rating.

There are no estimated damages to critical facilities or high potential loss facilities in the Town of Chapel Hill.



Figure O.5 – Fire Intensity Scale, Town of Chapel Hill



Source: Southern Wildfire Risk Assessment



## O.4 CAPABILITY ASSESSMENT

### O.4.1 Overall Capability

Details on the tools and resources in place and available to the Town of Chapel Hill are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Chapel Hill has an overall capability rating of High. The Town could improve regulatory capability by developing a Continuity of Operations Plan and/or an Evacuation Plan to support emergency preparedness and response. The Town could also develop a Post-Disaster Redevelopment Ordinance to plan and set mitigation requirements for post-disaster reconstruction. The Town has strong fiscal capability and moderate administrative and outreach capability but no structural mitigation experience.

### O.4.2 Floodplain Management

The Town of Chapel Hill joined the NFIP through emergency entry in 1973 and has been a regular participant since April 1978. The following tables reflect NFIP policy and claims data for the Town categorized by structure type, flood zone, Pre-FIRM and Post-FIRM.

**Table O.16 – NFIP Policy and Claims Data by Structure Type**

Structure Type	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
Single Family	273	\$169,235	\$78,055,100	127	\$1,395,389.00
2-4 Family	54	\$32,024	\$8,934,600	15	\$279,372.47
All Other Residential	334	\$296,386	\$39,705,500	98	\$6,992,733.96
Non Residential	55	\$254,818	\$19,468,100	97	\$5,266,751.98
<b>Total</b>	<b>716</b>	<b>\$752,463</b>	<b>\$146,163,300</b>	<b>337</b>	<b>\$13,934,247.41</b>

Source: FEMA Community Information System, accessed May 2020

**Table O.17 – NFIP Policy and Claims Data by Flood Zone**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	469	\$638,789	\$77,729,700	243	\$12,676,346.47
A Zones	12	\$11,945	\$1,233,000	5	\$189,883.78
B, C & X Zone					
Standard	26	\$24,409	\$4,607,600	37	\$463,697.66
Preferred	209	\$77,320	\$62,593,000	50	\$604,054.78
<b>Total</b>	<b>716</b>	<b>\$752,463</b>	<b>\$146,163,300</b>	<b>335</b>	<b>\$13,933,982.69</b>

Source: FEMA Community Information System, accessed May 2020

**Table O.18 – NFIP Policy and Claims Data Pre-FIRM**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	395	\$591,240	\$60,192,900	216	\$11,901,422.32
A Zones	11	\$11,848	\$1,184,200	5	\$189,883.78
B, C & X Zone	115	\$51,847	\$30,006,100	72	\$838,731.28
Standard	20	\$18,538	\$3,204,100	32	\$339,357.21
Preferred	95	\$33,309	\$26,802,000	40	\$499,374.07
<b>Total</b>	<b>521</b>	<b>\$654,935</b>	<b>\$91,383,200</b>	<b>293</b>	<b>\$12,930,037.38</b>

Source: FEMA Community Information System, accessed May 2020



Table O.19 – NFIP Policy and Claims Data Post-FIRM

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	74	\$47,549	\$17,536,800	27	\$774,924.15
A Zones	1	\$97	\$48,800	0	\$0.00
B, C & X Zone	120	\$49,882	\$37,194,500	15	\$229,021.16
Standard	6	\$5,871	\$1,403,500	5	\$124,340.45
Preferred	114	\$44,011	\$35,791,000	10	\$104,680.71
<b>Total</b>	<b>195</b>	<b>\$97,528</b>	<b>\$54,780,100</b>	<b>42</b>	<b>\$1,003,945.31</b>

Source: FEMA Community Information System, accessed May 2020

O.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Consider creative zoning options.	Flood, Hurricane and Tropical Storm, Severe Weather	1.2	Moderate	Town of Chapel Hill - Planning Department/ Managers Office	General Fund (existing staff salaries)	2020-2025	Carried Forward	In Progress. ToCH continues to try to engage with developers to pursue creative zoning options including conditional zoning which allows flexible and open conversations.-The Blue Hill District and the Innovative, Light Industrial Conditional Zoning District are other examples of creative zoning options. The Town Council and Town staff review zoning requirements and make adjustments as needed to achieve hazard mitigation goals.
P-2	Encourage mixed-use development forms.	Flood, Hurricane and Tropical Storm	1.2	Moderate	Town of Chapel Hill - Planning Department/ Managers Office	General Fund (existing staff salaries)	2020-2025	Carried Forward	In Progress. ToCH continues to emphasize mixed-use redevelopment in the downtown and in future focus areas, as per the comprehensive plan. The Town is undertaking an evaluation of its future land use map and development through an initiative called "Charting Our Future" ( <a href="http://chartingourfuture.info/">http://chartingourfuture.info/</a> ).
P-3	Establish a growth management protocol to maintain sufficient infrastructure capacity.	Flood, Hurricane and Tropical Storm, Severe Weather	4.1	Moderate	Town of Chapel Hill	N/A	2015-2020	Carried Forward	In Progress. The Town will continue existing growth management protocols to maintain sufficient infrastructure capacity including the Town's urban services district and the rural buffer, both of which continue to guide development decisions within the municipal boundaries. The Town is undertaking an evaluation of its future land use map through an initiative called "Charting Our Future" which will provide additional guidance on maintaining sufficient infrastructure capacity. ( <a href="http://chartingourfuture.info/">http://chartingourfuture.info/</a> ).
P-4	Improve the Development Review Process	Flood, Hurricane and Tropical Storm	1.2	Moderate	Town of Chapel Hill - Planning Department	General Fund (existing staff salaries)	2020-2025	Carried Forward	In Progress. This continues to be an ongoing effort since 2009. ToCH is in the middle of future land use plan update. After this update,-a complete rewrite of the development ordinance ("Charting Our Future") will follow, which will include a comprehensive review of the Development Review Process.
P-5	Continue to enforce the stormwater management regulations through the Town's Land Use Management Ordinance and the floodplain regulations through the town's Flood Damage Prevention Ordinance. Continue training initiatives to maintain the Certified Floodplain Manager (CFM) registrations.	Flood, Hurricane and Tropical Storm	1.2	Moderate	Town of Chapel Hill - Stormwater Division	Stormwater Fund (existing staff salaries)	2020-2025	Carried Forward	Revised to remove development of a comprehensive stormwater program master plan because this action has been completed. The Town now has a Certified Floodplain Manager and will continue to support training.
P-6	Continue to participate in county-wide collaborative efforts and mitigation strategies	All Hazards	3.2	Moderate	Town of Chapel Hill - Emergency Management Division	General Fund (existing staff salaries)	2020-2025	New	
P-7	Continue enforcement of the North Carolina State Building Code.	All Hazards	1.2	Moderate	Town of Chapel Hill - Inspections Department	General Fund (existing staff salaries)	2020-2025	New	

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
P-8	Continue participation in the National Flood Insurance Program (NFIP) to allow citizens to be eligible for affordable flood insurance.	Flood, Hurricane and Tropical Storm	1.2	Moderate	Town of Chapel Hill - Stormwater Division	Stormwater Fund (existing staff salaries)	2020-2025	New	
P-9	Explore expanding situational awareness tools and strategies for increased monitoring of local hazards	All Hazards	2.2	Moderate	Town of Chapel Hill - Emergency Management Division	General Fund (existing staff salaries)	2020-2025	New	
Property Protection									
PP-1	Develop a network of greenways with regional connections.	Flood, Hurricane and Tropical Storm, Severe Weather	1.1	Moderate	Town of Chapel Hill - Parks and Recreation and Planning Department	General Fund (existing staff salaries)	2020-2025	Carried Forward	In Progress. Have greenway master plan which is folded into mobility plan. Almost complete with Bolin Creek Trail connection and in design for Morgan Creek Trail that will extend trail towards Carrboro town limits. Town is in conversations with the County to discuss plan for a greenway that would connect Chapel Hill and Hillsborough. Town of Chapel Hill has 15½ miles of greenways trails (some paved and some soft surface) and 1000 acres of open space. NOTE: There is no open space plan or recreation master plan. NOTE: There is a Recreation Standards and Needs Assessment included as a component of the Comprehensive Parks Plan, adopted 5/29/2013. Recommendations for open space and recreation are also included. ( <a href="https://www.townofchapelhill.org/town-hall/departments-services/parks-recreation/planning-and-development/comprehensive-parks-plan-adopted-may-29-2013">https://www.townofchapelhill.org/town-hall/departments-services/parks-recreation/planning-and-development/comprehensive-parks-plan-adopted-may-29-2013</a> ).
PP-2	Preserve open space in residential developments through the application of conservation development principles.	Flood, Hurricane and Tropical Storm, Severe Weather	1.1	Moderate	Town of Chapel Hill - Planning Department/ Managers Office	General Fund (existing staff salaries)	2020-2025	Carried Forward	ToCH is in the middle of future land use plan update. After this update, a complete rewrite of the development ordinance ("Charting Our Future") will follow, which will be an opportunity to further address conservation development.
Natural Resource Protection									
NRP-1	Manage watersheds, stormwater, and water quality and seek funding to design and construct projects on the subwatershed study reports' priority project lists, which have been identified and approved by the Town Council.	Flood, Hurricane and Tropical Storm, Severe Weather	1.1	Moderate	Town of Chapel Hill - Stormwater Division	Stormwater Fund (existing staff salaries)	2020-2025	Carried Forward	In 2014, the Town Council adopted the Stormwater Master Plan, which included a recommendation for conducting subwatershed studies. These studies evaluate existing conditions and identify problems – failing/undersized infrastructure, drainage and flooding, water quality, and stream conditions – then develop integrated watershed plans for improvements based on a full build-out condition, using zoning and land use plans. The studies began in the Booker Creek watershed - the Lower Booker Creek subwatershed study has been completed; the Eastwood Lake subwatershed study is under review; and the Cedar Fork subwatershed study is underway. With the Council approval of the Lower Booker Creek Subwatershed Study report and project recommendations, the Town now has a list of priority capital projects to be designed, permitted, and constructed.

**ANNEX O: TOWN OF CHAPEL HILL**

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
NRP-2	Strive to ensure future development occurs in a manner that protects floodplains, streams, wetlands, and other natural features which work to reduce flood hazard susceptibility and continue to enforce existing regulations.	Flood, Hurricane and Tropical Storm	1.1	Moderate	Town of Chapel Hill - Planning Department/Managers Office	General Fund (existing staff salaries)	2020-2025	New	
NRP-3	Coordinate with OWASA on long-term water supply planning and local conservation measures.	Drought, Extreme Heat	1.1	Moderate	Town of Chapel Hill - Resilience	OWASA	2020-2025	New	
NRP-4	Strategically preserving, acquiring, or protecting additional open spaces to provide environmental buffer. Work to implement open space recommendations as outlined in the Recreation Standards and Needs Assessment included as a component of the Comprehensive Parks Plan, adopted 5/29/2013. ( <a href="https://www.townofchapelhill.org/town-hall/departments-services/parks-recreation/planning-and-development/comprehensive-parks-plan-adopted-may-29-2013">https://www.townofchapelhill.org/town-hall/departments-services/parks-recreation/planning-and-development/comprehensive-parks-plan-adopted-may-29-2013</a> ).	Flood, Hurricane & Tropical Storm, Severe Weather	1.1	Moderate	Town of Chapel Hill	N/A	2015-2020	Carried Forward	In Progress. ToCH has open space standards in the ordinances for residential property. In addition, there are environmental resections for development town-wide. The Town has adopted the Jordan Watershed Stormwater Management for New Develop ordinance in an effort to further protect land with environmental value.
NRP-5	Encourage public and private partnerships to restore and maintain the Town's environmental resources.	Flood, Hurricane & Tropical Storm, Severe Weather	1.1	Moderate	Town of Chapel Hill	N/A	2015-2020	Carried Forward	In Progress. These types of partnerships are negotiated on a case-by-case basis. Currently, the town is working with UNC Healthcare at Eastowne, which contains a natural heritage site that the Town is working to preserve.
Structural Projects									
SP-1	Continue to identify and explore possible retrofits to critical facilities and Town-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology. This could include, but is not limited to: wind retrofits, low water consumption fixtures, leak detectors, back up generators, ignition-resistant materials, 320 or 361 compliant safe rooms, lightning protection, hail resistant roofing, anchoring fixed building equipment.	Flood, Hurricane & Tropical Storm, Severe Weather	4.2	Moderate	Town of Chapel Hill - Public Works	General Fund (existing staff salaries) / Unified Hazard Mitigation Assistance (UHMA)	2020-2025	Carried Forward	No progress made due to funding limitations.
SP-2	Seek funding to install backup generators or quick connect hook ups for mobile generators on any newly constructed county/town critical facilities.	Flood, Hurricane & Tropical Storm, Severe Weather	4.2	Moderate	Town of Chapel Hill	Local, State grants, other federal grants	2015-2020	Carried Forward	No progress made due to funding limitations.
SP-3	Coordinate with utility partners and property owners regarding the use of microgrids and other forms of distributed energy to provide backup power to critical facilities.	Severe Weather, Hurricane and Tropical Storm	4.2	Moderate	Town of Chapel Hill - Resilience	General Fund, Utilities, Developers, Federal Grants (DOE)	2020-2025	New	
SP-4	Coordinate with OWASA to enhance the capacity of regional water system interconnects, as needed.	Drought, Extreme Heat	4.2	Moderate	Town of Chapel Hill - Resilience	OWASA	2020-2025	New	
SP-5	Coordinate with OWASA to limit the impacts of water supply leaks through infrastructure planning, maintenance and design.	Critical Infrastructure Failure	4.2	Moderate	Town of Chapel Hill - Resilience	OWASA	2020-2025	New	



Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Emergency Services									
ES-1	Engage in regional events, activities, and training opportunities related to natural hazards in order to improve communication, enhance, partnerships, and improve planning efforts both within the Town and with other local jurisdictions.	Flood, Hurricane & Tropical Storm, Severe Weather	3.2	Moderate	Town of Chapel Hill - Emergency Management Division	General Fund (existing staff salaries)	2020-2025	Carried Forward	The Town of Chapel Hill Office of Emergency Management (EM) routinely engages with emergency management services in surrounding jurisdictions and participates in joint meetings, planning sessions, and briefings with other agencies and jurisdictions. The Town has maintained an agreement for a countywide alert system.
ES-2	Identify and implement strategies to increase swift water rescue capacity.	Flood, Severe Weather, Hurricane and Tropical Storm	3.1	Moderate	Town of Chapel Hill - Fire Department	Emergency Management Performance Grant (EMPG)??	2020-2025	New	
ES-3	Engage with regional and county stakeholders in comprehensive emergency response planning including Complex Coordinated Terror Attack response and Mass Casualty Incident response planning.	All Hazards	3.2	Moderate	Town of Chapel Hill - Emergency Management Division	General Fund (existing staff salaries)	2020-2025	New	
Public Education & Awareness									
PEA-1	Encourage low-impact development for addressing stormwater quality and quantity concerns.	Flood, Hurricane and Tropical Storm	1.2	Moderate	Town of Chapel Hill - Planning Department	General Fund (existing staff salaries)	2020-2025	Carried Forward	In Progress. Low Impact Design (LID) is encouraged throughout the Town (The central theme of these regulations is to encourage "low-impact design" that disperses pavement into small modules, and replicates the natural hydrological system of the site." LUMO Article 5 Design and Development Standards).
PEA-2	Provide education and outreach to Chapel Hill residents <b>in multiple languages</b> in order to increase awareness of natural hazard potential in the town.	All Hazards	2.1	Moderate	Town of Chapel Hill - Emergency Management Division and Communications and Public Affairs	General Fund (existing staff salaries)	2020-2025	New	
PEA-3	Strive to improve communication and outreach in multiple languages to Town of Chapel Hill residents before, during, and after hazard weather event with the county's website, press releases, social media accounts in order to keep residents informed and improve public safety in and around the Town.	All Hazards	2.1	Moderate	Town of Chapel Hill - Emergency Management Division and Communications and Public Affairs	General Fund (existing staff salaries)	2020-2025	New	
PEA-4	To achieve Comprehensive Plan objectives: The Town is undertaking an evaluation of its future land use map (FLUM) and planning to rewrite the Town's UDO through an initiative called "Charting Our Future" ( <a href="http://chartingourfuture.info/">http://chartingourfuture.info/</a> ). The FLUM includes Resiliency Maps that depict areas of Town subject to flooding. It is anticipated that the new UDO will utilize these maps to attempt to mitigate flooding through updated regulations.	Flood, Hurricane and Tropical Storm	1.2	Moderate	Orange County Planning and Inspections Department; Emergency Services	General Fund (existing staff salaries)	2020-2025	New	

## Annex P Town of Hillsborough

### P.1 PLANNING PROCESS

The table below lists the HMPC members who represented the Town of Hillsborough.

**Table P.1 – HMPC Members**

Representative	Position or Title
Jerry Wagner	Fire Marshall/Emergency Manager
Justin Snyder	Planning Department

### P.2 COMMUNITY PROFILE

#### Geography

The Town of Hillsborough is located in central Orange County along the Eno River. The Town is part of the Durham-Chapel Hill, NC Metropolitan Statistical Area. Hillsborough comprises a total land area of 4.6 square miles.

#### Population and Demographics

Table P.2 provides population counts and growth estimates for the Town of Hillsborough as compared to Orange County and the Eno-Haw region overall. Table P.3 provides demographic information for Hillsborough as compared to the county and the state.

**Table P.2 – Population Counts, Hillsborough, 2010-2018**

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
Town of Hillsborough	5,446	6,087	7,083	996	16.4%
<b>Orange County</b>	<b>118,227</b>	<b>124,244</b>	<b>142,938</b>	<b>18,694</b>	<b>15.0%</b>
<b>Region Total</b>	<b>507,964</b>	<b>567,634</b>	<b>649,276</b>	<b>81,642</b>	<b>14.4%</b>

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

**Table P.3 – Demographic and Social Characteristics, Hillsborough, 2018**

Demographic & Social Characteristics	Hillsborough	Orange County	North Carolina
Median Age	38.7	34.7	38.6
% of Population Under 5 years old	9.4	4.6	5.9
% of population Over 65 years old	12.2	12.8	15.5
% of Population Over 25 with high school diploma	88.4%	92.7%	87.4%
% of Population Over 25 with bachelor's degree or higher	46.9%	57.6%	30.5%
% with Disability	11.4%	8.8	13.6
% Speak English less than "very well"	4.1%	5.9	4.6

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

#### Housing

The table below details key housing statistics for Hillsborough as compared to the County overall.

**Table P.4 – Housing Statistics, Hillsborough, 2010-2018**

Housing Characteristics	Hillsborough	Orange County
Housing Units (2010)	2,593	55,597
Housing Units (2018)	2,949	57,502
Housing Units Percent Change (2010-2018)	13.7%	3.4%
Housing Occupancy Rate	88.3	91.4%
% Owner-Occupied	67.5	61.9%
Average Household Size	2.57	2.51
% of Housing Units with no Vehicles Available	5.7	5.0%
% of Housing Units that are mobile homes	5.5	8.3%
Median Home Value	\$242,100	\$292,500

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2014-2018 5-Year Estimates

### Economy

The following tables present key economic statistics for Hillsborough as compared to the county and the state.

**Table P.5 – Economic Statistics, Hillsborough, 2018**

Demographic & Social Characteristics	Hillsborough	Orange County	North Carolina
Median Household Income	56,038	\$68,211	\$52,413
Per Capita Income	34,697	\$40,650	\$29,456
Unemployment Rate	6.2%	4.4%	6.3%
% of Individuals Below Poverty Level	13.2	13.4	15.4
% Without Health Insurance	8.0	7.2	11.1

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

## P.3 RISK ASSESSMENT

This section contains a summary of the Town's asset inventory as well as hazard profile and vulnerability assessment for those hazards that are spatially defined and have variations in risk that could be evaluated quantitatively on a jurisdictional level. The hazards included in this section are: Dam Failure, Flood, and Wildfire.

### Asset Inventory

The following tables summarize the asset inventory for the Town of Hillsborough in order to estimate the total physical exposure to hazards in this area. The locations of critical facilities are shown in Figure P.1. Critical facilities are a subset of identified assets from the Critical Infrastructure & Key Resources (CIKR) dataset. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted and displayed. Additionally, this map does not include newer facilities identified by Orange County Emergency Management. See Figure M.1 for a map of updated critical facilities in Orange County.

Building counts are provided based on data from the NCEM IRISK database, and supplemental parcel exposure is based on November 2019 county parcel data.

Table P.6 – Critical Infrastructure &amp; Key Resources by Type

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	Defense	Government Facilities	Healthcare	IT	National Monuments and Icons	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Hillsborough	9	53	0	234	1	59	0	56	15	0	0	0	0	25	10	4	6	472

Source: NCEM Risk Management Tool

Table P.7 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Hillsborough	24	2	2	0	1	6	0	35

Source: NCEM Risk Management Tool

Table P.8 – IRISK Inventory of Building Counts and Values

Jurisdiction	Building Count	Building Value
Town of Hillsborough	3,883	\$704,636,732

Source: NCEM Risk Management Tool

To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Eno-Haw Region, current parcel data was evaluated to identify recent development that was not included in NCEM's IRISK database. The building footprint layer from IRISK was compared to current parcel data; any parcels with an improved value that did not already have a building in IRISK were summarized in the table below. This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

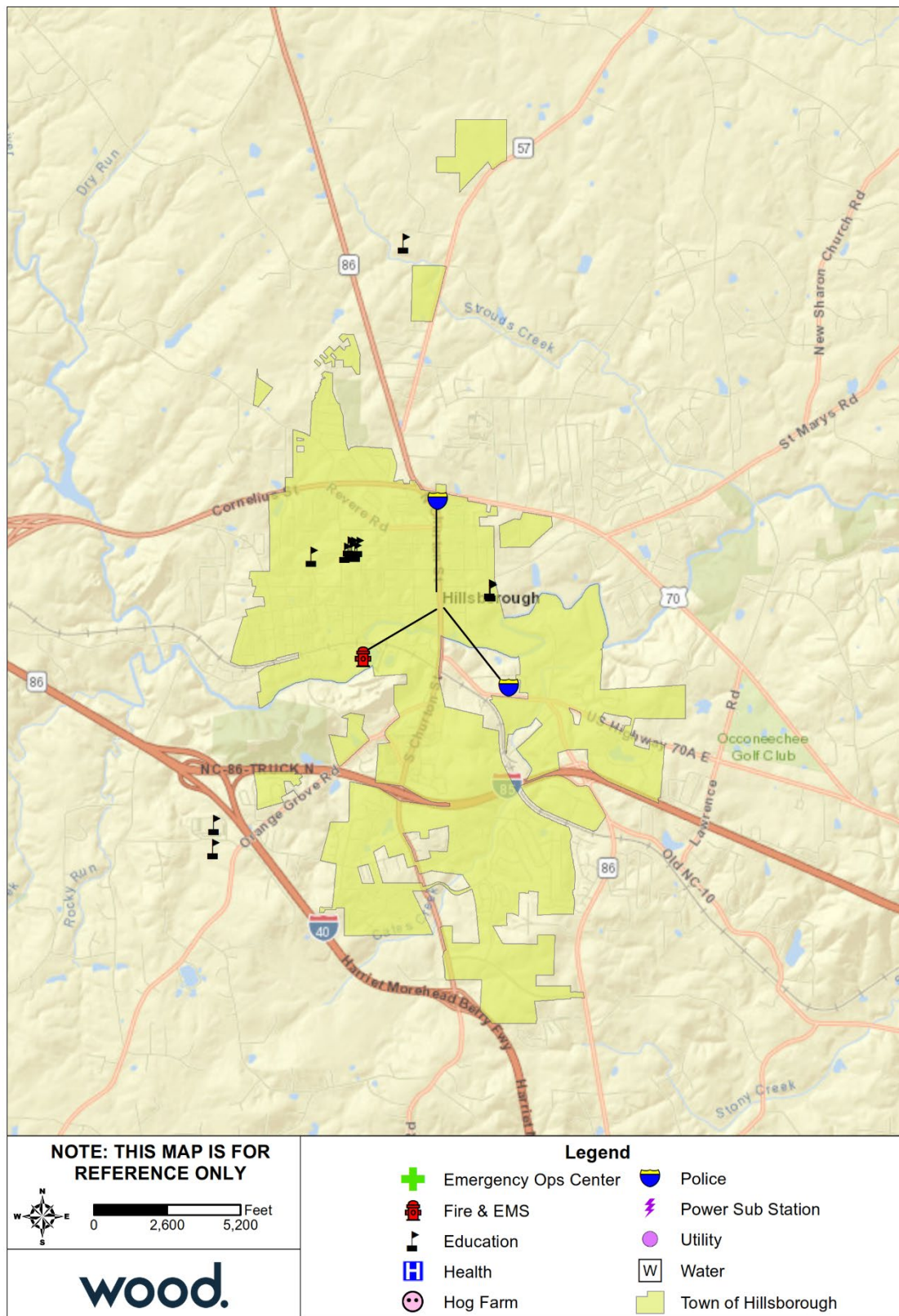
Table P.9 – Parcels Development Not Included in IRISK, November 2019

Jurisdiction	Improved Parcel Count	Total Improved Value
Hillsborough	815	\$254,184,904

Source: County parcel data, retrieved November 2019; IRISK database building footprints



Figure P.1 – Critical Facilities, Town of Hillsborough



Source: NCEM IRISK Database, GIS Analysis

Eno-Haw

Regional Hazard Mitigation Plan  
2020

**P.3.1 Dam Failure**

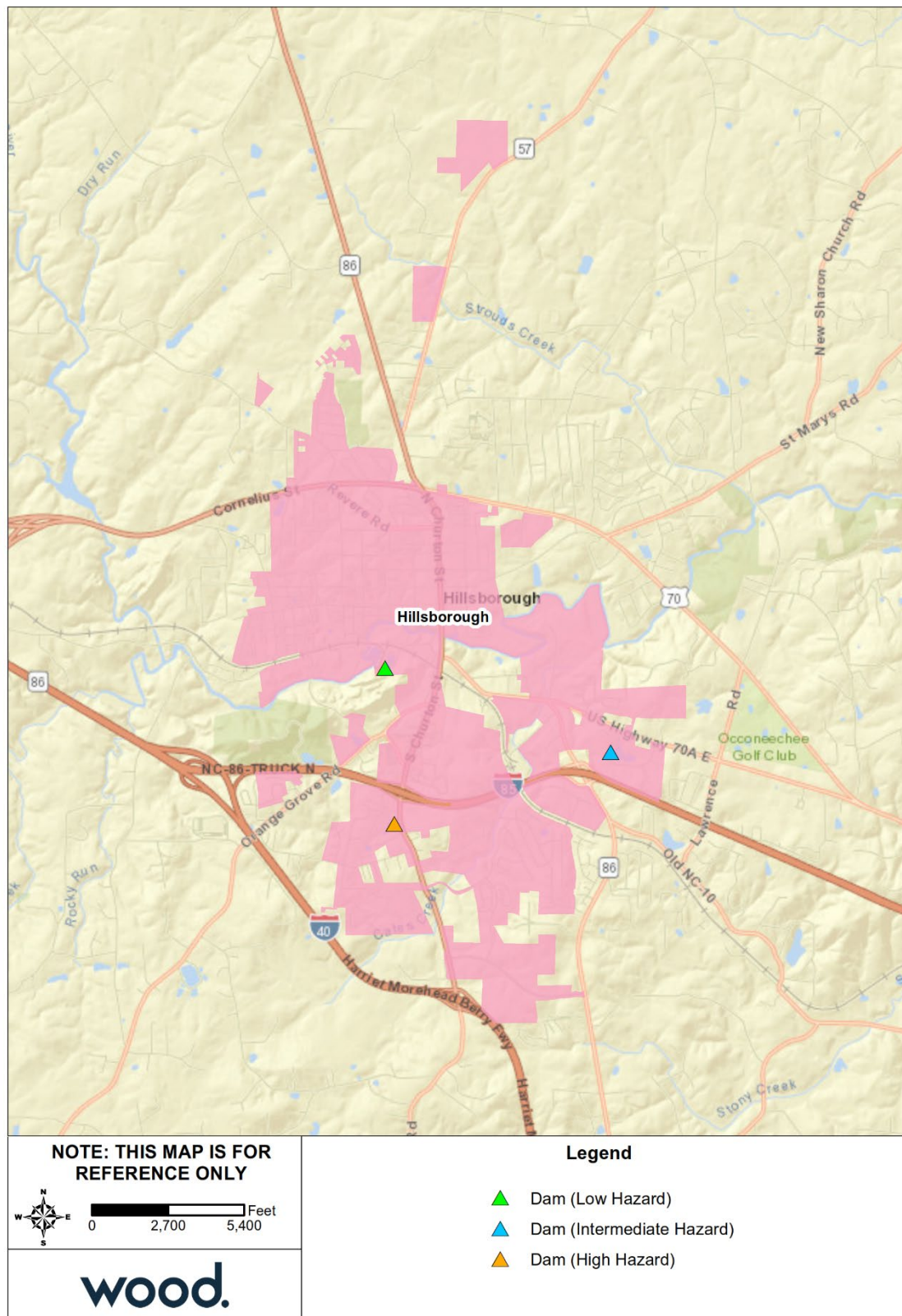
Table P.10 lists the high hazard dams in the Town of Hillsborough identified by the North Carolina Dam Inventory as of July 2018. All dam locations throughout Hillsborough are shown in Figure P.2. Additionally, Hillsborough is the nearest downstream location to three high hazard dams located in unincorporated Orange County, Lake Orange Dam, Hillsborough Water Supply Dam, and Randy Fox Dam.

**Table P.10 – High Hazard Dams in Town of Hillsborough**

Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
Flint Ridge Dam	NC03663	Poor	22	Hillsborough

Source: NC Dam Inventory, July 2018

Figure P.2 – Dam Locations, Town of Hillsborough



Source: NC Dam Inventory, July 2018

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Regional Hazard Mitigation Plan  
2020

### P.3.2 Flood

Table P.11 details the acreage of the Town of Hillsborough by flood zone on the effective DFIRM. Per this assessment, over 6 percent of Hillsborough falls within the mapped 1%-annual-chance floodplains.

**Table P.11 – Flood Zone Acreage in the Town of Hillsborough**

Flood Zone	Acreage	Percent of Total (%)
Zone AE	233.4	6.4
Zone X (500-year)	29.8	0.8
Zone X Unshaded	3,366.3	92.7
<b>Total</b>	<b>3,629.5</b>	<b>--</b>

Source: FEMA Effective DFIRM

Figure P.3 reflects the effective mapped flood hazard zones for the Town of Hillsborough, and Figure P.4 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the region, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below and compared to total recent development counts and values. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. Additionally, this assessment does not evaluate flood impacts or provide damage estimates. According to this assessment, 1.0 percent of recent development in Hillsborough is located in or near the SFHA.

**Table P.12 – Recent Development at Risk to Flood, Town of Hillsborough**

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
8	\$17,512,500	1.0%	6.9%

Source: Parcel data retrieved November 2019; FEMA Effective DFIRM

Table P.13 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector and flood event in Hillsborough. There are no High Potential Loss Facilities with estimated flood damages in the Town.

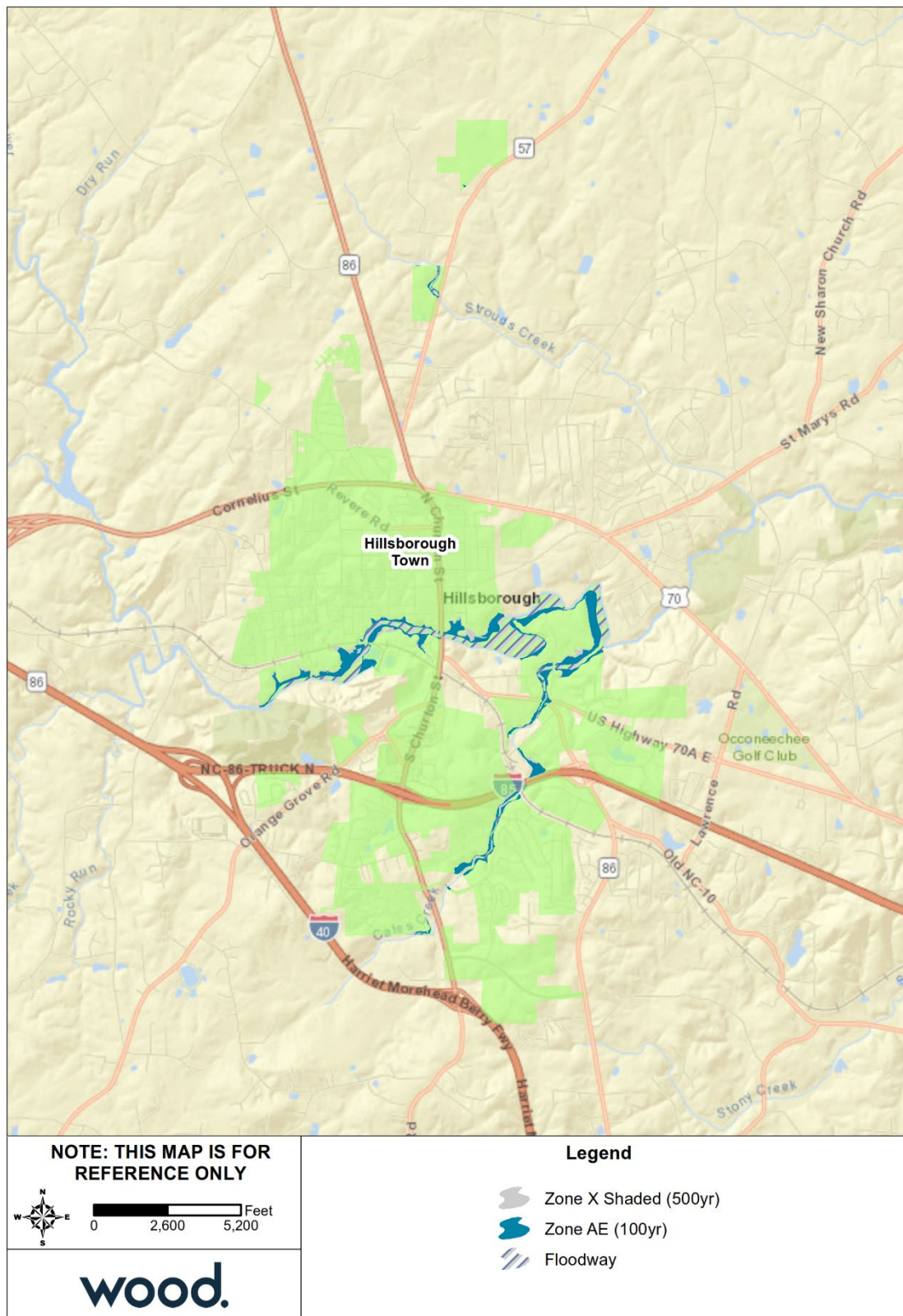
**Table P.13 – Critical Facilities Exposed to Flooding, Town of Hillsborough**

Sector	Event	Number of Buildings at Risk	Estimated Damages
Food and Agriculture	25 Year	1	\$758
	50 Year	1	\$5,767
	100 Year	1	\$9,528
	500 Year	1	\$20,701

Source: NCEM Risk Management Tool



Figure P.3 – FEMA Flood Hazard Areas, Town of Hillsborough

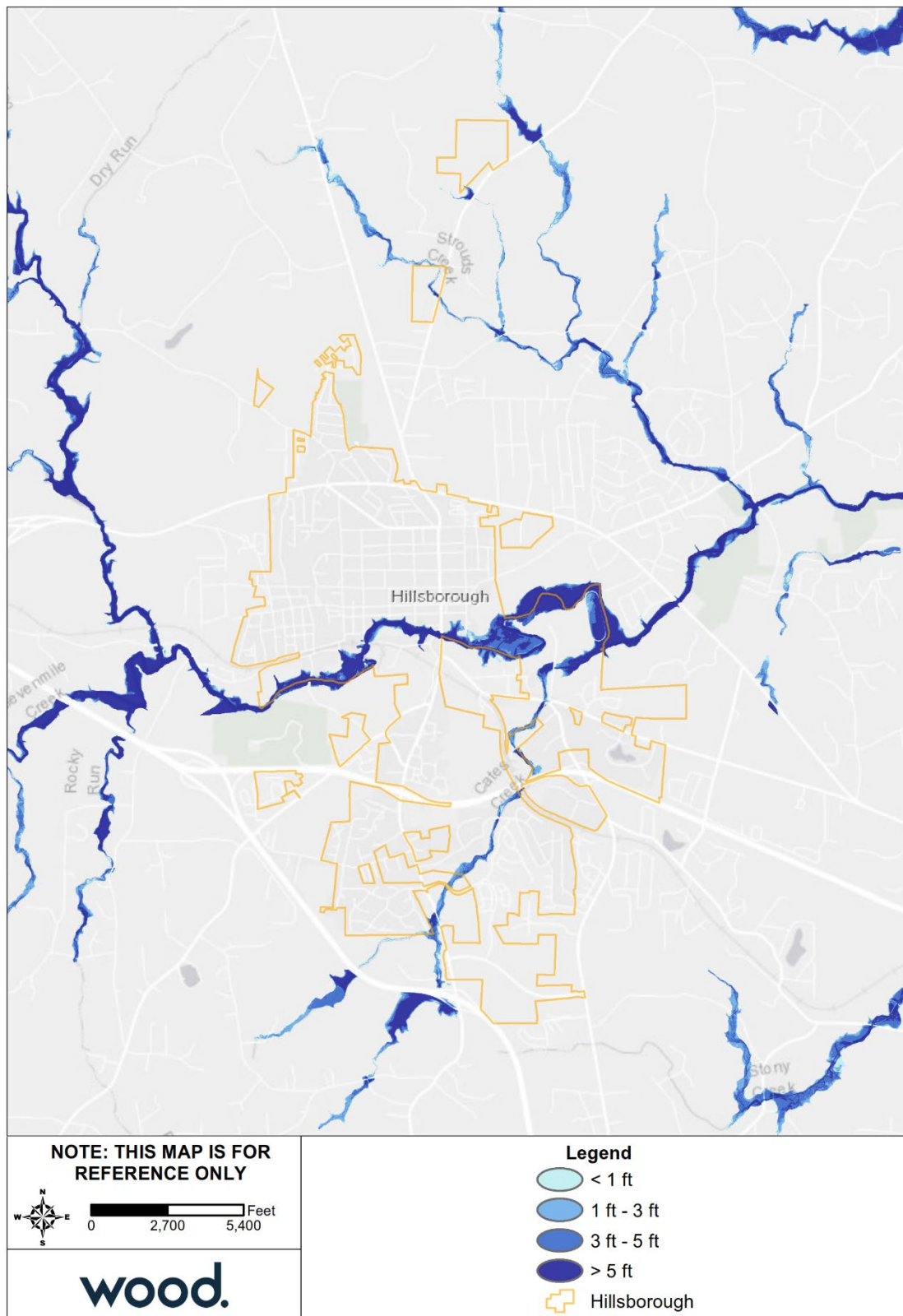


Source: FEMA Effective DFIRM

Eno-Haw

Regional Hazard Mitigation Plan  
2020

Figure P.4 – Flood Depth, 1%-Annual-Chance Floodplain, Town of Hillsborough



Source: FEMA Effective DFIRM

### P.3.3 Wildfire

Table P.14 summarizes the acreage in the Town of Hillsborough that falls within the Wildland Urban Interface (WUI), categorized by housing density. Areas in the WUI are those where development may intermix with flammable vegetation. Over 17 percent of the Town of Hillsborough is not included in the WUI.

**Table P.14 – Wildland Urban Interface Acreage, Town of Hillsborough**

	Housing Density	Total Acreage	Percent of Total Acreage
	<i>Not in WUI</i>	618.91	17.1%
	LT 1hs/40ac	384.62	10.6%
	1hs/40ac to 1hs/20ac	213.87	5.9%
	1hs/20ac to 1hs/10ac	207.18	5.7%
	1hs/10ac to 1hs/5ac	262.03	7.2%
	1hs/5ac to 1hs/2ac	395.05	10.9%
	1hs/2ac to 3hs/1ac	1,494.52	41.2%
	GT 3hs/1ac	53.29	1.5%
	<b>Total</b>	<b>3,629.48</b>	

Source: Southern Wildfire Risk Assessment

Figure M.5 depicts the WUI for all of Orange County. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure M.6 depicts Burn Probability for the County based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Figure P.5 depicts the Fire Intensity Scale; which indicates the potential severity of fire based on fuel loads, topography, and other factors; in order to detail potential wildfire extent in the Town of Hillsborough. There is a small cluster of high potential fire intensity in the eastern edge of the Town. Overall, 11 percent of the Town has a Class 3 fire intensity rating and 1.5 percent has a Class 4 rating.

Table P.15 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table P.16 provides counts and estimated damages for High Potential Loss Properties in the Town of Hillsborough.

**Table P.15 – Critical Facilities Exposed to Wildfire, Town of Hillsborough**

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	7	\$2,675,438
Commercial Facilities	19	\$35,931,466
Critical Manufacturing	2	\$2,739,377
Food and Agriculture	4	\$196,116
Government Facilities	9	\$68,561,410
Healthcare and Public Health	3	\$6,633,604
<b>All Categories</b>	<b>44</b>	<b>\$116,737,411</b>

Source: NCEM Risk Management Tool

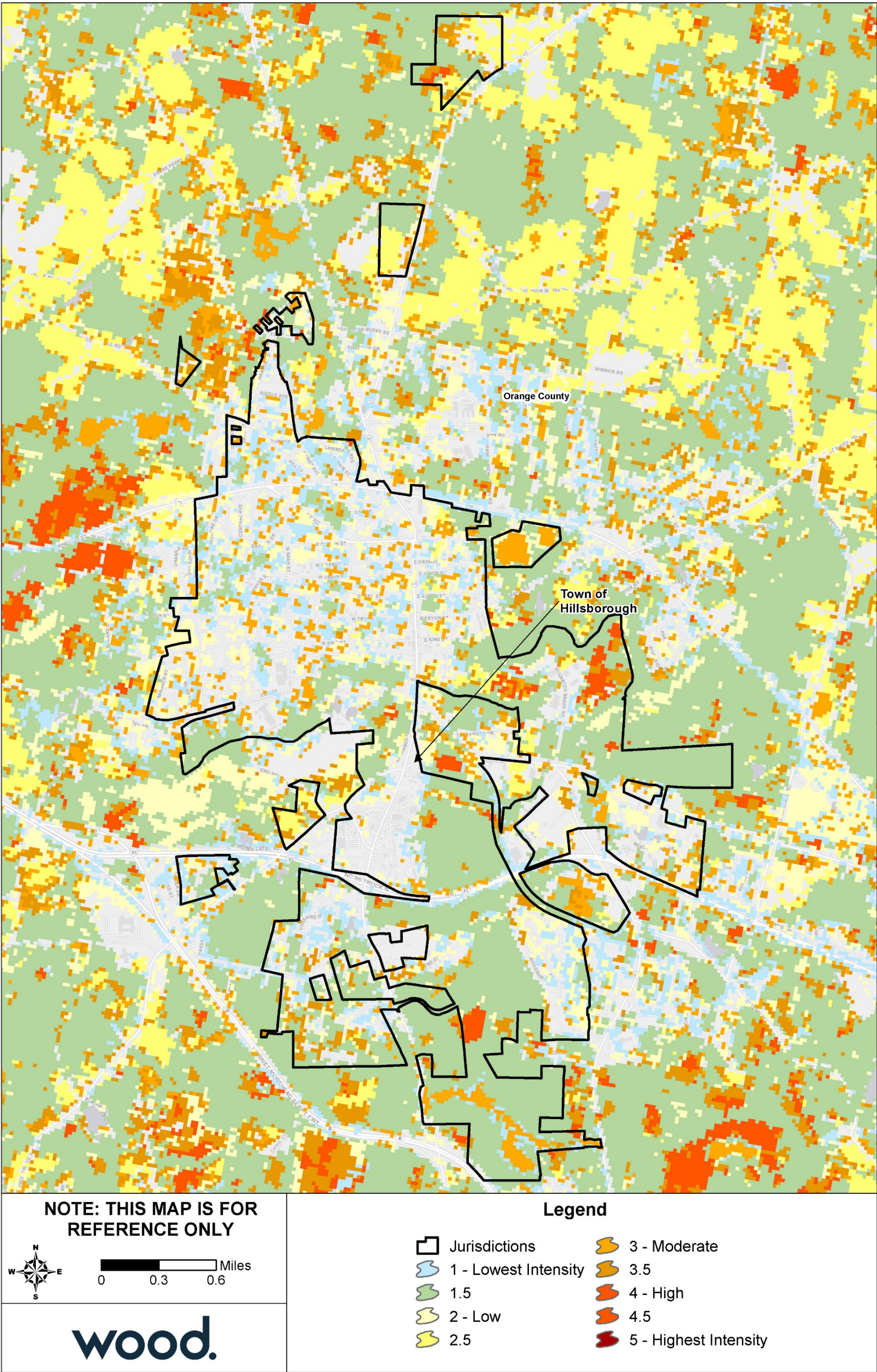
**Table P.16 – High Potential Loss Properties Exposed to Wildfire, Town of Hillsborough**

Category	Number of Buildings at Risk	Estimated Damages
Commercial	5	\$30,443,834
Residential	1	\$4,097,733
<b>All Categories</b>	<b>6</b>	<b>\$34,541,567</b>

Source: NCEM Risk Management Tool



Figure P.5 – Fire Intensity Scale, Town of Hillsborough



Source: Southern Wildfire Risk Assessment



## P.4 CAPABILITY ASSESSMENT

### P.4.1 Overall Capability

Details on the tools and resources in place and available to the Town of Hillsborough were provided by the Town's HMPC representatives and are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Hillsborough has an overall capability rating of Moderate. The Town could improve regulatory capability by developing an Evacuation Plan to support emergency preparedness and response. The Town could also develop a Disaster Recovery Plan and/or a Post-Disaster Redevelopment Ordinance to plan and set mitigation requirements for post-disaster reconstruction. The Town has moderate administrative, fiscal, and outreach capability and limited structural mitigation experience.

### P.4.2 Floodplain Management

The Town of Hillsborough joined the NFIP through emergency entry in 1977 and has been a regular participant since May 1980. The following tables reflect NFIP policy and claims data for the Town categorized by structure type, flood zone, Pre-FIRM and Post-FIRM.

**Table P.17 – NFIP Policy and Claims Data by Structure Type**

Structure Type	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
Single Family	23	\$8,594	\$6,956,000	6	\$5,813.33
2-4 Family	0	\$0	\$0	1	\$3,218.69
All Other Residential	0	\$0	\$0	0	\$0.00
Non Residential	4	\$17,638	\$2,200,000	0	\$0.00
<b>Total</b>	<b>27</b>	<b>\$26,232</b>	<b>\$9,156,000</b>	<b>7</b>	<b>\$9,032.02</b>

Source: FEMA Community Information System, accessed May 2020

**Table P.18 – NFIP Policy and Claims Data by Flood Zone**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	3	\$14,243	\$1,250,000	2	\$5,813.33
B, C & X Zone					
Standard	1	\$1,805	\$550,000	0	\$0.00
Preferred	23	\$10,184	\$7,356,000	5	\$3,218.69
<b>Total</b>	<b>27</b>	<b>\$26,232</b>	<b>\$9,156,000</b>	<b>7</b>	<b>\$9,032.02</b>

Source: FEMA Community Information System, accessed May 2020

**Table P.19 – NFIP Policy and Claims Data Pre-FIRM**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	2	\$13,839	\$1,000,000	2	\$5,813.33
B, C & X Zone	8	\$6,297	\$3,230,000	3	\$3,218.69
Standard	1	\$1,805	\$550,000	0	\$0.00
Preferred	7	\$4,492	\$2,680,000	3	\$3,218.69
<b>Total</b>	<b>10</b>	<b>\$20,136</b>	<b>\$4,230,000</b>	<b>5</b>	<b>\$9,032.02</b>

Source: FEMA Community Information System, accessed May 2020

Table P.20 – NFIP Policy and Claims Data Post-FIRM

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	1	\$404	\$250,000	0	\$0.00
B, C & X Zone	16	\$5,692	\$4,676,000	2	\$0.00
Standard	0	\$0	\$0	0	\$0.00
Preferred	16	\$5,692	\$4,676,000	2	\$0.00
<b>Total</b>	17	\$6,096	\$4,926,000	2	\$0.00

Source: FEMA Community Information System, accessed May 2020

P.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
P-1	Work with the Tree Board, Public Works Department, and utility companies to ensure that dangerous situations are addressed in a timely manner	All Hazards	3.1	Moderate	Town of Hillsborough Public Works Department	Grants; estimated cost \$20,000	2019-2025	Carried Forward	This has been partially completed. We will continue to work towards completion. This can be a moving target due to new threats such as leaning or dead trees, aging infrastructure, etc.
P-2	Work with State efforts to study hydrology and maps/designate any new flood prone areas	Flood	1.1	High	Town of Hillsborough Planning Department	N/A	2019-2025	Carried Forward	New flood maps and GIS maps have been drawn for a good portion of our jurisdiction as of 2017, but the northwest, south, and southwest areas of town still utilize 2007 FIRM panels.
Structural Projects									
SP-1	Construct new recreational facilities out of flood-resistant and resilient building materials due to their locations in flood-prone areas	Flood	4.2	Moderate	Town of Hillsborough Public Space and Public Works	Town Budget, grants	2020-2025	New	Due to the propensity for recreational land and structures to be located in flood prone areas, this will become a higher priority as the Town develops new public spaces and amenities
SP-2	Relocate the Public Works operation to a non-floodprone site. This is a sizable project and is expected to be completed in the next 5-7 years.	Flood	4.2	Moderate	Town of Hillsborough Public Works Department	Town Budget, grants; estimated cost \$1.1m	2023-2024	Carried Forward	This was originally budgeted for a contract for the 2016-2017 budget cycle, but due to funding and project delays, this will likely be re-prioritized to the 2023-2024 budget
Emergency Services									
ES-1	Conduct Emergency Operations Center (EOC) exercises and staff drills to address the increasing threat of terrorism and to increase staff coordination and response time for hazards	All Hazards	2.2	High	All Town Staff	Town Budget; estimated cost \$20,000	2020-2025	New	For FY2020 the town command/EOC staff conducted an exercise/training session on 11-14-2019 with a town wide event expected in the spring of 2020.
Public Education & Awareness									
PEA-1	Construct an extension of a fiber optic loop to serve underprivileged and rural residents with high speed internet service for better access to emergency information.	All Hazards	2.2	High	Town of Hillsborough Administration, Orange County Emergency Services	Grants	2020-2025	New	This program would expand much-needed access to high speed internet infrastructure to underserved, under-represented, and rural areas of Town, thus providing access to different types of emergency information in the event of an emergency. The Town is currently in the planning stages of this expansion, and construction is scheduled to begin in FY20.

## Annex Q Person County

### Q.1 PLANNING PROCESS

The table below lists the HMPC members who represented Person County.

**Table Q.1 – HMPC Members**

Representative	Position or Title
Doug Young	Director, Emergency Services Dept.
Lori Oakley	Planning Director
Kayla DiCristina	Planner
Treco Lea-Jeffers	Stakeholder

### Q.2 COMMUNITY PROFILE

#### Geography

Person County is located in the northern portion of the Piedmont of North Carolina, along the border with the State of Virginia. The County is also neighbored by Granville County to the east, Durham and Orange Counties to the south, and Caswell County to the west.

#### Population and Demographics

Table Q.2 provides population counts and growth estimates for Person County unincorporated areas as compared to the county and the region overall.

**Table Q.2 – Population Counts, Unincorporated Person County, 2010-2018**

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
Unincorporated Person County	26,927	30,660	31,022	362	1.2%
<b>Person County</b>	<b>35,623</b>	<b>39,022</b>	<b>39,305</b>	<b>283</b>	<b>0.7%</b>
<b>Region Total</b>	<b>507,964</b>	<b>567,634</b>	<b>649,276</b>	<b>81,642</b>	<b>14.4%</b>

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

Note: Unincorporated area statistics calculated by subtracting jurisdiction counts from the county total.

#### Housing

The table below details key housing statistics for Person County unincorporated areas as compared to the County overall.

**Table Q.3 – Housing Statistics, Unincorporated Person County, 2010-2018**

Housing Characteristics	Person County	Unincorporated Person County
Housing Units (2010)	18,193	14,149
Housing Units (2018)	18,428	14,478
Housing Units Percent Change (2010-2018)	1.3%	2.3%

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2014-2018 5-Year Estimates



### Q.3 RISK ASSESSMENT

This section contains a summary of the County's asset inventory as well as hazard profile and vulnerability assessment for those hazards that are spatially defined and have variations in risk that could be evaluated quantitatively on a jurisdictional level. The hazards included in this section are: Dam Failure, Flood, and Wildfire.

#### Asset Inventory

The following tables summarize the asset inventory for unincorporated Person County in order to estimate the total physical exposure to hazards in this area. The locations of critical facilities are shown in Figure Q.1. Critical facilities are a subset of identified assets from the Critical Infrastructure & Key Resources (CIKR) dataset. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted and displayed.

Building counts are provided based on data from the NCEM IRISK database, and supplemental parcel exposure is based on November 2019 county parcel data.

**Table Q.4 – Critical Infrastructure & Key Resources by Type**

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	Defense	Government Facilities	Healthcare	IT	National Monuments and Icons	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Unincorporated Person County	2,279	1	0	306	0	86	0	46	9	0	0	0	0	46	52	1	0	2,826

Source: NCEM Risk Management Tool

The following facilities were identified by Person County and Roxboro's HMPC and added to the critical facilities maps. It is the intention of the HMPC that future updates of IRISK incorporate these facilities as critical assets.

**Table Q.5 – Supplemental Critical Facilities**

Facility Type	Facility Name
Police Station	Roxboro Police Department
Fire/EMS	Station 2
Fire/EMS	EMS
Fire/EMS	Person County Ambulance/911 Communication
Fire/EMS	Station 1
Fire/EMS	Rescue Squad
Fire/EMS	Station 3
Fire/EMS	Ceffo Volunteer Fire Department
Fire/EMS	Hurdle Mills Fire Department
Fire/EMS	Woodsdale #1 Volunteer Fire Department
Fire/EMS	Person County EMS Station 2
Fire/EMS	Timberlake Volunteer Fire Department
Fire/EMS	Woodsdale #2 Volunteer Fire Department

## ANNEX Q: PERSON COUNTY UNINCORPORATED AREAS

Facility Type	Facility Name
Fire/EMS	Allensdale Volunteer Fire Department
Fire/EMS	Moriah Fire Sation 2
Fire/EMS	Hurdle Mills Fire Department
Fire/EMS	Tripel Springs Volunteer Fire Department
Fire/EMS	Moriah #1 Volunteer Fire and Rescue
Water	Water Treatment Plant
Water	Wastewater Treatment Facility
Utility	Mt. Tirzah Tower
Utility	Woodland Tower
Utility	Bethel Hill Tower
Utility	Critcher Wilkerson Tower
Power Substation	Capital Power - Roxboro Power Plant
Power Substation	Hyco Lake Power Plant/Duke Energy Site Roxboro
Power Substation	Mayo Lake Power Plant/Duke Energy Mayo Plant
Municipal	Human Services
Municipal	City Hall
Municipal	Communications
Municipal	IT
Municipal	Animal Services/Ground Maintenance
Municipal	County Office Building/Elections
Municipal	PCOB
Municipal	Public Services
Municipal	LEC
Fuel Station	Shell Service Station
Fuel Station	Roseville Grocery
Fuel Station	T.G. Brooks Co., Inc.
Fuel Station	Snips Bros Oil Co., Inc.
Airport	Person County Airport

Source: Durham County

**Table Q.6 – High Potential Loss Facilities by Use**

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Unincorporated Person County	2	10	2	6	0	6	0	26

Source: NCEM Risk Management Tool

**Table Q.7 – IRISK Inventory of Building Counts and Values**

Jurisdiction	Building Count	Building Value
Unincorporated Person County	17,714	\$1,424,187,837

Source: NCEM Risk Management Tool

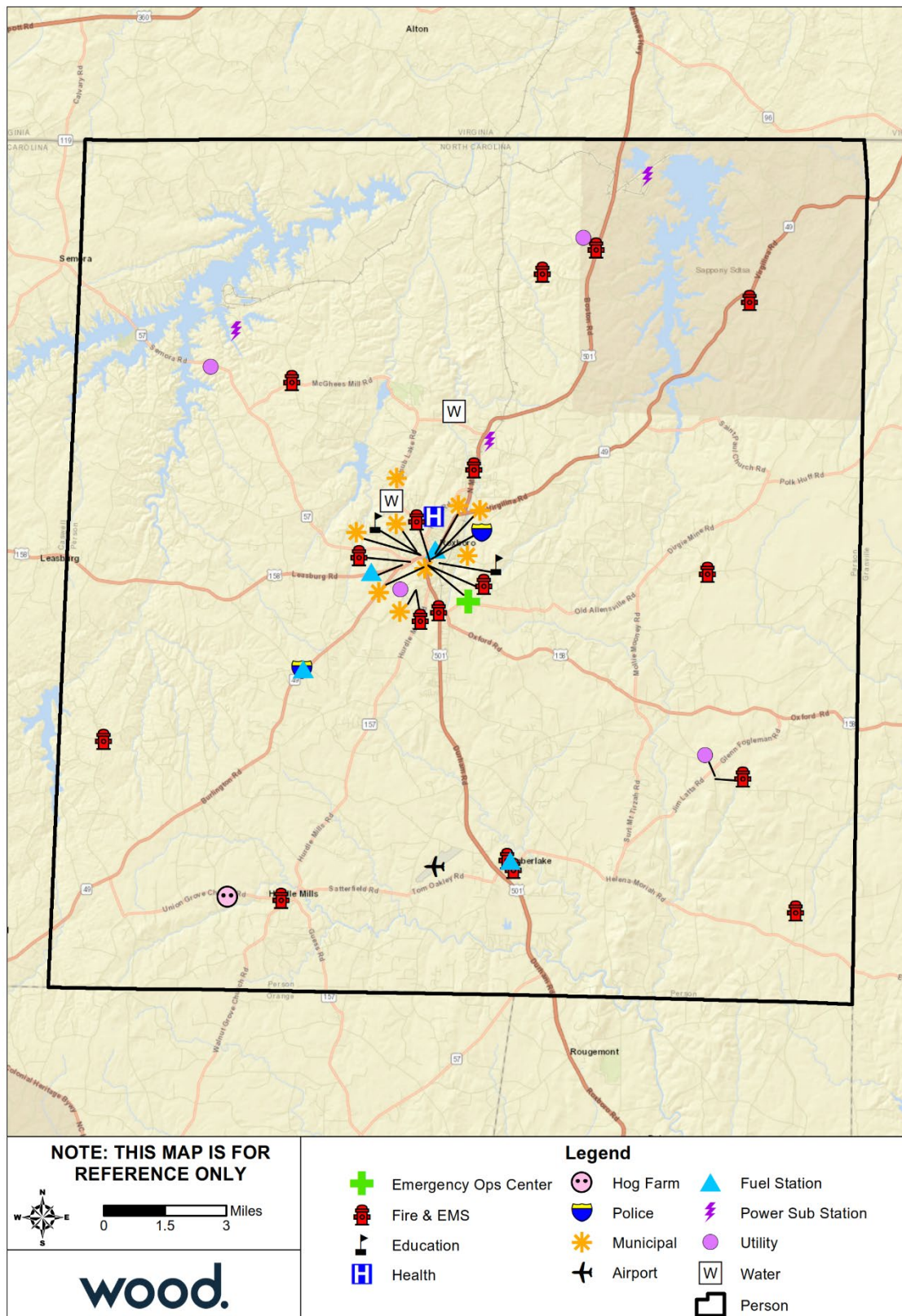
To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Eno-Haw Region, current parcel data was evaluated to identify recent development that was not included in NCEM's IRISK database. The building footprint layer from IRISK was compared to current parcel data; any parcels with an improved value that did not already have a building in IRISK were summarized in the table below. This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

**Table Q.8 – Parcels Development Not Included in IRISK, November 2019**

Jurisdiction	Improved Parcel Count	Total Improved Value
Unincorporated Person County	1,624	\$217,189,070

Source: County parcel data, retrieved November 2019; IRISK database building footprints

Figure Q.1 – Critical Facilities, Person County



Source: NCEM IRISK Database, GIS Analysis

Eno-Haw

Regional Hazard Mitigation Plan  
2020



**Q.3.1 Dam Failure**

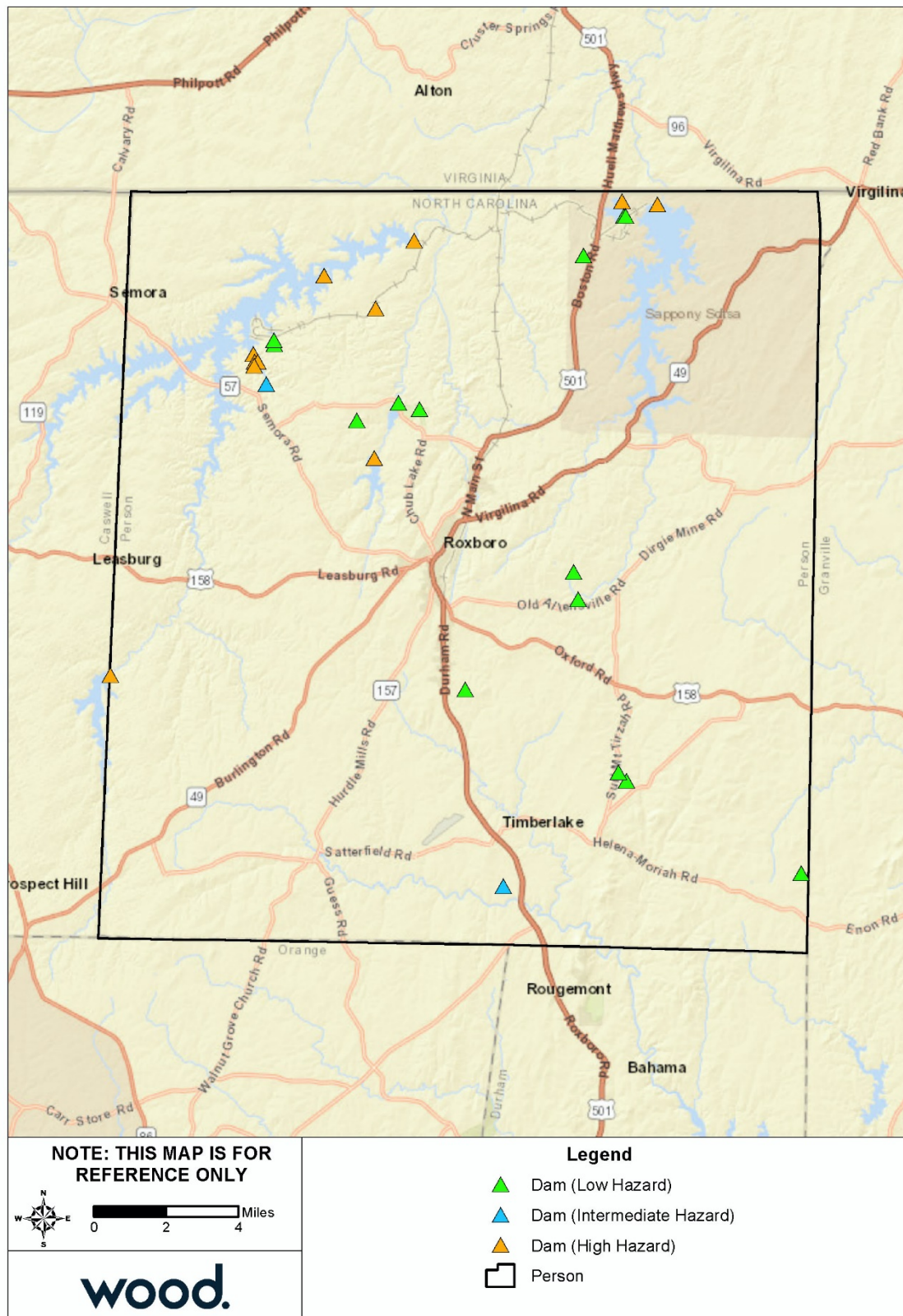
Table Q.9 lists the high hazard dams in unincorporated Orange County identified by the North Carolina Dam Inventory as of July 2018. All dam locations throughout Orange County are shown in Figure Q.2.

**Table Q.9 – High Hazard Dams in Unincorporated Orange County**

Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
Lake Hyco Dam	NC00656	Poor	77,000	Mcgehees Mill
Roxboro Municipal Lake Dam	NC00658	Satisfactory	4,125	Chub Lake
Roxboro Afterbay Dam	NC00666	Fair	16,800	Denniston
South Hyco Lake Dam (Lake Roxboro)	NC03689	Satisfactory	9,400	
Mayo Lake Dam	NC06002	Fair	-	
Mayo Ash Pond Dam	NC06003	Fair	-	
Roxboro West Ash Pond Dam	NC06006	Fair	-	
Roxboro West FGD Settling Pond	NC06008	Fair	-	
Roxboro East FGD Settling Pond	NC06009	Fair	-	
Roxboro FGD Forward Flush Pond	NC06010	Fair	-	
Jimmie Bowes Transmission Line Embankment	NC06016	Satisfactory	-	

Source: NC Dam Inventory, July 2018

Figure Q.2 – Dam Locations, Person County



Source: NC Dam Inventory, July 2018

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2020

### Q.3.2 Flood

Table Q.10 details the acreage of unincorporated Person County by flood zone on the effective DFIRM. Per this assessment, over 6 percent of unincorporated Person County falls within the mapped 1%-annual-chance floodplains.

**Table Q.10 – Flood Zone Acreage in Unincorporated Person County**

Flood Zone	Acreage	Percent of Total (%)
Zone A	25.7	0.0
Zone AE	16,218.6	6.3
Zone X (500-year)	83.4	0.0
Zone X Unshaded	242,522.7	93.7
<b>Total</b>	<b>258,850.5</b>	<b>--</b>

Source: FEMA Effective DFIRM

Figure Q.3 reflects the effective mapped flood hazard zones for Person County, and Figure Q.4 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the region, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below and compared to total recent development counts and values. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. Additionally, this assessment does not evaluate flood impacts or provide damage estimates. According to this assessment, 8.0 percent of recent development in unincorporated Person County is located in or near the SFHA.

**Table Q.11 – Recent Development at Risk to Flood, Unincorporated Person County**

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
130	\$23,186,799	8.0%	10.7%

Source: Parcel data retrieved November 2019; FEMA Effective DFIRM

Table Q.12 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector and flood event in Roxboro. There are no estimated damages to High Potential Loss Facilities in unincorporated Person County.

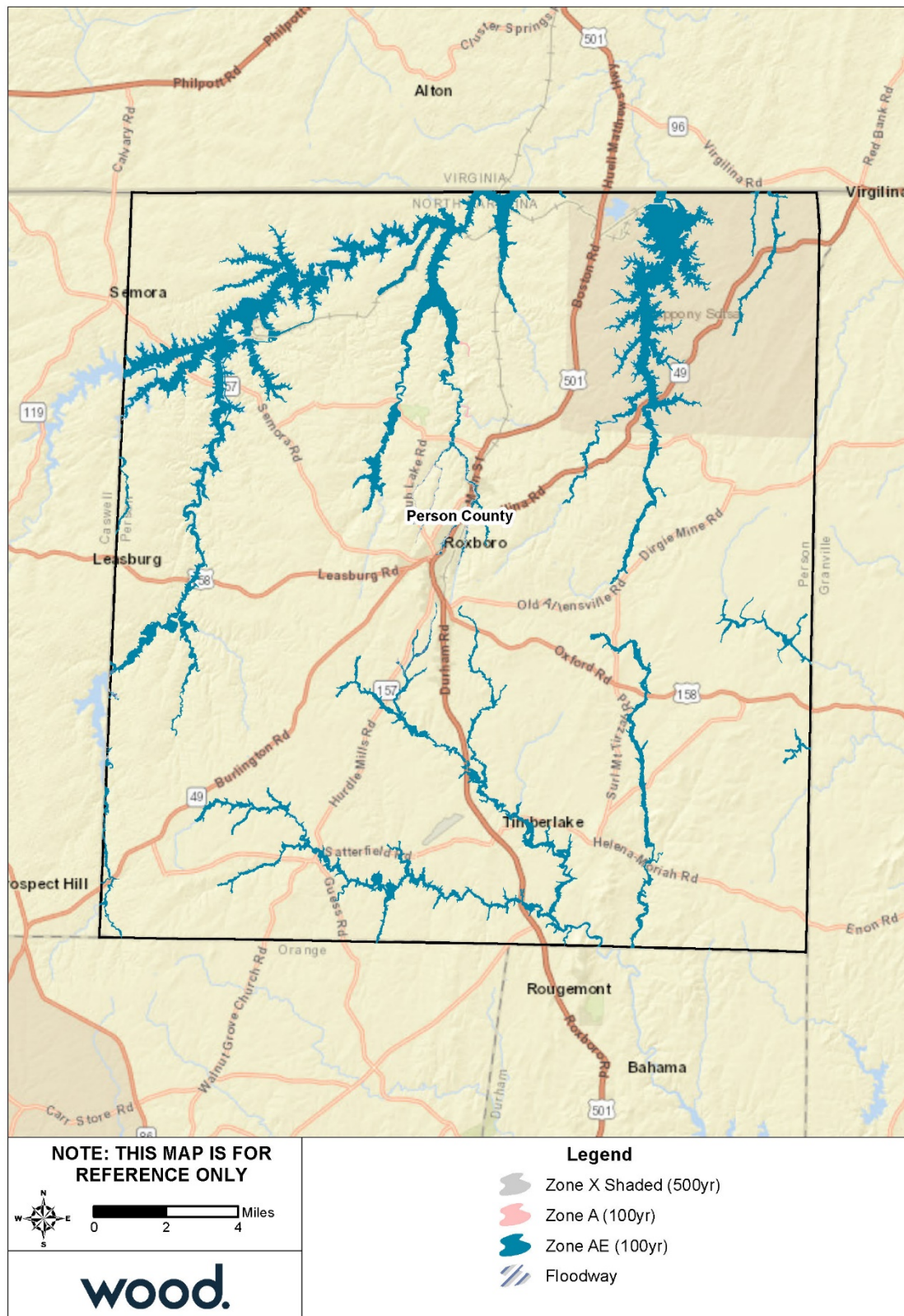
**Table Q.12 – Critical Facilities Exposed to Flooding, Unincorporated Person County**

Sector	Event	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	500 Year	1	\$67
Critical Manufacturing	500 Year	1	\$1,592
<b>All Categories</b>	<b>500 Year</b>	<b>2</b>	<b>\$1,659</b>

Source: NCEM Risk Management Tool



Figure Q.3 – FEMA Flood Hazard Areas, Person County



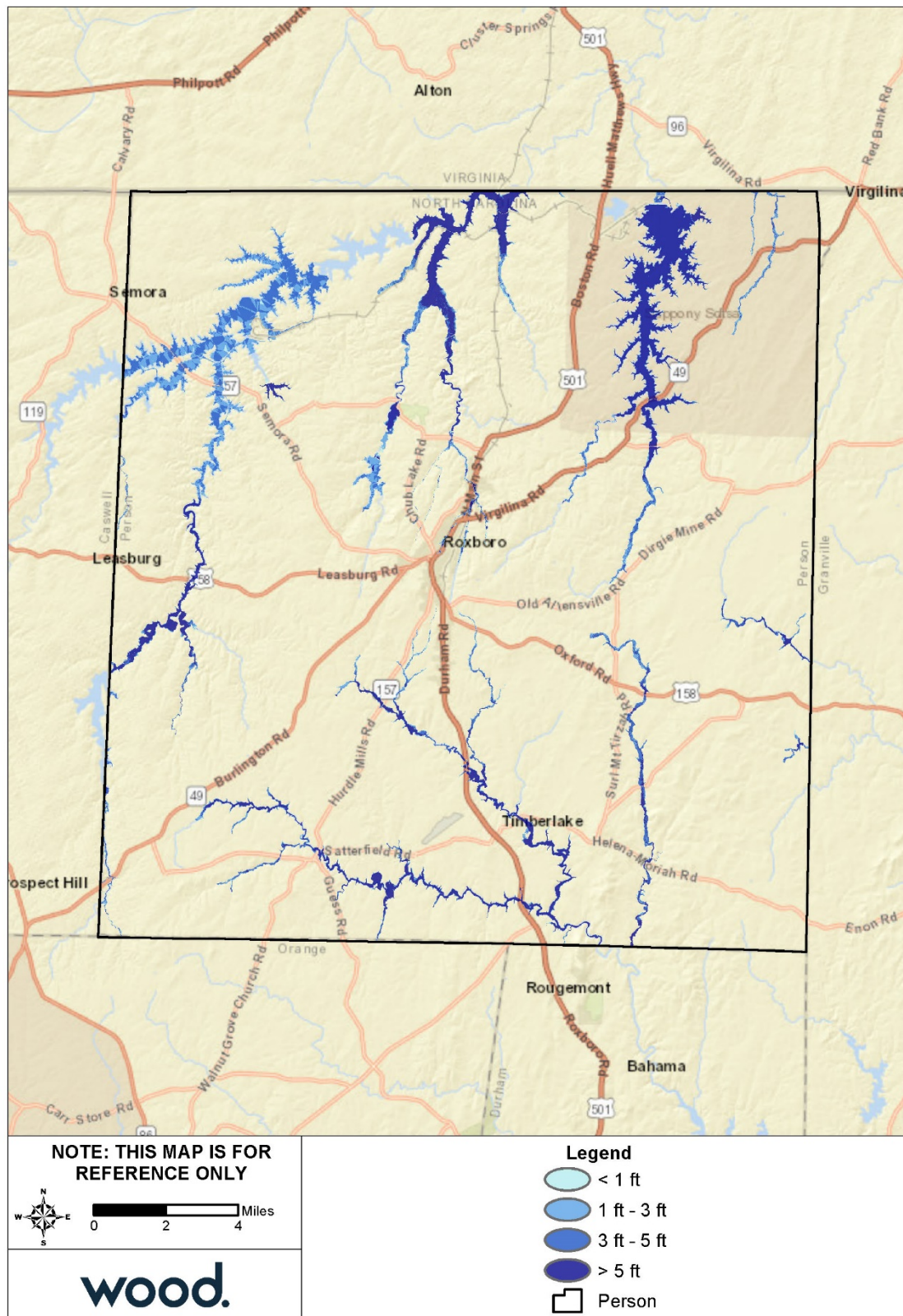
Source: FEMA Effective DFIRM

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Regional Hazard Mitigation Plan  
2020



Figure Q.4 – Flood Depth, 1%-Annual-Chance Floodplain, Person County



Source: FEMA Effective DFIRM

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2020

### Q.3.3 Wildfire

Table Q.13 summarizes the acreage in unincorporated Person County that falls within the Wildland Urban Interface (WUI), categorized by housing density. Areas in the WUI are those where development may intermix with flammable vegetation. Over 38 percent of unincorporated Person County is not included in the WUI.

**Table Q.13 – Wildland Urban Interface Acreage, Person County**

	Housing Density	Total Acreage	Percent of Total Acreage
	<i>Not in WUI</i>	45,408.95	38.4%
	LT 1hs/40ac	13,917.78	11.8%
	1hs/40ac to 1hs/20ac	9,345.21	7.9%
	1hs/20ac to 1hs/10ac	12,692.43	10.7%
	1hs/10ac to 1hs/5ac	12,822.76	10.8%
	1hs/5ac to 1hs/2ac	12,525.49	10.6%
	1hs/2ac to 3hs/1ac	11,156.21	9.4%
	GT 3hs/1ac	381.02	0.3%
	<b>Total</b>	<b>118,249.85</b>	

Source: Southern Wildfire Risk Assessment

Figure Q.5 depicts the WUI for all of Person County. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure Q.6 depicts Burn Probability based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Fire Intensity Scale, which indicates the potential severity of fire based on fuel loads, topography, and other factors, is depicted for Person County in Section 4 of this plan and detailed for the City of Roxboro in the City's annex.

WUI areas are distributed throughout the county with some larger gaps in development in the northern part of the county. Burn probability is low throughout the county with clusters of slightly elevated burn probability in the northwestern corner of the county and east of Roxboro. A small portion, approximately 4.7 percent, of Person County may experience up to a Class 4 Fire Intensity, which poses significant harm or damage to life and property. An additional 17.5 percent of the County may experience Class 3 Fire Intensity, which has potential for harm to life and property but is easier to suppress with dozer and plows. The remainder of the County is either non-burnable (14.9%) or would face a Class 1 or Class 2 Fire Intensity, which are easily suppressed.

Table Q.14 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table Q.15 provides counts and estimated damages for High Potential Loss Properties in unincorporated Person County.

**Table Q.14 – Critical Facilities Exposed to Wildfire, Unincorporated Person County**

Sector	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	32	\$26,098,459
Critical Manufacturing	17	\$7,765,270
Food and Agriculture	483	\$19,215,021
Government Facilities	2	\$2,699,978
Transportation Systems	5	\$1,643,211
<b>All Categories</b>	<b>539</b>	<b>\$57,421,939</b>

Source: NCEM Risk Management Tool

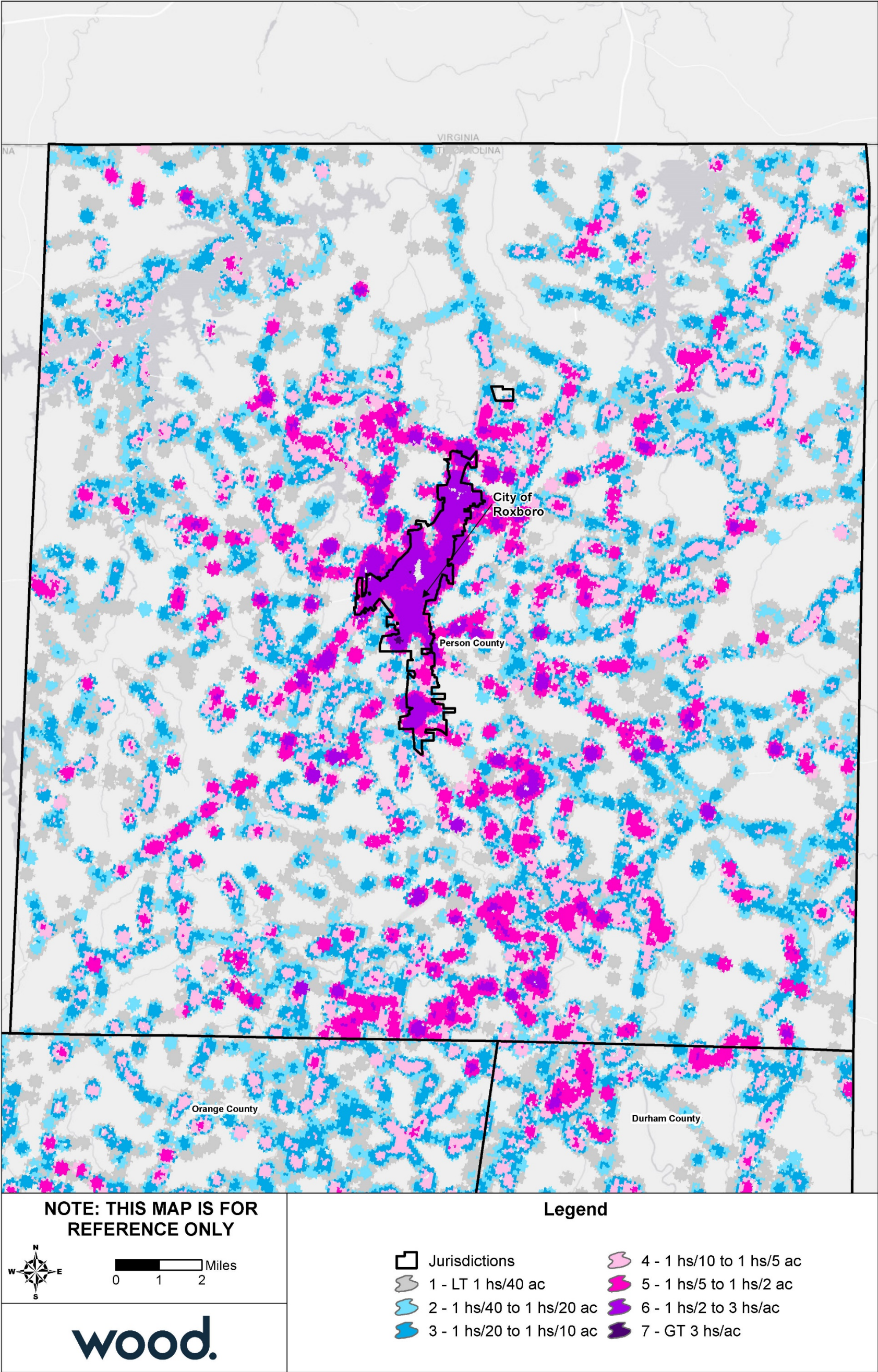
**Table Q.15 – High Potential Loss Properties Exposed to Wildfire, Unincorporated Person County**

Category	Number of Buildings at Risk	Estimated Damages
Religious	1	\$6,213,482
<b>All Categories</b>	<b>1</b>	<b>\$6,213,482</b>

Source: NCEM Risk Management Tool



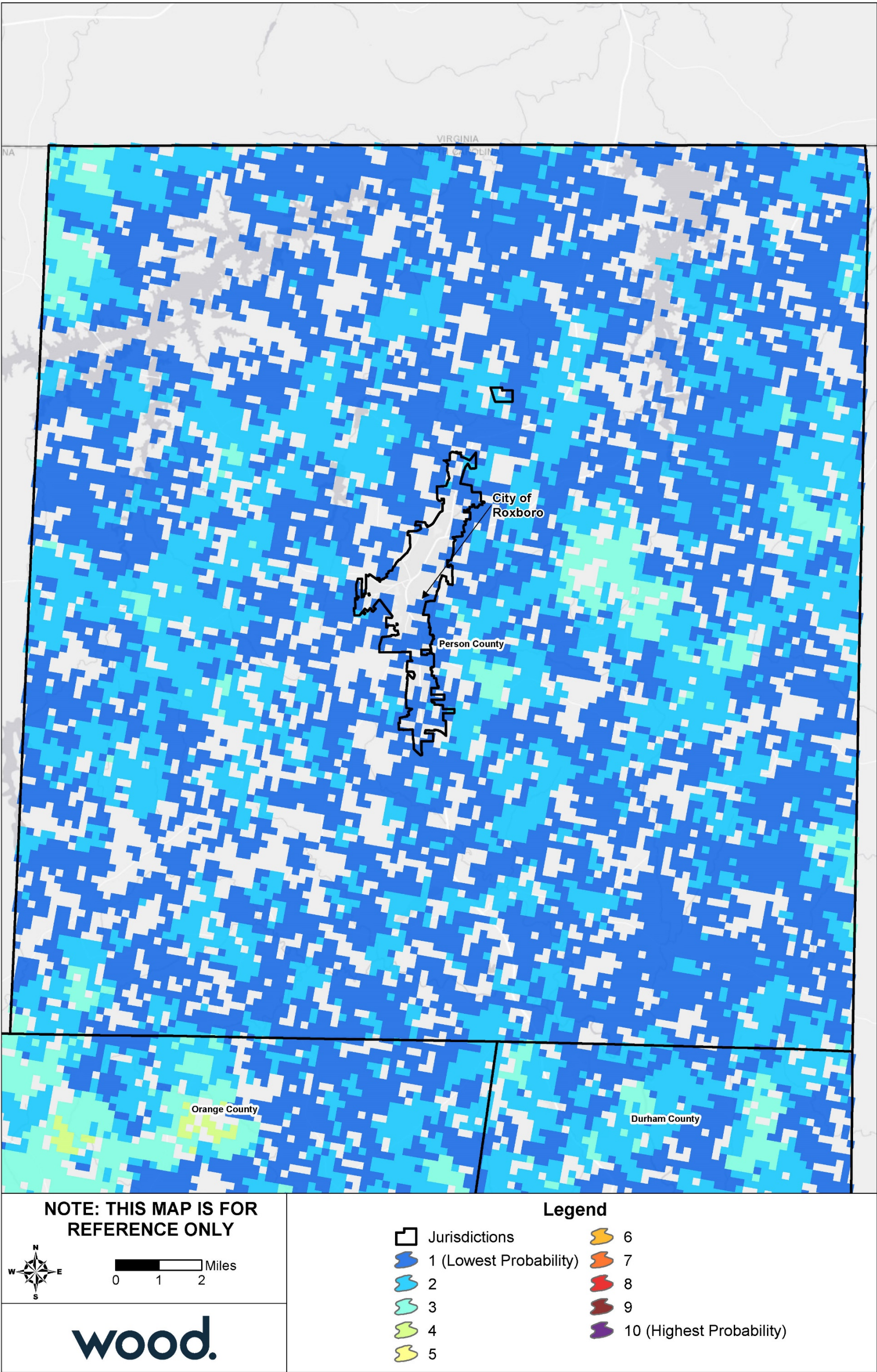
Figure Q.5 – Wildland Urban Interface, Person County



Source: Southern Wildfire Risk Assessment



Figure Q.6 – Burn Probability, Person County



Source: Southern Wildfire Risk Assessment



## Q.4 CAPABILITY ASSESSMENT

### Q.4.1 Overall Capability

Details on the tools and resources in place and available to Person County were provided by the County's HMPC representatives and are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Alamance County has an overall capability rating of Moderate. The County could improve regulatory capability for mitigation of flood hazards by developing a Floodplain Management Plan, Open Space Management Plan, or Stormwater Management Plan. To improve fiscal capability, the County could develop an Economic Development Plan. To improve regulatory capability for post-disaster reconstruction, the County could develop a Post-Disaster Redevelopment Ordinance. The County has moderate administrative, fiscal, and outreach capability and some experience with structural mitigation.

### Q.4.2 Floodplain Management

Person County joined the NFIP through emergency entry in March 1990 and has been a regular participant since September 1990. The following tables reflect NFIP policy and claims data for the County categorized by structure type, flood zone, Pre-FIRM and Post-FIRM.

**Table Q.16 – NFIP Policy and Claims Data by Structure Type**

Structure Type	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
Single Family	14	\$5,527	\$4,339,600	4	\$8,356.96
2-4 Family	0	\$0	\$0	0	\$0.00
All Other Residential	0	\$0	\$0	0	\$0.00
Non Residential	0	\$0	\$0	0	\$0.00
<b>Total</b>	<b>14</b>	<b>\$5,527</b>	<b>\$4,339,600</b>	<b>4</b>	<b>\$8,356.96</b>

Source: FEMA Community Information System, accessed May 2020

**Table Q.17 – NFIP Policy and Claims Data by Flood Zone**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	2	\$857	\$559,600	1	\$0.00
B, C & X Zone					
Preferred	12	\$4,670	\$3,780,000	3	\$8,356.96
<b>Total</b>	<b>14</b>	<b>\$5,527</b>	<b>\$4,339,600</b>	<b>4</b>	<b>\$8,356.96</b>

Source: FEMA Community Information System, accessed May 2020

**Table Q.18 – NFIP Policy and Claims Data Pre-FIRM**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	0	\$0	\$0	1	\$0.00
B, C & X Zone	5	\$2,032	\$1,680,000	0	\$0.00
Standard	0	\$0	\$0	0	\$0.00
Preferred	5	\$2,032	\$1,680,000	0	\$0.00
<b>Total</b>	<b>5</b>	<b>\$2,032</b>	<b>\$1,680,000</b>	<b>1</b>	<b>\$0.00</b>

Source: FEMA Community Information System, accessed May 2020

Table Q.19 – NFIP Policy and Claims Data Post-FIRM

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	2	\$857	\$559,600	0	\$0.00
B, C & X Zone	7	\$2,638	\$2,100,000	3	\$8,356.96
Standard	0	\$0	\$0	0	\$0.00
Preferred	7	\$2,638	\$2,100,000	3	\$8,356.96
<b>Total</b>	<b>9</b>	<b>\$3,495</b>	<b>\$2,659,600</b>	<b>3</b>	<b>\$8,356.96</b>

Source: FEMA Community Information System, accessed May 2020

Q.5 MITIGATION STRATEGY

Action #	Action Description	Applicable Jurisdictions	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Status Comments
Prevention										
P-1	At next land Use Plan Update, incorporate a stand-alone element for hazard mitigation and involve citizens in comprehensive planning activities that identify and mitigate hazards.	Person County, City of Roxboro	All Hazards	1.2	Moderate	PC/CR PLAN	Local	2020/2021	Carried Forward	Carried forward from PC (P-1). Land Use Plan update is in progress
P-2	Update the Person County Subdivision Ordinance by reviewing and incorporating hazard mitigation objectives.	Person County	All Hazards	1.1	Low	PC PLAN	Local	2025	Carried Forward	Carried forward from PC (P-4). Not completed due to staffing issues 2015-2016. Current staff is interested in updating the Subdivision Ordinance in general and plans to address this item.
P-3	Update the Person County Floodplain Ordinance to comply with state and national standards.	Person County	Flood	1.2	High	PC PLAN	Local	2020	Carried Forward	Carried forward from PC (P-3). Floodplain Ordinance update is in progress
P-4	Revise and update the regulatory floodplain maps.	Person County, City of Roxboro	Flood	4.1	Moderate	PC/CR PLAN & GIS	Local	2020	Carried Forward	Carried forward from PC (P-6) and CR (PI-23). Floodplain map updates are in progress (per FEMA).
P-5	Use GIS to map 50' riparian buffers as required by the State within watersheds.	Person County, City of Roxboro	Flood	1.1	Moderate	GIS	Local	2021	Carried Forward	Carried forward from CR (P-8). Riparian buffers have not yet been mapped by the County due to administrative limitations.
P-6	Identify at risk-populations that may be exceptionally vulnerable in the event of long-term power outages.	Person County, City of Roxboro	Extreme Heat, Severe Weather, Severe Winter Storm	2.2	High	PC/CR PLAN & ES	Local	2025	New	
P-7	Organize outreach to vulnerable populations during long-term power outage events	Person County, City of Roxboro	Extreme Heat, Severe Weather, Severe Winter Storm	2.1	High	ES	Local	2025	New	
P-8	Public Services receive training on erosion and sedimentation control and assists property owners and developers with issues.	City of Roxboro	Flood	1.1	High	CR ADMN, CR PLAN, CR PUBLIC SERVICES	Local	2020-2025	Carry forward	Planning Director, who serves FPA, attends regular NFIP workshops for updates and provides information to property owners regarding proper floodplain development practices. Public Services Director requires sedimentation and erosion control data on all new development projects.
P-9	At the next update of the Land Use Plan, consider incorporating a Greenway or Open Space Plan	City of Roxboro	Flood	2.1	Moderate	CR PLAN	Local	2020	On-going/carry forward	There are some provisions in the existing UDO, additional improvements may be considered, pending the political climate.
P-10	Enforce impervious surface calculation/ limitation for residential and non-residential development.	City of Roxboro	Flood	3.1	High	CR PLAN	Local	2024	On-going/carry forward	City requires Stormwater Administrator review and approval of all new construction/ redevelopment projects.
Property Protection										
PP-1	Enforce minimum housing standards ordinance	City of Roxboro	All Hazards	1.2	High	CR PLAN & CR CODE ENFORCEMENT	Local	2020-2025	Carried forward	Carried forward from CR (PP-14). Have increased contracted hours with Code Enforcement officer to be able to maintain activity on minimum housing enforcement issues throughout the City and will continue to monitor



ANNEX Q: PERSON COUNTY UNINCORPORATED AREAS

Action #	Action Description	Applicable Jurisdictions	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Status Comments
										the need to determine if further increases are necessary.
PP-2	Create and maintain a list of repetitive flood loss properties. Currently none to record/map	Person County, City of Roxboro	Flood	4.2	Moderate	PC/CR PLAN, GIS, & INSP	Local	2021	Carried forward	Carried forward from PC (PP-10). Continue to track flood loss properties through GIS and Building Inspections using Crisis Track Software. No flood loss properties as of 2019.
PP-3	Enforce Stormwater Ordinance for new and redevelopment on residential and commercial properties.	Person County, City of Roxboro	Flood	1.1	High	PC/CR PLAN	Local	2025	Carried forward	Carried forward from PC (P-7). Person County plans to continue enforcing the Stormwater Ordinance
Natural Resource Protection										
NRP-1	Establish Enhanced Voluntary Ag District (EVAD) Ordinance	Person County, City of Roxboro	Flood, Erosion	1.1	Moderate	SW	Local	2025	New	
NRP-2	Develop a conservation easement program	Person County, City of Roxboro	Flood, Erosion	1.1	Moderate	SW, CR PLAN	Federal; Local; State	2025	New	
NRP-3	Encourage participation in State & Federal Cost Share programs	Person County, City of Roxboro	Drought, Flood, Erosion	1.1	High	SW, NRCS, & FORESTRY	Federal; Local; State	2020-2025	New	
NRP-4	Conduct landowner/farmer workshops on conservation practices	Person County, City of Roxboro	Drought, Flood, Erosion	1.1	Moderate	SW & AG	State; Local	2020-2025	New	
Structural Projects										
SP-1	Identify at risk facilities and evaluate potential mitigation techniques for all hazards	Person County, City of Roxboro	All Hazards	4.2	High	PC/CR PLAN, GIS, & ES	Local	2025	New	
SP-2	Retrofit existing public facilities and critical facilities to withstand impacts from all hazards	Person County, City of Roxboro	All Hazards	4.2	High	ES	Federal; State; Local	2025	New	Grant application in progress.
SP-3	Identify and strengthen public facilities to act as shelters for all hazards	Person County, City of Roxboro	All Hazards	4.2	High	ES	Federal; State; Local	2025	New	Grant application in progress.
SP-4	Any and all portions of the buildings that have been submerged for any length of time will be inspected for flood related damage as well as other conditions that may be dangerous to live, health or property	Person County, City of Roxboro	Flood	4.2	High	INSP	Federal; State; Local	2020-2025	Carried forward	Carried forward from PC (PI-8). Performed by Building Inspections on a case-by-case basis, as needed. Re-evaluate program success in next update
SP-5	Encourage the identification and retrofitting of safe rooms in public buildings, critical facilities, schools, and nursing homes.	Person County, City of Roxboro	Severe Weather	4.2	Moderate	ES	Local	2025	New	
Emergency Services										
ES-1	Ensure adequate evacuation warning in case of major hazard event.	Person County, City of Roxboro	All Hazards	3.1	High	ES	Local	2020-2025	Carried forward	Carry forward from PC (ES-11). County now has several warning procedures like emergency notification system, social & news media, message boards, etc. We continue to re-evaluate after events.

ANNEX Q: PERSON COUNTY UNINCORPORATED AREAS

Action #	Action Description	Applicable Jurisdictions	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Status Comments
ES-2	Maintain/improve shelter capacities with alternative power/heat sources.	Person County, City of Roxboro	All Hazards	4.2	High	ES	Federal; State; Local	2025	Carried forward	Carry forward from PC (ES-12). Shelters do not have alternative power sources. Grant application in progress.
ES-3	Review program to maintain continuity of government operations.	Person County, City of Roxboro	All Hazards	3.1	Low	ES	Local	2025	Carried forward	Carry forward from PC (ES-13). County's COOP Plan was rewritten in 2018 and reviewed annually.
ES-4	Identify alternate/new Emergency Operations Center locations.	Person County, City of Roxboro	All Hazards	3.1	High	ES	Local	2025	Carried forward	Carry forward from PC (ES-14). Current EOC is inadequate. The EOC location and Alternate location are ID in the EOP and tested.
ES-5	Update and maintain Emergency Plan. Review and update EOP every four years.	Person County, City of Roxboro	All Hazards	3.1	Low	ES	Local	2025	Carried forward	Carry forward from PC (ES-15). OEM reviews the EOP annually and updates as needed. The EOP is re-adopted every four years.
ES-6	Track drainage, erosion, and flooding problems within the City planning jurisdiction.	City of Roxboro	Flood	1.1	High	CR PLAN & CR PUBLIC SERVICES	Local	2020-2025	Carried forward	Carried forward from CR (ES-19). Tracking underway and will be ongoing through next plan update from OEM, Plans and GIS.
ES-7	Continue to maintain a debris removal program for problem sites.	City of Roxboro	Flood	3.2	Moderate	CR PLAN	Local	2020-2025	Carried forward	Some work complete, further may be necessary. County is looking at participating in the State's Pre-Position Debris Contract Program and we are in conversation with Private Sector about contractor. This is ongoing through next plan update.
Public Education & Awareness										
PEA-1	The Emergency Services Department will periodically make various hazard education items available through various media outlets including websites, newspaper, radio	Person County, City of Roxboro	All Hazards	2.1	Moderate	ES	Local	2020-2025.	Carried forward	Carried forward from PC (PI-19). OEM and Plans Dept. conducts HM awareness during Emergency Preparedness week annually or as requested and OEM host regular NWS Storm Ready/Spotter seminars or as requested.
PEA-2	The Emergency Services Department will establish an annual hazard awareness week in coordination with the media to promote hazard awareness.	Person County, City of Roxboro	All Hazards	2.1	Moderate	ES	Local	2020-2025	Carried forward	Carried forward from PC (PI-20). Established in 2019. To be performed annually. OEM conducts HM awareness along with Emergency Preparedness week annually or as requested and we host regular NWS Storm Ready/Spotter seminars or as requested.
PEA-3	Place flood protection and other hazard mitigation education materials in public buildings (i.e. City Hall, County offices, library etc.).	Person County, City of Roxboro	All Hazards	2.1	Moderate	PC/CR PLAN & ES	Local	2025	New	
PEA-4	Post warning signage at local parks and outdoor venues with information about severe weather.	Person County, City of Roxboro	Severe Weather	2.1	High	ES	Local	2025	New	
PEA-5	Ensure school officials are aware of the best area of refuge in school buildings during orientation.	Person County, City of Roxboro	Severe Weather	2.1	High	ES	Local	2025	New	

## Annex R City of Roxboro

### R.1 PLANNING PROCESS

The table below lists the HMPC member who represented the City of Roxboro.

**Table R.1 – HMPC Members**

Representative	Position or Title
Lauren Johnson	Planning Director

### R.2 COMMUNITY PROFILE

#### Geography

The City of Roxboro is located in central Person County. The City is part of the Durham-Chapel Hill, NC Metropolitan Statistical Area. Roxboro comprises a total land area of 6.4 square miles.

#### Population and Demographics

Table R.2 provides population counts and growth estimates for the City of Roxboro as compared to the Person County and the Eno-Haw region. Table R.3 provides demographic information for Roxboro as compared to the county and the state.

**Table R.2 – Population Counts, Roxboro, 2010-2018**

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
City of Roxboro	8,696	8,362	8,283	-79	-0.9%
Person County	35,623	39,022	39,305	283	0.7%
Region Total	507,964	567,634	649,276	81,642	14.4%

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

**Table R.3 – Demographic and Social Characteristics, Roxboro, 2018**

Demographic & Social Characteristics	Roxboro	Person County	North Carolina
Median Age	37.1	43.2	38.6
% of Population Under 5 years old	6.7	5.2	5.9
% of population Over 65 years old	18.4	18.4	15.5
% of Population Over 25 with high school diploma	78.9%	86.3%	87.4%
% of Population Over 25 with bachelor's degree or higher	11.8%	15.3%	30.5%
% with Disability	22.4%	18.8	13.6
% Speak English less than "very well"	4.2%	1.6	4.6

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

#### Housing

The table below details key housing statistics for Roxboro as compared to the County overall.

**Table R.4 – Housing Statistics, Roxboro, 2010-2018**

Housing Characteristics	Roxboro	Person County
Housing Units (2010)	4,044	18,193
Housing Units (2018)	3,950	18,428
Housing Units Percent Change (2010-2018)	-2.3%	1.3%
Housing Occupancy Rate	84.2	85.4%
% Owner-Occupied	40.0	75.2%
Average Household Size	2.35	2.46
% of Housing Units with no Vehicles Available	20.1	7.8%
% of Housing Units that are mobile homes	16.8	22.6%
Median Home Value	\$84,200	\$117,100

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2014-2018 5-Year Estimates

### Economy

The following tables present key economic statistics for Roxboro as compared to the county and the state.

**Table R.5 – Economic Statistics, Roxboro, 2018**

Demographic & Social Characteristics	Roxboro	Person County	North Carolina
Median Household Income	27,170	\$48,811	\$52,413
Per Capita Income	17,560	\$25,922	\$29,456
Unemployment Rate	14.1%	8.6%	6.3%
% of Individuals Below Poverty Level	36.2	17.7	15.4
% Without Health Insurance	15.1	9.2	11.1

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

## R.3 RISK ASSESSMENT

This section contains a summary of the City's asset inventory as well as hazard profile and vulnerability assessment for those hazards that are spatially defined and have variations in risk that could be evaluated quantitatively on a jurisdictional level. The hazards included in this section are: Flood and Wildfire.

### Asset Inventory

The following tables summarize the asset inventory for the City of Roxboro in order to estimate the total physical exposure to hazards in this area. The locations of critical facilities are shown in Figure R.1. Critical facilities are a subset of identified assets from the Critical Infrastructure & Key Resources (CIKR) dataset. See Table Q.5 in the Person County annex for a list of facilities added by the HMPC. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted and displayed.

Building counts are provided based on data from the NCEM IRISK database, and supplemental parcel exposure is based on November 2019 county parcel data.



Table R.6 – Critical Infrastructure &amp; Key Resources by Type

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	Defense	Government Facilities	Healthcare	IT	National Monuments and Icons	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Roxboro	118	14	0	448	0	104	0	74	45	2	0	0	0	48	4	1	5	863

Source: NCEM Risk Management Tool

Table R.7 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Roxboro	3	28	8	11	0	3	9	62

Source: NCEM Risk Management Tool

Table R.8 – IRISK Inventory of Building Counts and Values

Jurisdiction	Building Count	Building Value
City of Roxboro	6,617	\$918,466,278

Source: NCEM Risk Management Tool

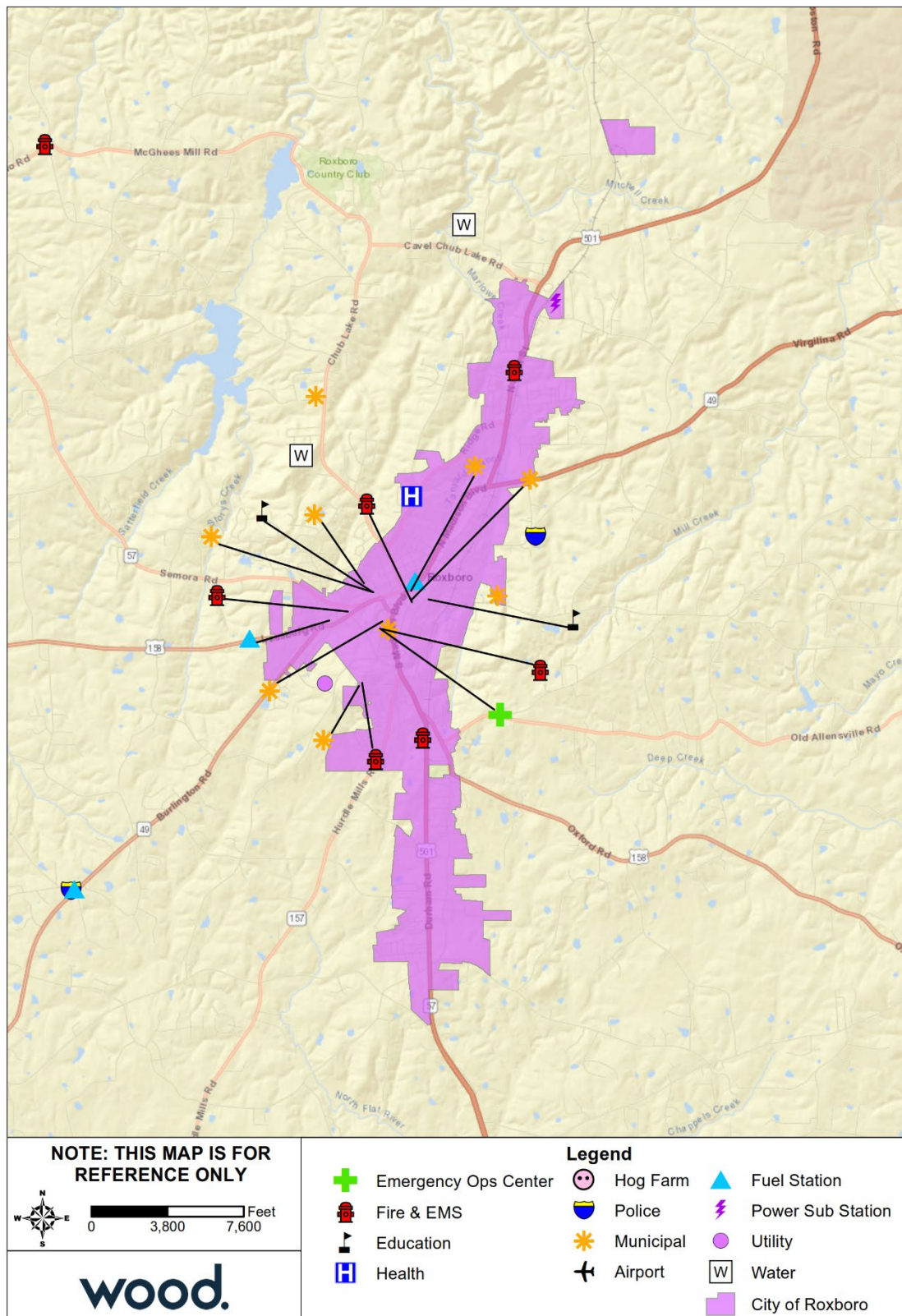
To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Eno-Haw Region, current parcel data was evaluated to identify recent development that was not included in NCEM's IRISK database. The building footprint layer from IRISK was compared to current parcel data; any parcels with an improved value that did not already have a building in IRISK were summarized in the table below. This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

Table R.9 – Parcels Development Not Included in IRISK, November 2019

Jurisdiction	Improved Parcel Count	Total Improved Value
Roxboro	131	\$14,402,001

Source: County parcel data, retrieved November 2019; IRISK database building footprints

Figure R.1 – Critical Facilities, City of Roxboro



Source: NCEM IRISK Database, GIS Analysis, Person County, City of Roxboro

Eno-Haw

Regional Hazard Mitigation Plan  
2020

### R.3.1 Flood

Table R.10 details the acreage of the City of Roxboro by flood zone on the effective DFIRM. Per this assessment, over 3 percent of Roxboro falls within the mapped 1%-annual-chance floodplains.

**Table R.10 – Flood Zone Acreage in the City of Roxboro**

Flood Zone	Acreage	Percent of Total (%)
Zone AE	138.8	3.4
Zone X (500-year)	18.7	0.5
Zone X Unshaded	3,975.8	96.2
<b>Total</b>	<b>4,133.3</b>	<b>--</b>

Source: FEMA Effective DFIRM

Figure R.2 reflects the effective mapped flood hazard zones for the City of Roxboro, and Figure R.3 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the region, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below and compared to total recent development counts and values. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. Additionally, this assessment does not evaluate flood impacts or provide damage estimates. According to this assessment, 6.9 percent of recent development in unincorporated Person County is located in or near the SFHA.

**Table R.11 – Recent Development at Risk to Flood, City of Roxboro**

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
9	\$728,798	6.9%	5.1%

Source: Parcel data retrieved November 2019; FEMA Effective DFIRM

Table R.12 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector and flood event in Roxboro. Table R.13 summarizes estimated damages to High Potential Loss Facilities in the City.

**Table R.12 – Critical Facilities Exposed to Flooding, City of Roxboro**

Sector	Event	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	10 Year	1	\$3,138
	25 Year	5	\$97,133
	50 Year	5	\$145,223
	100 Year	15	\$710,283
	500 Year	15	\$900,233
Healthcare and Public Health	100 Year	2	\$9,794
	500 Year	2	\$9,794
All Categories	10 Year	1	\$3,138
	25 Year	5	\$97,133
	50 Year	5	\$145,223
	100 Year	17	\$720,077
	500 Year	17	\$910,027

Source: NCEM Risk Management Tool

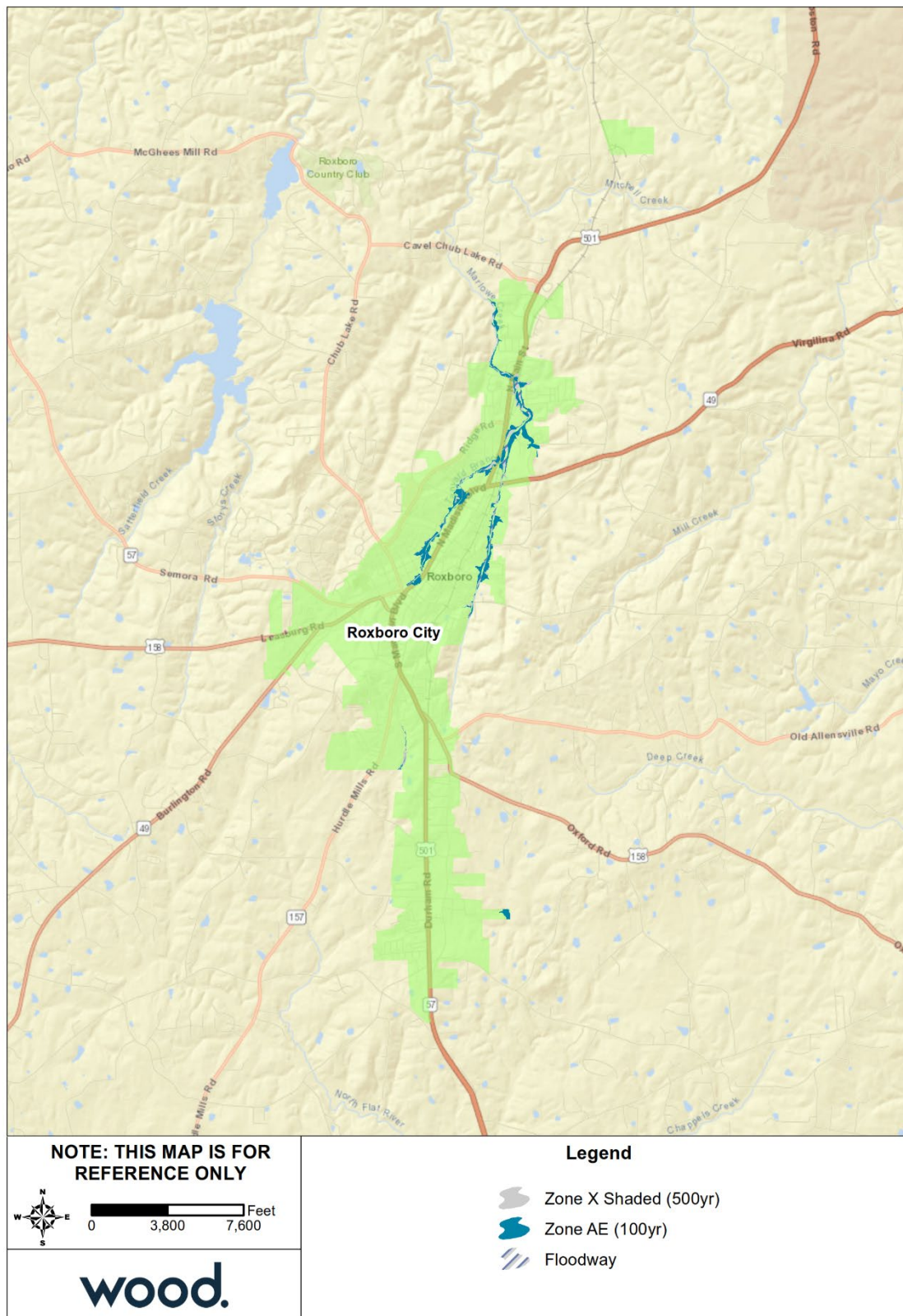
**Table R.13 – High Potential Loss Properties Exposed to Flooding, City of Roxboro**

Category	Event	Number of Buildings at Risk	Estimated Damages
Commercial	100 Year	1	\$398,733
	500 Year	1	\$398,733

Source: NCEM Risk Management Tool



Figure R.2 – FEMA Flood Hazard Areas, City of Roxboro

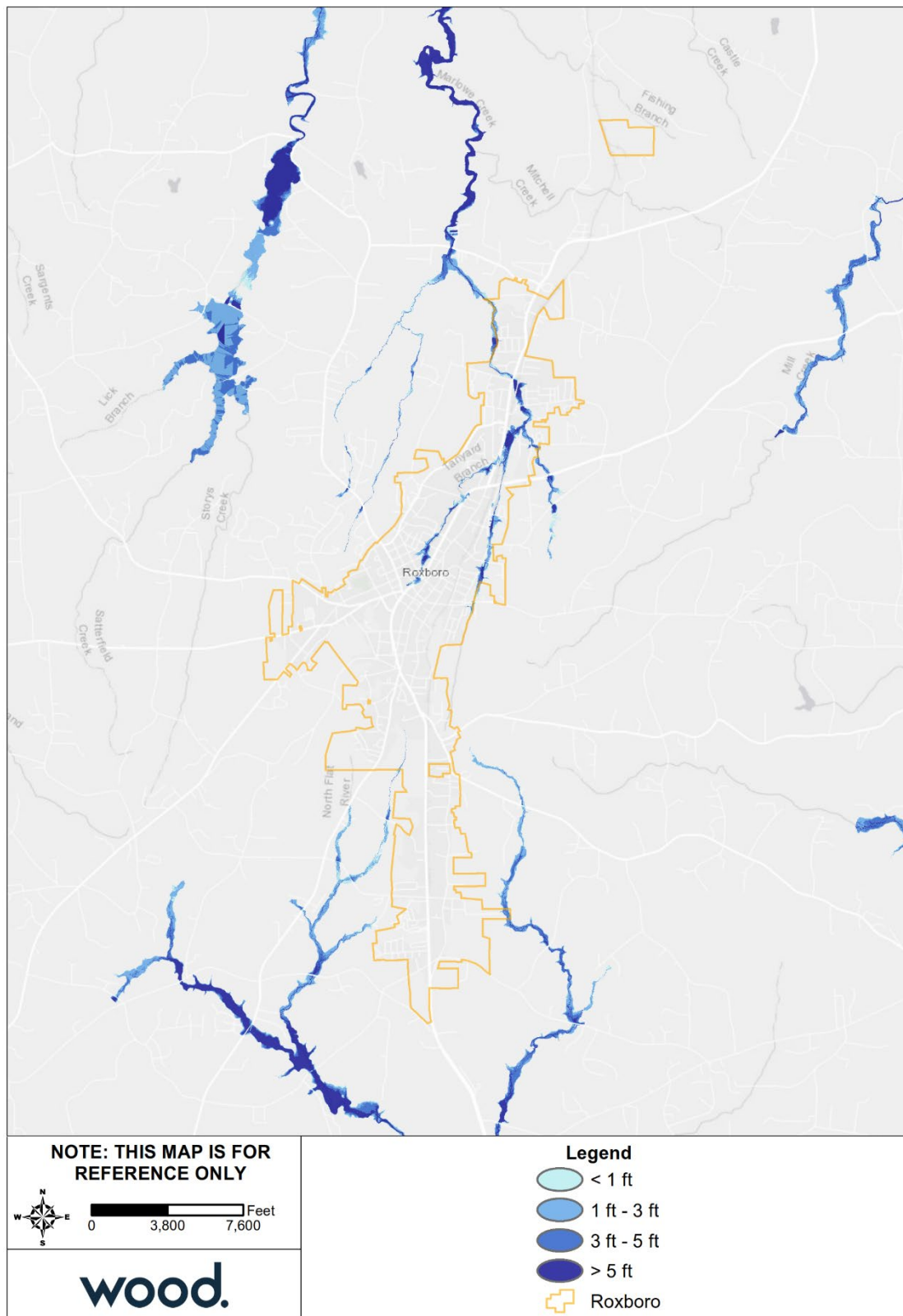


Source: FEMA Effective DFIRM

Eno-Haw

Regional Hazard Mitigation Plan  
2020

Figure R.3 – Flood Depth, 1%-Annual-Chance Floodplain, City of Roxboro



Source: FEMA Effective DFIRM

Eno-Haw

Regional Hazard Mitigation Plan  
2020

### R.3.2 Wildfire

Table R.14 summarizes the acreage in the City of Roxboro that falls within the Wildland Urban Interface (WUI), categorized by housing density. Areas in the WUI are those where development may intermix with flammable vegetation. Less than 6 percent of the Town of Zebulon is not included in the WUI.

**Table R.14 – Wildland Urban Interface Acreage, City of Roxboro**

	Housing Density	Total Acreage	Percent of Total Acreage
	<i>Not in WUI</i>	240.66	5.8%
	LT 1hs/40ac	134.61	3.3%
	1hs/40ac to 1hs/20ac	69.07	1.7%
	1hs/20ac to 1hs/10ac	144.75	3.5%
	1hs/10ac to 1hs/5ac	289.37	7.0%
	1hs/5ac to 1hs/2ac	634.89	15.4%
	1hs/2ac to 3hs/1ac	2,602.13	63.0%
	GT 3hs/1ac	17.79	0.4%
	<b>Total</b>	<b>4,133.28</b>	

Source: Southern Wildfire Risk Assessment

Figure Q.5 depicts the WUI for all of Person County. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure Q.6 depicts Burn Probability based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Figure R.4 depicts the Fire Intensity Scale; which indicates the potential severity of fire based on fuel loads, topography, and other factors; in order to detail potential wildfire extent in the City of Roxboro. There are no significant clusters of high or moderate potential fire intensity in the City. Overall, 11% of the City has a Class 3 fire intensity rating, but less than 1% has a Class 4 rating.

Table R.15 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table R.16 provides counts and estimated damages for High Potential Loss Properties in the City of Roxboro.

**Table R.15 – Critical Facilities Exposed to Wildfire, City of Roxboro**

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	1	\$1,296,658
Commercial Facilities	21	\$50,427,343
Critical Manufacturing	4	\$11,681,142
Food and Agriculture	57	\$2,164,577
Government Facilities	2	\$4,684,306
Transportation Systems	6	\$4,451,968
<b>All Categories</b>	<b>91</b>	<b>\$74,705,994</b>

Source: NCEM Risk Management Tool

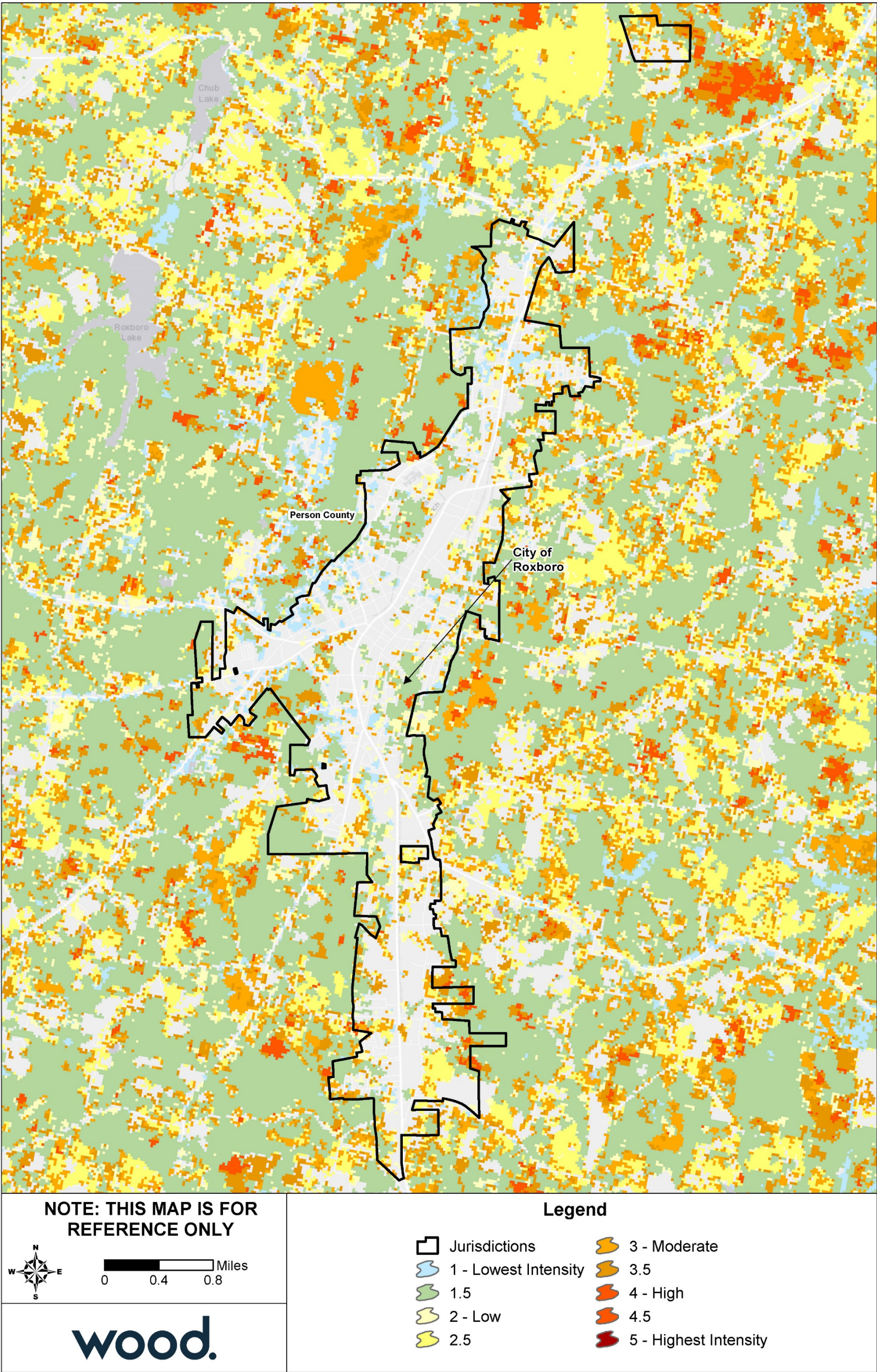
**Table R.16 – High Potential Loss Properties Exposed to Wildfire, City of Roxboro**

Category	Number of Buildings at Risk	Estimated Damages
Commercial	1	\$32,323,792
Government	1	\$4,112,728
Industrial	1	\$9,422,390
Residential	1	\$1,983,425
<b>All Categories</b>	<b>4</b>	<b>\$47,842,335</b>

Source: NCEM Risk Management Tool



Figure R.4 – Fire Intensity Scale, City of Roxboro



Source: Southern Wildfire Risk Assessment



## R.4 CAPABILITY ASSESSMENT

### R.4.1 Overall Capability

Details on the tools and resources in place and available to the City of Roxboro were provided by the City's HMPC representatives and are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Roxboro has an overall capability rating of Moderate. The City could improve regulatory capability by developing a Post-Disaster Redevelopment Ordinance to plan and set mitigation requirements for post-disaster reconstruction. Developing an Open Space Management plan or an Economic Development plan could also improve mitigation capability. The City has strong administrative capability, moderate fiscal and outreach capability, but no structural mitigation experience.

### R.4.2 Floodplain Management

The City of Roxboro joined the NFIP as a regular participant in March 1991. The following tables reflect NFIP policy and claims data for the City categorized by structure type, flood zone, Pre-FIRM and Post-FIRM.

**Table R.17 – NFIP Policy and Claims Data by Structure Type**

Structure Type	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
Single Family	3	\$3,651	\$330,000	2	\$24,521.54
2-4 Family	0	\$0	\$0	0	\$0.00
All Other Residential	0	\$0	\$0	0	\$0.00
Non Residential	6	\$12,483	\$3,466,800	0	\$0.00
<b>Total</b>	<b>9</b>	<b>\$16,134</b>	<b>\$3,796,800</b>	<b>2</b>	<b>\$24,521.54</b>

Source: FEMA Community Information System, accessed May 2020

**Table R.18 – NFIP Policy and Claims Data by Flood Zone**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	7	\$13,009	\$2,686,800	2	\$24,521.54
B, C & X Zone					
Preferred	2	\$3,125	\$1,110,000	0	\$0.00
<b>Total</b>	<b>9</b>	<b>\$16,134</b>	<b>\$3,796,800</b>	<b>2</b>	<b>\$24,521.54</b>

Source: FEMA Community Information System, accessed May 2020

**Table R.19 – NFIP Policy and Claims Data Pre-FIRM**

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	6	\$10,383	\$1,943,700	2	\$24,521.54
B, C & X Zone	2	\$3,125	\$1,110,000	0	\$0.00
Preferred	2	\$3,125	\$1,110,000	0	\$0.00
<b>Total</b>	<b>8</b>	<b>\$13,508</b>	<b>\$3,053,700</b>	<b>2</b>	<b>\$24,521.54</b>

Source: FEMA Community Information System, accessed May 2020

Table R.20 – NFIP Policy and Claims Data Post-FIRM

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	1	\$2,626	\$743,100	0	\$0.00
<b>Total</b>	<b>1</b>	<b>\$2,626</b>	<b>\$743,100</b>	<b>0</b>	<b>\$0.00</b>

Source: FEMA Community Information System, accessed May 2020

R.5 MITIGATION STRATEGY

Action #	Action Description	Applicable Jurisdictions	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Status Comments
Prevention										
P-1	At next land Use Plan Update, incorporate a stand-alone element for hazard mitigation and involve citizens in comprehensive planning activities that identify and mitigate hazards.	Person County, City of Roxboro	All Hazards	1.2	Moderate	PC/CR PLAN	Local	2020/2021	Carried Forward	Carried forward from PC (P-1). Land Use Plan update is in progress
P-2	Update the Person County Subdivision Ordinance by reviewing and incorporating hazard mitigation objectives.	Person County	All Hazards	1.1	Low	PC PLAN	Local	2025	Carried Forward	Carried forward from PC (P-4). Not completed due to staffing issues 2015-2016. Current staff is interested in updating the Subdivision Ordinance in general and plans to address this item.
P-3	Update the Person County Floodplain Ordinance to comply with state and national standards.	Person County	Flood	1.2	High	PC PLAN	Local	2020	Carried Forward	Carried forward from PC (P-3). Floodplain Ordinance update is in progress
P-4	Revise and update the regulatory floodplain maps.	Person County, City of Roxboro	Flood	4.1	Moderate	PC/CR PLAN & GIS	Local	2020	Carried Forward	Carried forward from PC (P-6) and CR (PI-23). Floodplain map updates are in progress (per FEMA).
P-5	Use GIS to map 50' riparian buffers as required by the State within watersheds.	Person County, City of Roxboro	Flood	1.1	Moderate	GIS	Local	2021	Carried Forward	Carried forward from CR (P-8). Riparian buffers have not yet been mapped by the County due to administrative limitations.
P-6	Identify at risk-populations that may be exceptionally vulnerable in the event of long-term power outages.	Person County, City of Roxboro	Extreme Heat, Severe Weather, Severe Winter Storm	2.2	High	PC/CR PLAN & ES	Local	2025	New	
P-7	Organize outreach to vulnerable populations during long-term power outage events	Person County, City of Roxboro	Extreme Heat, Severe Weather, Severe Winter Storm	2.1	High	ES	Local	2025	New	
P-8	Public Services receive training on erosion and sedimentation control and assists property owners and developers with issues.	City of Roxboro	Flood	1.1	High	CR ADMN, CR PLAN, CR PUBLIC SERVICES	Local	2020-2025	Carry forward	Planning Director, who serves FPA, attends regular NFIP workshops for updates and provides information to property owners regarding proper floodplain development practices. Public Services Director requires sedimentation and erosion control data on all new development projects.
P-9	At the next update of the Land Use Plan, consider incorporating a Greenway or Open Space Plan	City of Roxboro	Flood	2.1	Moderate	CR PLAN	Local	2020	On-going/carry forward	There are some provisions in the existing UDO, additional improvements may be considered, pending the political climate.
P-10	Enforce impervious surface calculation/ limitation for residential and non-residential development.	City of Roxboro	Flood	3.1	High	CR PLAN	Local	2024	On-going/carry forward	City requires Stormwater Administrator review and approval of all new construction/ redevelopment projects.
Property Protection										
PP-1	Enforce minimum housing standards ordinance	City of Roxboro	All Hazards	1.2	High	CR PLAN & CR CODE ENFORCEMENT	Local	2020-2025	Carried forward	Carried forward from CR (PP-14). Have increased contracted hours with Code Enforcement officer to be able to maintain activity on minimum housing enforcement issues throughout the City and will continue to monitor

Action #	Action Description	Applicable Jurisdictions	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Status Comments
										the need to determine if further increases are necessary.
PP-2	Create and maintain a list of repetitive flood loss properties. Currently none to record/map	Person County, City of Roxboro	Flood	4.2	Moderate	PC/CR PLAN, GIS, & INSP	Local	2021	Carried forward	Carried forward from PC (PP-10). Continue to track flood loss properties through GIS and Building Inspections using Crisis Track Software. No flood loss properties as of 2019.
PP-3	Enforce Stormwater Ordinance for new and redevelopment on residential and commercial properties.	Person County, City of Roxboro	Flood	1.1	High	PC/CR PLAN	Local	2025	Carried forward	Carried forward from PC (P-7). Person County plans to continue enforcing the Stormwater Ordinance
Natural Resource Protection										
NRP-1	Establish Enhanced Voluntary Ag District (EVAD) Ordinance	Person County, City of Roxboro	Flood, Erosion	1.1	Moderate	SW	Local	2025	New	
NRP-2	Develop a conservation easement program	Person County, City of Roxboro	Flood, Erosion	1.1	Moderate	SW, CR PLAN	Federal; Local; State	2025	New	
NRP-3	Encourage participation in State & Federal Cost Share programs	Person County, City of Roxboro	Drought, Flood, Erosion	1.1	High	SW, NRCS, & FORESTRY	Federal; Local; State	2020-2025	New	
NRP-4	Conduct landowner/farmer workshops on conservation practices	Person County, City of Roxboro	Drought, Flood, Erosion	1.1	Moderate	SW & AG	State; Local	2020-2025	New	
Structural Projects										
SP-1	Identify at risk facilities and evaluate potential mitigation techniques for all hazards	Person County, City of Roxboro	All Hazards	4.2	High	PC/CR PLAN, GIS, & ES	Local	2025	New	
SP-2	Retrofit existing public facilities and critical facilities to withstand impacts from all hazards	Person County, City of Roxboro	All Hazards	4.2	High	ES	Federal; State; Local	2025	New	Grant application in progress.
SP-3	Identify and strengthen public facilities to act as shelters for all hazards	Person County, City of Roxboro	All Hazards	4.2	High	ES	Federal; State; Local	2025	New	Grant application in progress.
SP-4	Any and all portions of the buildings that have been submerged for any length of time will be inspected for flood related damage as well as other conditions that may be dangerous to live, health or property	Person County, City of Roxboro	Flood	4.2	High	INSP	Federal; State; Local	2020-2025	Carried forward	Carried forward from PC (PI-8). Performed by Building Inspections on a case-by-case basis, as needed. Re-evaluate program success in next update
SP-5	Encourage the identification and retrofitting of safe rooms in public buildings, critical facilities, schools, and nursing homes.	Person County, City of Roxboro	Severe Weather	4.2	Moderate	ES	Local	2025	New	
Emergency Services										
ES-1	Ensure adequate evacuation warning in case of major hazard event.	Person County, City of Roxboro	All Hazards	3.1	High	ES	Local	2020-2025	Carried forward	Carry forward from PC (ES-11). County now has several warning procedures like emergency notification system, social & news media, message boards, etc. We continue to re-evaluate after events.



Action #	Action Description	Applicable Jurisdictions	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Status Comments
ES-2	Maintain/improve shelter capacities with alternative power/heat sources.	Person County, City of Roxboro	All Hazards	4.2	High	ES	Federal; State; Local	2025	Carried forward	Carry forward from PC (ES-12). Shelters do not have alternative power sources. Grant application in progress.
ES-3	Review program to maintain continuity of government operations.	Person County, City of Roxboro	All Hazards	3.1	Low	ES	Local	2025	Carried forward	Carry forward from PC (ES-13). County's COOP Plan was rewritten in 2018 and reviewed annually.
ES-4	Identify alternate/new Emergency Operations Center locations.	Person County, City of Roxboro	All Hazards	3.1	High	ES	Local	2025	Carried forward	Carry forward from PC (ES-14). Current EOC is inadequate. The EOC location and Alternate location are ID in the EOP and tested.
ES-5	Update and maintain Emergency Plan. Review and update EOP every four years.	Person County, City of Roxboro	All Hazards	3.1	Low	ES	Local	2025	Carried forward	Carry forward from PC (ES-15). OEM reviews the EOP annually and updates as needed. The EOP is re-adopted every four years.
ES-6	Track drainage, erosion, and flooding problems within the City planning jurisdiction.	City of Roxboro	Flood	1.1	High	CR PLAN & CR PUBLIC SERVICES	Local	2020-2025	Carried forward	Carried forward from CR (ES-19). Tracking underway and will be ongoing through next plan update from OEM, Plans and GIS.
ES-7	Continue to maintain a debris removal program for problem sites.	City of Roxboro	Flood	3.2	Moderate	CR PLAN	Local	2020-2025	Carried forward	Some work complete, further may be necessary. County is looking at participating in the State's Pre-Position Debris Contract Program and we are in conversation with Private Sector about contractor. This is ongoing through next plan update.
Public Education & Awareness										
PEA-1	The Emergency Services Department will periodically make various hazard education items available through various media outlets including websites, newspaper, radio	Person County, City of Roxboro	All Hazards	2.1	Moderate	ES	Local	2020-2025.	Carried forward	Carried forward from PC (PI-19). OEM and Plans Dept. conducts HM awareness during Emergency Preparedness week annually or as requested and OEM host regular NWS Storm Ready/Spotter seminars or as requested.
PEA-2	The Emergency Services Department will establish an annual hazard awareness week in coordination with the media to promote hazard awareness.	Person County, City of Roxboro	All Hazards	2.1	Moderate	ES	Local	2020-2025	Carried forward	Carried forward from PC (PI-20). Established in 2019. To be performed annually. OEM conducts HM awareness along with Emergency Preparedness week annually or as requested and we host regular NWS Storm Ready/Spotter seminars or as requested.
PEA-3	Place flood protection and other hazard mitigation education materials in public buildings (i.e. City Hall, County offices, library etc.).	Person County, City of Roxboro	All Hazards	2.1	Moderate	PC/CR PLAN & ES	Local	2025	New	
PEA-4	Post warning signage at local parks and outdoor venues with information about severe weather.	Person County, City of Roxboro	Severe Weather	2.1	High	ES	Local	2025	New	
PEA-5	Ensure school officials are aware of the best area of refuge in school buildings during orientation.	Person County, City of Roxboro	Severe Weather	2.1	High	ES	Local	2025	New	

## Appendix A Plan Review Tool

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## APPENDIX A:

### LOCAL MITIGATION PLAN REVIEW TOOL

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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*.

<b>Jurisdiction:</b> Alamance, Durham, Orange, and Person Counties, NC	<b>Title of Plan:</b> Eno-Haw Regional Hazard Mitigation Plan	<b>Date of Plan:</b> May 2020
<b>Local Point of Contact:</b> David Stroud	<b>Address:</b> 4021 Stirrup Creek Drive, Suite 100 Durham, NC 27703	
<b>Title:</b> Hazard Mitigation Planning & Emergency Lead		
<b>Agency:</b>		
<b>Phone Number:</b> 919-856-6485	<b>E-Mail:</b> david.stroud@woodplc.com	

<b>State Reviewer:</b> John Mello	<b>Title:</b> Hazard Mitigation Planner	<b>Date:</b> 7/2/2020 7/17/2020
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<b>FEMA Reviewer:</b> Robin Berzins  Edwardine S. Marrone	<b>Title:</b> Mitigation Spc, FIT TN HM Planning NC-FIT-Mitigation Planner	7/29/2020  8/31/2020
<b>Date Received in FEMA Region IV</b>	7/22/2020	
<b>Plan Not Approved</b>	09/18/20	
<b>Plan Approvable Pending Adoption</b>		
<b>Plan Approved</b>	9/22/2020	

✓ = Reviewer concurs; ✓ = QC Reviewer concurs

## 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		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
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 (p. 5-22) Appendix B (p. B.1-B.20) ✓✓ Section 1, p. 2	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 (p. 8, 10, 15-16); Appendix B (p. B.76-B.78) ✓✓	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 (p. 12-14); Appendix B (p. B.21-B.75) ✓✓	X		
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Section 2 (p. 8-9) ✓✓ Section 5, p. 266-281	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 8 (p. 324-325) ✓ Section 8, p. 321-322	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 8 (p. 321-324) ✓ Section 8, p. 318-321	X		
<b>ELEMENT A: REQUIRED REVISIONS</b> <b>NCEM 1<sup>st</sup> Review:</b> A1: No revisions required. A2: No revisions required. A3: No revisions required. A4: No revisions required. A5: No revisions required. A6: No revisions required.				



1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT				
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Section 4.5 (p. 67-265; Hazard Description, Location, Extent, Hazard Summary by Jurisdiction), Annexes A-R ✓✓	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 4.5 (p. 67-265; Past Occurrences, Probability of Future Occurrence, Hazard Summary by Jurisdiction), ✓✓	X		
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 4.5 (p. 67-265; Vulnerability Assessment, Hazard Summary by Jurisdiction), Annexes A-R ✓✓	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))	Section 4.5.5 (p.130-131) ✓✓	X		
<b>ELEMENT B: REQUIRED REVISIONS</b> <b>NCEM 1<sup>st</sup> Review:</b> 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))	Section 5 (p. 266-281) ✓✓	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))	Section 5 (p. 272-274) ✓✓	X		
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Section 6 (p.282-284) ✓✓	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 6 (p. 282-285), Section 7 (p. 286-320) ✓✓	X		

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
<b>Regulation (44 CFR 201.6 Local Mitigation Plans)</b>				
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))	Section 6 (p. 284-285), Section 7 (p. 286-320) ✓✓	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 8 (p.321-324) ✓ Section 8, p.321	X		
<b>ELEMENT C: REQUIRED REVISIONS</b> <b>NCEM 1<sup>st</sup> Review:</b> C1: No revisions required. C2: No revisions required. C3: No revisions required. C4: No revisions required. C5: Requires revisions. Corrected. Dates/Date ranges added. <b>Implementation Timeline</b> This <b>MUST</b> be documented as a completion date or a date range (e.g. 2025 or 2020-2025). This can be easily cleaned up but <b>MUST</b> have a date in this column. Examples of needed revisions are words such as ongoing, OSFM to determine, As Needed Depending Upon Weather, Annually. There are several other examples I could list but I believe you will easily identify them.  C6: No revisions required.  <b>C5. Mitigation Action Table NCEM 2nd Review:</b> All Tables corrected and "Implementation Timeline" format should meet Federal Criteria.				
<b>ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION</b> (applicable to plan updates only)				
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Section 3 (p. 23-46), Section 4 (p. 57-265; Asset Inventory, Vulnerability Assessment), Annexes A-R ✓✓	X		
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Section 2 (p. 15-22), Section 5 (p.266-281) ✓✓	X		
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Section 6 (p. 282-285), Section 7 (p. 285-320) ✓✓	X		

## 1. REGULATION CHECKLIST

Regulation (44 CFR 201.6 Local Mitigation Plans)

Location in Plan  
(section and/or  
page number)

Met

Not  
Met

### ELEMENT D: REQUIRED REVISIONS

#### NCEM 1<sup>st</sup> Review:

D1: No revisions required.

D2: Requires extensive revisions. Corrected. Added status updates on progress in past five years where possible. Clarified where progress was not made due to capability or other limitations.

#### 2020 Implementation Status Comments

This column **MUST** state what activity has occurred during the **previous five years of the planning cycle**. The common mistake made here is that communities say what they intend to do in the future which FEMA will not accept. This occurred a lot.

Other repeated examples are status statements like No progress reported, still working on, ongoing, as needed, annually, continually done by planning, no change, etc. These statement do not “tell a story” which is what FEMA wants.

Keep this simple but clearly state an example(s) of activity during the **previous five years of the planning cycle**. If no activity has occurred then FEMA wants a statement to briefly explain why. This is not punitive in any way. They just want an idea of why the action wasn’t completed; such as limited staffing prevented completion; no funding was available, Federal disaster declaration occurred redirecting priorities, political will doesn’t support the activity, etc.

D3: No revisions required.

#### D2. Mitigation Action Table NCEM 2nd Review:

All actions corrected. Comments have been added or clarified to report progress or a reason for no activity.

### 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))	Plan will be adopted pending APA letter from FEMA; Adoption resolutions will be added to Section 9	X	
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))	Plan will be adopted pending APA letter from FEMA; Adoption resolutions will be added to Section 9		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**

**E2:** 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. At least one participating jurisdiction must formally adopt the plan within one calendar year of FEMA's designation of the plan as "Approvable Pending Adoption."

FEMA recommends that all participating jurisdictions coordinate the adoption process as soon as the plan has received APA status to ensure that all participants are covered by a plan for the full five years.

*For additional information, please see Element E, Plan Adoption, in the "Local Mitigation Plan Review Guide", October 1, 2011, Pages 28-29 and Task 8 of the Local Mitigation Planning Handbook, March 2013.*

Prior to review completion adoption documentation was provided by:

Counties: Alamance, Orange, Person.

Cities: Graham, Mebane, Roxboro.

Towns: Carrboro, Elon, Haw River, Hillsborough.

10-27-20 Durham Co provided adoption documentation.

01-05-21 City of Durham provided adoption documentation

03-26-21 The following jurisdictions provided adoption documentation:

- City of Burlington
- Town of Chapel Hill
- Town of Swepsonville

7-1-21 The following jurisdictions provided adoption documentation:

- Village of Alamance
- Town of Ossipee

8-19-21 The Town of Green Level provided adoption documentation.

### **ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)**

F1.			
F2.			

### **ELEMENT F: REQUIRED REVISIONS**



## 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. Element A: Planning Process

### Plan Strengths

- Participating jurisdictions involvement in the planning process is well documented.
- Stakeholders participating in the plan updated included representatives from American Red Cross, Universities, and Utilities.

### Opportunity for Improvement

**The HMP Committee needs to review the document for correctness and completeness prior to submission for formal review by NCEMA and FEMA.** For example, the header for Annex F Town of Green Level is Annex B: City of Burlington. This needs to be corrected along with any other similar issues.

## Element B: Hazard Identification and Risk Assessment

### Plan Strengths

- The hazards discussed are those that may affect the participating jurisdictions in varying degrees. The way the plan is written allows the reader to have a full picture of which hazards present a higher risk to the participating jurisdictions therefore these are the hazards that have higher priority mitigations strategies.
- The risk assessment is the groundwork for the development of mitigation measures. The plan draws from each of the community's plans to document the community's sustained efforts to incorporate hazard mitigation principles and practices into routine government activities and functions thus establishing a successful and sustainable local hazard mitigation program.

### Opportunity for Improvement

- Although the county maps conveying dam location include the communities within each county, it is difficult to distinguish the jurisdiction a dam is in, for example page 70. In [Annex B: City of Burlington](#), page 351 shows 8 dams; [Annex D: City of Mebane](#), page 383 shows 3 dams; [Annex E: Town of Elon](#), page 399, does include a map displaying dam locations within these jurisdictions. Not all annexes include a dam location map. Is it a correct assumption that the Cities of Burlington, and Mebane and the Town of Elon are the only jurisdictions within Alamance County that have a dam located within the boundaries? Annex A: Alamance County Unincorporated Areas, Figure A.2 – Dam Locations, Unincorporated Alamance County shows dams that may be in jurisdictions other than the 3 mentioned above.
- Comparing information found in Table A-8 – High Hazard Dams in Unincorporated Alamance County there should be more descriptions of Dam Failure risk than was provided.
- [Annex J: Village of Alamance](#) documents dam failure on page 462: "According to the North Carolina Dam Inventory as of July 2018, the Village of Alamance is the nearest downstream location to two high hazard dams located in the City of Burlington. Both of these dams, McEwan Estate Dam and Lake Mackintosh Dam, were in fair condition at the time of their last inspection." No additional information is provided describing the risk to the Village of Alamance.
- The map located on page 70 and any other county map should display the towns more visibly by adding borders or using the jurisdiction color scheme used in the map on page 24.
- Improve information relative to dam failure risk for jurisdictions downstream to dams located outside of their jurisdiction.
- General suggestion, statewide maps used conveying risk assessment information should identify the location of the planning area. County maps should indicate the area for each jurisdiction within the county.

## Element C: Mitigation Strategy

### Plan Strengths

- Having a documented structure for developing new actions and reporting on the status of existing actions will provide the living document a path for continued efforts towards maintaining and building a resilient community.
- The proposed mitigation projects are specific and actionable. Those carried over from the previous plan, were evaluated and re-prioritized.
- Mitigation focused on high or moderate risks hazard.

## Element D: Plan Update, Evaluation, and Implementation (*Plan Updates Only*)

### Plan Strengths

A monitoring, evaluation, and updating process is well documented and will allow the jurisdictions to continue to further mitigation.

## B. Resources for Implementing Your Approved Plan

- **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>
- **Risk MAP Program:**  
This resource provides an introduction to Risk MAP and information about the products Risk MAP offers to better understand flood risk. This information can help planning to reduce flood risk and communicate with residents.  
<https://www.fema.gov/risk-map-program-information-community-officials>



### 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	Alamance County	County					Y	Y	Y	Y	Y	
2	Burlington	City					Y	Y	Y	Y	Y	
3	Graham	City					Y	Y	Y	Y	Y	
4	Mebane	City					Y	Y	Y	Y	Y	
5	Elon	Town					Y	Y	Y	Y	Y	
6	Green Level	Town					Y	Y	Y	Y	Y	
7	Haw River	Town					Y	Y	Y	Y	Y	
8	Ossipee	Town					Y	Y	Y	Y	Y	
9	Sweptsonville	Town					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 Requirements
10	Alamance	Village					Y	Y	Y	Y	Y	
11	Durham County	County					Y	Y	Y	Y	Y	
12	Durham	City					Y	Y	Y	Y	Y	
13	Orange County	County					Y	Y	Y	Y	Y	
14	Carrboro	Town					Y	Y	Y	Y	Y	
15	Chapel Hill	Town					Y	Y	Y	Y	Y	
16	Hillsborough	Town					Y	Y	Y	Y	Y	
17	Person County	County					Y	Y	Y	Y	Y	
18	Roxboro	City					Y	Y	Y	Y	Y	

## Appendix B Planning Process Documentation

### PLANNING STEP 1: ORGANIZE TO PREPARE THE PLAN

**Table B.1 – HMPC Meeting Topics, Dates, and Locations**

Meeting Title	Meeting Topic	Meeting Date	Meeting Location
HMPC Mtg. #1 – Project Kickoff	1) Introduction to DMA, CRS, and FMA requirements and the planning process 2) Review of HMPC responsibilities and the project schedule.	July 11, 2019	Whitted Human Services Building, Room 230, 300 West Tryon Street, Hillsborough
HMPC Mtg. #2	1) Review and update plan goals 2) Brainstorm a vision statement 3) Report on status of actions from the 2015 plan 4) Complete the capability self-assessment	October 8, 2019	Whitted Human Services Building, Room 230, 300 West Tryon Street, Hillsborough
HMPC Mtg. #3	1) Review Draft Hazard Identification & Risk Assessment (HIRA) 2) Draft objectives and Mitigation Action Plans	November 26, 2019	Whitted Human Services Building, Room 230, 300 West Tryon Street, Hillsborough
HMPC Mtg. #4	1) Review the Draft Hazard Mitigation Plan 2) Solicit comments and feedback	May 20, 2020 2 p.m.	Zoom Video Conference Call

Note: All HMPC Meetings were open to the public.

## HMPC Meeting Agendas, Minutes, and Sign-in Sheets

HMPC Meeting 1: July 11, 2019

### Eno-Haw Regional Hazard Mitigation Plan Update

Meeting 1: Hazard Mitigation Planning Committee Project Kickoff

Time & Date: Thursday, July 11, 2019, 2:00-4:00 p.m.

Location: Whitted Human Services Building, Room 230, 300 West Tryon Street, Hillsborough

#### Agenda

1. Introductions
2. Project Overview
  - a. Requirement for Update
  - b. Trends in Disasters – Why Plan?
  - c. Disaster Mitigation Act (DMA) Requirements
    - i. Organize Resources
    - ii. Risk Assessment
      1. Hazard Identification
      2. Vulnerability Assessment
      3. Capability Assessment
    - iii. Develop Mitigation Plan
      1. Hazard Strategies
      2. Mitigation Categories
  - d. Scope of Work
  - e. Risk Management Tool
3. Project Schedule
4. Plan Website
5. Public Survey
6. Next Steps
  - a. Capability Assessment
  - b. Mitigation Action Status Updates
  - c. Mitigation Goals Update
7. Questions
8. Adjourn



### Eno Haw Regional Hazard Mitigation Plan

Meeting 1: Hazard Mitigation Planning Committee Project Kick-Off Meeting

Time & Date: Thursday, July 11, 2019, 2:00-4:00 p.m.

Location: Whitted Human Services Building, Room 230, 300 West Tryon Street, Hillsborough

#### Introductions

Chris Crew from North Carolina Emergency Management thanked everyone for agreeing to participate and discussed the importance of hazard mitigation and the history of mitigation planning in North Carolina. He encouraged everyone on the HMPC to provide feedback throughout the planning process so that we can continue to improve with each plan update.

David Stroud, a consultant from Wood, kicked off the meeting by providing the meeting agenda and had everyone in attendance introduce themselves. There were 35 people in attendance and recorded on the sign-in sheet, including representatives from 12 of the 18 participating jurisdictions.

#### Hazard Mitigation Plan Update Requirement

David discussed the Disaster Mitigation Act of 2000 plan update requirement and the HMGP grant process. Communities are required to update their hazard mitigation plans every five years to remain eligible for federal disaster funding. HMGP funding is provided by the North Carolina Division of Emergency Management with a 75% federal/25% local cost share. When a Presidential Disaster Declaration is made for the State of North Carolina, any community in the state is eligible to apply for HMGP funding, regardless of whether that community is located in the declared area.

#### Trends in Disasters

Trends are resulting in increases costs for disaster response and recovery. As growth and development occur, exposure to hazard events increases. Exposure to risk includes the people as well as the infrastructure and buildings. Because exposure has increased, when hazard events occur they cause more damage. There are also trends toward more severe hazard events. There has been a continual increase in hazard expenses and an increase in the issuance of major disaster declarations. David reviewed a list of the 16 costliest natural disasters by NOAA estimates. Thirteen of them occurred within the last 20 years and 5 occurred just within the last 3 years.

Four reasons why addressing these trends is a priority were presented: 1) the cost of doing nothing is too high as the costs of response and recovery continue to grow; 2) many events are predictable and repetitive; 3) loss reduction activities can be undertaken, and they work, they're cost effective and environmentally sound, and there are funds available to help; and 4) there are legal and moral responsibilities to act.

#### Planning Requirements

David reviewed the Disaster Mitigation Act (DMA) of 2000 planning requirements, which include a four-phase planning process: organize resources, risk assessment, develop a mitigation plan, and adoption and implementation. The approach that will be led by the consultant team at Wood blends this four-phase process with the processes of the Flood Mitigation Assistance (FMA) Program and the Community Rating System (CRS) Floodplain Management Planning. This completed Hazard Mitigation Plan (HMP) will meet the requirements of all three FEMA programs.

David discussed the main phases of this planning process, as follows:

Phase I: Organize Resources, will involve planning for public involvement and coordinating with other departments and agencies. Other stakeholders to involve include North Carolina Emergency Management, FEMA Region IV, NOAA, other adjoining communities, citizens, schools, businesses, and others.

Phase II: Risk Assessment entails hazard identification (what can happen here), vulnerability assessment (what will be affected or impacted), and capability assessment (how prepared we are).

David presented Wood's recommendations for which hazards to include in the plan. It was noted that Durham and Orange County are attempting to earn EMAP accreditation and would need to profile technological and human caused hazards to do so. David explained that while these hazards will not be reviewed by FEMA, we can include them in the plan to the extent that data is available to generate a profile of risk and vulnerability. Wood will send a poll to the EM Coordinators to determine which technological and human-caused hazards in the State of North Carolina Hazard Mitigation Plan are most relevant to the Eno-Haw Region.

Based on this discussion, the following hazards will be profiled: Dam Failure, Drought, Extreme Heat, Earthquake, Flood, Landslide, Hurricane, Severe Weather (Thunderstorm Winds, Lightning, Hail), Severe Winter Weather, Tornado, and Wildfire. Technological & human-caused hazards will be added to this list following input from EM Coordinators.

The vulnerability assessment will use NCEM IRISK data. The Triangle Resiliency Assessment was mentioned – data from this assessment will be incorporated in the vulnerability assessment and used to discuss potential impacts of climate change on each of the profile hazards. Hazards will be prioritized using the Priority Risk Index. Each community will self-assess capability to determine ability to implement projects and where gaps exist.

Phase III: Develop Mitigation Plan involves setting planning goals, reviewing mitigation alternatives, and drafting an action plan. Typical strategies are to alter the hazard, avert the hazard, adapt to the hazard, or avoid the hazard. In addition to reviewing actions from the previous plan, the HMPC may need to develop new actions. David noted that in this process Wood will ensure that the Region meets the CRS requirements for considering mitigation alternatives to maximize CRS credit for the plan.

### Scope of Work

The plan will meet the following criteria:

- The plan will include all required elements, as defined in the FEMA Local Mitigation Plan Review Guide.
- The plan will meet or exceed the final rule for local mitigation planning found in 44 CFR, Section 201.6, in order to be approved by FEMA.
- Hazards assessed in the plan will coordinate with the current FEMA-approved State Mitigation Plan.
- The plan will include natural and human-caused hazards and mitigation measures.
- The plan will incorporate any local climate adaptation data and findings.

### Risk Management Tool

Abby, another consultant with Wood, discussed North Carolina Emergency Management's new tool for mitigation planning, which will be used in this effort. RMT integrates all available IRISK data to assist in the vulnerability assessment. Additionally, the RMT will generate and maintain a digital version of the plan, which may be useful in plan maintenance and future updates.

### Project Schedule

The anticipated project schedule was presented. The process will aim for completion of a final draft document by January 2020 to send to NCEM for review. This timeline does not include final approval and adoption of the plan. The update must be approved and adopted by August 2020.

### Plan Website & Public Survey

Abby presented the website for the planning process, which will be a tool for HMPC coordination and public outreach. The website is [www.EnoHawHMP.com](http://www.EnoHawHMP.com). The site contains upcoming meetings announcements, meeting agendas and minutes, draft documents of the plan update, information on the identified hazards, and opportunities to provide feedback including the public survey. All communities are asked to place a link to this website on their local community pages to encourage more public involvement. Abby noted that the public survey has already received responses and will be a useful tool for information related to hazard priorities, public awareness and preparedness, mitigation priorities, and continued public outreach methods.

### Next Steps

Community representatives need to complete the capability assessment and return it to Abby at [abigail.moore@woodplc.com](mailto:abigail.moore@woodplc.com) by Friday, August 2<sup>nd</sup>. Representatives should come to the next meeting with a status identified for all existing mitigation actions from the 2015 plan or send this information to Abby prior to that meeting using the Excel spreadsheet that will be emailed and posted on the website. It should be clearly noted for each action whether it's Completed, Deleted, or Carrying Forward. Representatives should also be prepared to discuss revisions to the mitigation goals. The capability assessment and past actions will be posted on the plan website.



Eno-Haw Regional Hazard Mitigation Plan  
Hazard Mitigation Planning Committee Meeting #1  
Thursday, July 11th, 2:00 PM

	Name	Organization	Phone	E-Mail
1.	Abby Moore	Wood.	919-768-9927	abigail.moore@woodplc.com
2.	David Spradley	WOOD.	919-385-6497	David.Spradley@woodplc.com
3.	Sarah Pickhardt	Orange County EM	919-245-6138	sarah.pickhardt@orangecountync.gov
4.	Tanner O'Quin	Durham EM	910-335-1898	tquinn@dcconc.gov
5.	Leslie O'Connor	Durham EM	919-560-7273	loconnor@dcconc.gov
6.	Francesca Zito	WOOD.		francesca.zito@woodplc.com
7.	Kirby Saunders	Orange Co EM	919-245-6135	k.saunders@orangecountync.gov
8.	Michael D. Harvey	Orange Co. Planning	245-2597	mharvey@orangecountync.gov
9.	HELSER	NCEM	919-825-2305	HELSER@NCEM
10.	Sandi Bridges	DCEM	919-560-0621	sbridges@dcconc.gov
11.	Paul Bailey	Ala. Co. EM	336-516-6826	paul.bailey@alacounty-em.com
12.	Kancy King	Alamance Co EM	336-570-4080	kancy.king@alamance-nc.gov
13.	Kathryn Taggett	DCEM	910-515-5948	ktaggett@dcconc.gov
14.	Pamela Graham	Town of Elm	336-584-2859	pamela@ci.elm.nc.us
15.	Kyle Smith	City of Mebane	919-563-3401	ksmith@cityofmebane.com
16.	Shanelle Simon	Durham County	919-284-5090	shanelle@dcconc.gov
17.	Shan Favel	Durham County	919-560-7992	shanelle@dcconc.gov
18.	Edwardine Harrone	FEMA (FITT-NC)	404-433-3968	EDWARDINE.HARRONE@FEMA.DHS.GOV
19.	Isney Moncada	Orange County	919-245-2599	isney.moncada@orangecountync.gov
20.	David Leonard	NCEM	336-266-2642	david.leonard@ncfhs.gov



Eno-Haw Regional Hazard Mitigation Plan  
Hazard Mitigation Planning Committee Meeting #1

Thursday, July 11th, 2:00 PM

21.	Lori Oakley	Person County	336-597-1950	loakley@personcountync.gov
22.	Karla Saxton	Person County	330-507-1750	ksaxton@personcountync.gov
23.	Lauren Johnson	City of Hillsboro	336-392-6018	ljohnson@cityofhillsboro.com
24.	Michelle Hartman	Durham	919-619-5175	michelle.a.hartman@duke.edu
25.	Diana N. Graham	Durham	919-797-0744	CSG@DianaNGraham.com
26.	SARA FEUSEN	DURHAM	919.280.0236	SARA@BELKARCHITECTURE.NET
27.	Marty Roupe	Town of Cambo	919-910-7333	mroupe@townofcambo.org
28.	Justin Snyder	Hillsborough	919-296-9473	justin.snyder@hillsboroughnc.gov
29.	April Johnson	Durham	919-692-3036	april@preservationdurham.org
30.	Rose M (anuel)	City of Burlington	336.516.4674	Rmanuel@burlingtonnc.gov
31.	Graham Sumner	City of Durham	919-560-4326	gsumner@cityofdurhamnc.gov
32.	JOHN RICHARDSON	TOWN OF CHAPEL HILL	919-969-5075	JOHN.RICHARDSON@TOWNOFCHAPELHILL.ORG
33.	Mare Armstrong	City County - Durham	919.560.4137	Mare.Armstrong@durhamnc.gov
34.	Susan Windsor	City County - Durham	919.560.4137#28212	Susan.Windsor@durhamnc.gov
35.	Jerry Wagner	Town of Hillsborough	919.296-7591	jerry.wagner@hillsboroughnc.gov
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HMPC Meeting 2: October 8, 2019

**Eno-Haw Regional  
Hazard Mitigation Plan Update**

Meeting 2: Hazard Mitigation Planning Committee

Time & Date: Tuesday, October 8, 2019, 1:00-3:00pm

Location: Whitted Human Services Building, Room 230, 300 West Tryon Street, Hillsborough

Agenda

1. Goals and Objectives
  - a. Review and update goals from the 2015 plan
  - b. Create objectives for each goal
2. Review additional mitigation ideas for new projects
3. Workshop: Review existing mitigation projects
  - a. Reporting on actions to be carried forward
4. Next Steps
5. Questions
6. Adjourn

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## **Eno Haw Regional Hazard Mitigation Plan**

Meeting 2: Hazard Mitigation Planning Committee, Meeting #2

Time & Date: Tuesday, October 8, 2019, 1:00-3:00 p.m.

Location: Whitted Human Services Building, Room 230, 300 West Tryon Street, Hillsborough

### **Introductions**

David Stroud and Abby Moore, consultants from Wood who are leading the Region through the planning process, facilitated the meeting. David began by providing the meeting agenda and had everyone in attendance introduce themselves. There were 24 people in attendance and recorded on the sign-in sheet.

### **Review and Update Mitigation Goals**

David reviewed the goals from the 2015 Eno-Haw Hazard Mitigation Plan and 2015 Person County-Roxboro Hazard Mitigation Plan. He recommended that the HMPC try to shorten their list of goals to arrive at a more manageable set of broad-based goals. Each goal will have nested objectives which can allow for more specificity. David discussed Wood's recommended revisions, which combine the majority of the existing plan goals. The proposed goals are as follows:

#1	Change, enhance, or adopt plans, ordinances, policies, regulations, and other local tools and mechanisms to better facilitate risk reduction activities and improve overall resiliency.
#2	Protect the public health, safety and welfare by increasing training, education, and public awareness of hazards and by encouraging collective and individual responsibility for mitigating hazard risks.
#3	Improve technical, administrative, financial, and political capability to implement effective mitigation projects and respond to hazards.
#4	Implement structure and infrastructure projects to improve public safety, reduce risk to vulnerable populations, and protect buildings, transportation, and other critical and essential functions of the Eno-Haw Region.

There were no comments on the recommended revisions to the goals, but these draft goals will be made available on the plan website and HMPC representatives have until October 25<sup>th</sup> to provide feedback on these goals.

### **Review and Update Objectives**

Following the discussion of goals, David presented a set of objectives, some pulled from the existing plans and some developed by Wood, as a starting point for the HMPC to identify objectives within each goal. Objectives should be more specific than goals but less specific than mitigation projects. Wood's recommended objectives are as follows:

#1-1	Strive to ensure that development occurs in such a way as to protect wetlands, floodplains, erosion control measures, and other natural features that serve to reduce hazard risk.
#1-2	Pursue policies that incorporate hazard mitigation into new development and post-disaster redevelopment.
#2-1	Implement a public awareness campaign to educate citizens of possible hazards and mitigation options.
#2-2	Pursue strategies and technologies to improve warning and notification of hazard events.
#3-1	Improve operations for hazards and emergencies that cause disruptions to traffic, release times, power outages, sheltering, and communications.
#3-2	Improve regular regional communication and foster the creation of more multi-jurisdictional regional planning efforts related to risk reduction and resiliency.
#4-1	Strive to keep infrastructure extensions out of known hazardous areas in order to actively discourage development in high risk areas.

### #4-2 Retrofit or otherwise protect critical facilities and infrastructure against damages.

Again, there were no comments on the proposed objectives, but HMPC representatives can review these objectives online and will have until October 25<sup>th</sup> to provide feedback. Additional objectives can also be added later in the process as new mitigation actions are developed.

#### Create Vision Statement

The next meeting task was to develop a vision statement to guide the plan development. David explained that the HMPC would generate a list of ideas and the consultant team would combine these recommendations to develop a draft vision statement. This draft vision statement will then be sent out to the entire HMPC for comment, revision, and approval.

David led the group in brainstorming key words or concepts that should be included in the vision for the plan. HMPC members were asked to consider what the successful implementation of the plan would bring about, what outcomes the plan would generate, and what the Eno-Haw Region will look like in five years. With these guiding questions, the group came up with the following list of concepts:

- ▶ Sustainability & Resiliency
- ▶ Efficiency
- ▶ Coordination – get everyone working on the same page, work across jurisdictions (resources, planning)
- ▶ Integration – link mitigation and future development decisions and reflect this in the Future Land Use Map
- ▶ Responsiveness & timely action – respond to and recover from disaster
- ▶ Comprehensive approach, comprehensive data
- ▶ Affordable / Fiscally responsible
- ▶ Practical
- ▶ Strategic approaches
- ▶ Stewards of our resources – environmental, historic, fiscal
- ▶ All hazards approach
- ▶ Preparedness
- ▶ Issue: Reservoirs/dams upstream – (coordination)
- ▶ Issue: General infrastructure / water supply / aging infrastructure – (planning for mitigation)

#### Review Mitigation Action Ideas

Abby reviewed a selection of mitigation action ideas from the FEMA “Mitigation Ideas” publication. She encouraged the HMPC to review the full document to find ideas for new mitigation actions. Each jurisdiction will need two actions per hazard (high and moderate priority hazards only). Jurisdictions participating in the CRS will need to meet the requirement of two actions in 5 of the 6 mitigation categories in order to receive full CRS credit.

#### Review Existing Mitigation Projects

Abby discussed the mitigation project reporting that each jurisdiction must complete. Time was set aside following the formal presentation for representatives to work on their action reporting and ask the consultants questions.

Abby clarified that each status must clearly state whether the action will be carried forward or removed in the plan update. Once the HMPC identifies which actions will be carried forward, supporting information and new prioritization ratings will be required for the update. HMPC members only need to report on existing actions at this time. New actions will be discussed later in the planning process.

#### Next Steps

Abby will send out the draft Vision Statement to the HMPC for review within the next week. HMPC members will have until Friday, October 25<sup>th</sup> to submit comments for inclusion in a final version of the Vision Statement.

HMPC members must also continue working on their mitigation action reporting. All jurisdictions should submit action statuses for all actions to Abby at [abigail.moore@woodplc.com](mailto:abigail.moore@woodplc.com) by Friday, October 25<sup>th</sup>.

#### Meeting Adjourned

Eno-Haw Regional Hazard Mitigation Plan Update  
HMPC Meeting 2

Page 2 of 2



Eno-Haw Regional Hazard Mitigation Plan  
Hazard Mitigation Planning Committee Meeting #2  
Tuesday, October 8th, 1:00 PM

	Name	Organization	Phone	E-Mail
1.	Abby Moore	Wood.	919-768-9927	abby.moore@woodplc.com
2.	David Straw	WOOD	919-325-6497	david.straw@woodplc.com
3.	Ashley Moncada	Orange County Planning		amunacado@orangecounty.nc.gov
4.	McKenzie Gentry	Durham County	919-560-7364	mfgentry@dcconline.gov
5.	Justin Snyder	Town of Hillsborough Planning	919-296-9473	justin.snyder@hillsboroughnc.gov
6.	Yancy King	Alanance Co. EM	336-570-4080	yking@kingalanance.com
7.	Vence Harris	Town of Chapel Hill-EM	919-968-2205	vharris@townofchapelhill.org
8.	Brennan Bouma	Orange County Sustainability	919-245-2626	bouma@orangecounty.nc.gov
9.	Diana N. Evahan	CSGC, LLC	919-797-6744	CSG@DianaEvahan.com
10.	Lori Oakley	Person County	336-597-1950	loakley@personcounty.nc.gov
11.	Laura Dierstina	Person County	(336) 597-1750	ldierstina@personcounty.nc.gov
12.	Roger Manuel	City of Burlington	336-516-4674	rmanuel@burlingtonnc.gov
13.	Graham S. Mansor	City of Durham	919-560-4326	gman@summersanddavis.com
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Eno-Haw Regional Hazard Mitigation Plan  
Hazard Mitigation Planning Committee Meeting #2  
Tuesday, October 8th, 1:00 PM

21.	Kyle Smith	MESBANE	919-563-3401	KSMITH@CITYOFMESA.NC.COM
22.	Bob Louis	MESBANE	336-516-4153	blouis@cityofmesa.nc.com
23.	Sarah Decker	Orange Co. EM	919-245-6128	sarah@orangecountync.com
24.	Sasha Gudwin	Orange Co. EM	919-945-9985	Sasha.Gudwin@orangecountync.com
25.	Jerry Wagner	Hillsborough FM/EM	919-296-9591	Jerry.Wagner@hillsboroughnc.gov
26.	Rene Harty	CARRISBORO	919-251-1517	RHarty@TownofCarrisboro.nc.gov
27.	Meredith McManis	Orange Co. Health	919-215-2071	mmmanis@orangecountync.gov
28.	Sandra Bridges	Durham Co. EM	919-500-0621	sbridges@dcconnc.gov
29.	Laura Janway	Town of Carrboro	(919) 918-7326	ljanway@townofcarrboro.org
30.	Darrell Jeter	UNC-CH	919-962-5729	djeter@unc.edu
31.	Alva Sizemore	Town of Efland	336- <del>584</del> 584-9190	asizemore@ci.efl.nc.us
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HMPC Meeting 3: November 26, 2019

**Eno-Haw Regional  
Hazard Mitigation Plan Update**

Meeting 3: Hazard Mitigation Planning Committee

Time & Date: Tuesday, November 26, 2019, 1:00-3:00pm

Location: Whitted Human Services Building, Room 230, 300 West Tryon Street, Hillsborough

Agenda

1. Review of Planning Process
  - a. HIRA Organization in the Plan
2. Review of the HIRA
  - a. Hazard Identification
  - b. Asset Inventory
  - c. Hazard Profiles
  - d. Summary of Priority Risk Index
3. Public Outreach Status
4. Review Organization of Jurisdictional Annexes
5. Review of Goals & Objectives
  - a. Discuss Mitigation Action Plan Requirements
6. Next Steps
7. Questions
8. Adjourn

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### Eno Haw Regional Hazard Mitigation Plan

Meeting 3: Hazard Mitigation Planning Committee, Meeting #3

Time & Date: Tuesday, November 26, 2019, 1:00-3:00 p.m.

Location: Whitted Human Services Building, Room 230, 300 West Tryon Street, Hillsborough

#### Introductions

David Stroud and Abby Moore, consultants from Wood, facilitated the meeting. There were 24 people in attendance and recorded on the sign-in sheet. David began by noting that this meeting would provide an overview of the Hazard Identification and Risk Assessment portion of the plan but encouraged everyone to review the actual draft document, which will be posted online by Wednesday, November 27<sup>th</sup>, to provide us with feedback and any necessary edits. He then provided the meeting agenda and a review of the planning process as a whole including where we are in that process – Step 4 Assess the Hazard & Step 5 Assess the Problem. We have already completed Step 6 Set Goals. Moving forward, the next step will be to review potential new mitigation actions and draft the plan.

#### Review the Hazard Identification and Risk Assessment (HIRA)

David reviewed the hazard identification, the HIRA methodology and process, and a summary of each hazard in the plan, explaining the overall risk level assigned to each hazard. Hazards were identified for initial review based on the list of hazards included in the 2018 State Hazard Mitigation Plan, the 2015 Eno-Haw Plan, and the 2015 Person County – Roxboro Plan. Major disaster declarations, NCEI storm events data, and other sources of hazard risk were reviewed to determine which hazards would be fully profiled in the plan. The full list of hazards profiled is as follows:

- ▶ Dam Failure
- ▶ Drought
- ▶ Earthquake
- ▶ Extreme Heat
- ▶ Flood
- ▶ Hurricane & Tropical Storm
- ▶ Landslide
- ▶ Severe Weather (Thunderstorm Wind, Lightning, Hail, Fog)
- ▶ Severe Winter Storm
- ▶ Tornado
- ▶ Wildfire
- ▶ Civil Unrest
- ▶ Cyber Threat
- ▶ Infectious Disease
- ▶ Radiological Incident
- ▶ Terrorism / Mass Casualty Event

The summary info that was presented on each hazard can be found in the PDF of the presentation posted on the plan website. The following comments were noted during the discussion:

- ▶ There was a question about the disaster declarations not including Hurricane Michael. The data in the draft is from March 2019 but we will update it and add Hurricane Michael.
- ▶ David requested that committee members provide GIS shapefiles for critical facilities if you feel that your critical facility map is missing any important assets.
- ▶ There was a question about PRI scores. Abby noted that PRI scores are calculated overall for the planning area and individually by jurisdiction at the end of each hazard profile.
- ▶ David requested information on past landslide events if anyone knows of any in the planning area.



- There was a request to also include Tier II facilities in the Hazardous Materials Incident profile. Representatives should send this data to Wood if they have it available.

In summary, the high priority hazards are: extreme heat, severe winter storm, hurricane & tropical storm, infectious disease, tornado, radiological emergency, severe weather, drought, flood, wildfire, and terrorism / mass casualty events. The moderate priority hazards are: dam failure, cyber threat, civil unrest, and hazardous materials incidents. Earthquake and landslide are low priority hazards and do not need to be prioritized for mitigation. Additionally, human-caused and technological hazards do not need to be prioritized for mitigation.

### **Plan Vision, Goals & Objectives**

The final plan goals, and objectives were provided for the committee to reference while developing mitigation actions. Minor changes were made to the vision, goals and objectives following committee feedback on the draft. The final version is posted on the plan website.

### **Mitigation Action Plan Requirements**

Each participating jurisdiction must have two actions for every high and moderate priority hazard. An all-hazards action can satisfy the criteria for one action for each hazard. Every jurisdiction must have a Structural Project. Emergency Services actions do not count toward the two actions per hazard requirement but do count toward CRS requirements. For full CRS credit, each CRS-participating jurisdiction must also have actions in at least 5 of the 6 mitigation categories.

NOTE: These requirements only apply to the natural hazards in the plan. You may develop actions for the technological and human-caused hazards, but this is not required by FEMA.

### **Next Steps**

The draft HIRA will be posted on the plan website by Wednesday, November 27<sup>th</sup>. The HMPC should review the HIRA and submit comments by Friday, December 10<sup>th</sup>. The HMPC should also work on developing new mitigation actions based on capability gaps and information in the HIRA. New mitigation actions are due to Wood by Friday, January 10<sup>th</sup>.

### **Meeting Adjourned**

Eno-Haw Regional Hazard Mitigation Plan  
Hazard Mitigation Planning Committee Meeting #3  
Tuesday, November 26th, 1:00 PM

	Name	Organization	Phone	E-Mail
1.	Abby Moore	Wood	919 768 9927	abigail.moore@woodplc.com
2.	Doug Young	PERSON COUNTY	336-597-4262	dyoung@personcountync.gov
3.	Ashley Moncado	Orange County		amoncado@orangecountync.gov
4.	EDUARDO S. MARONE	FEMA INTEGRATION TEAM	404-433-3968	EDUARDO.S.MARONE@FEMA.DHS.GOV
5.	DAVID STOUND	WOOD	919-325-6497	clavist.stound@woodplc.com
6.	Kelly Ferrell	American Red Cross	919-259-4175	kelly.ferrell@redcross.org
7.	Roger Manuel	Burlington	540-537-8515	rmanuel@burlingtonnc.gov
8.	Kayla DiGrisinga	PERSON COUNTY	336-597-7422	Kaigrisinga@personcountync.gov
9.	Quinn Johnson	City of Hillsboro	336-322-6018	quinnjohnson@cityofhillsboro.com
10.	Ryan Eaves	Durham County	919-560-7992	REAVES@Dco.nc.gov
11.	Justin Snyder	Town of Hillsborough	919-296-9473	justin.snyder@hillsboroughnc.gov
12.	Sarah Richardson	Orange County	919 245 6178	sarahrichard@orangecountync.gov
13.	Sarah Bridges	Durham EM	919 560 0621	sbridges@dcemc.gov
14.	STEPHAN WILSON	Durham City - Emergency	919 560 4137 2822	STEPHAN.WILSON@DURHAMNC.GOV
15.	Karen Sanders	ORANGE COUNTY EM	919-245-6455	KSANDERS@orangecountync.gov
16.	Bob Louis	City of Mebane F.D.	336-516-4153	blouis@cityofmebane.com
17.	Kyle Smith	City of Mebane	336-213-2746	KSMITH@cityofmebane.com
18.	Jerry L Wagner	Town of Hillsborough	919 296-9591	Jerry.wagner@hillsboroughnc.gov
19.	DAVID L. LEONARD	NCDEM	336-266-2642	david.leonard@ncdps.gov
20.	Gregory Summer son	City of Durham	919.560.4326	gregory.summer@cityofdurhamnc.gov

Eno-Haw Regional Hazard Mitigation Plan  
Hazard Mitigation Planning Committee Meeting #3  
Tuesday, November 26th, 1:00 PM

	Name	Organization	Phone	E-Mail
21.	Michelle Hartman	Resident Durham Duke School of Nursing	919-619-5175	michelle.a.hartman@duke.edu
22.	Laura Janney	Town of Carboro	(919) 918-7326	ljanney@townofcarboro.org
23.	Nancy King	ACEM	336-380-6933	nancy.king@akmanor-nv.com
24.	Broad Barley	ACEM	336 516 6826	broadbarley@akmanor-nv.com
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### HMPC Meeting 4: May 20, 2020

#### Eno Haw Regional Hazard Mitigation Plan

Hazard Mitigation Planning Committee, Meeting #4  
Time & Date: Wednesday, May 20, 2020, 2:00-3:00 p.m.  
Location: Zoom Video Conference Call

##### Introductions

David Stroud and Abby Moore, consultants from Wood, facilitated the meeting. There were 25 people in attendance on the call.

David and Abby presented the meeting slides according to the following agenda:

1. Where we are in the planning process
  - a. Planning Step 7 & Planning Step 8
  - b. Structure of the Plan
2. Review of Key Plan Components
  - a. Hazards & Priority Risk Index
    - i. Updates to the HIRA
  - b. Goals & Objectives Review
  - c. Mitigation Actions Discussion
  - d. Plan Implementation & Maintenance
    - i. Responsibilities of the HMPC
  - e. Integration with Other Plans
    - i. Past Integration Efforts
    - ii. Opportunities for Future Integration
3. Completing the Planning Process
4. Next Steps and Questions

##### Meeting Discussion

The following comments and questions were discussed throughout the meeting.

- Mitigation Action Plans: HMPC representatives should review their mitigation actions and look for opportunities to add new actions. If a community did not report otherwise on existing action items, all actions were carried forward; however, David and Abby recommended removing actions that are no longer a priority in order to focus efforts on a smaller set of feasible actions.
- Plan Integration: Abby asked HMPC representatives to share ways in which their communities have integrated the 2015 plans with other planning efforts and/or ways they plan to integrate this 2020 plan update with other local planning efforts. The following opportunities for integration of the 2020 plan were shared and will be incorporated in Section 8 of the draft plan:
  - Carrboro: The Town is beginning the process of updating its Comprehensive Plan this year.
  - Roxboro: The City is updating its Future Land Use Plan along with Person County.
  - Hillsborough: The Town will update its Historic District Design Guidelines next year to include hazard mitigation strategies for the preservation of historic resources.
  - Chapel Hill: The Town is updating its Future Land Use Map and land development regulations.
- Plan Adoption was discussed, and John Mello and Chris Crew from NCEM clarified that communities can adopt the plan at any time. Edwardine Marrone of FEMA Region IV was also on the call and clarified that the current Eno-Haw plan expiration date is August 2, 2015. This expiration is for the plan as a whole and does not vary by community. Chris Crew from NCEM encouraged communities to adopt the plan soon; if changes to the plan are needed following review by the State or FEMA, an adoption will still be valid and applicable to the updated plan. Abby will provide a template for adoption resolutions.
- The final public meeting will be held on Thursday, May 28<sup>th</sup> at 5pm via Zoom. Communities need to publicize the meeting to ensure the public has the opportunity to attend. For CRS communities to ensure

Eno-Haw Regional Hazard Mitigation Plan Update  
HMPC Meeting 4

Page 1 of 2



they receive credit for this second public meeting, it must be publicized at least three different ways, such as via Facebook, Twitter, or other social media, on a community website or event calendar, via a newsletter, or otherwise.

**Next Steps**

Review mitigation action plans and provide any updates or new actions by Friday, May 29<sup>th</sup>. Review the full draft plan and provide feedback by Wednesday, June 3<sup>rd</sup>. Wood will incorporate comments and feedback and submit the plan to the state for review ASAP following receipt of comments.

**Meeting Adjourned**

Minutes Placeholder

The screenshot shows a Zoom meeting in progress. The main window displays a presentation slide titled "Structure of the Plan - Overview". The slide content is as follows:

- 1. Introduction
- 2. Planning Process
- 3. Planning Area Profile
- 4. Risk Assessment
- 5. Capability Assessment
- 6. Mitigation Strategy
- 7. Mitigation Action Plans
- 8. Plan Maintenance
- 9. Plan Adoption

Below the main list, there are two sections:

- Appendices**
  - A. Plan Review Tool
  - B. Planning Process Documentation
  - C. Mitigation Alternatives (CRS Step 7)
  - D. References
- Annexes**
  - 1. Planning Process
  - 2. Community Profile
  - 3. Risk Assessment – Jurisdictional maps, tables, etc.
  - 4. Capability Assessment – Floodplain and NFIP Policy Data
  - 5. Mitigation Strategy – Mitigation Projects

The Zoom interface includes a top bar with "Zoom Meeting" and a "Zoom Group Chat" button. Below the top bar is a toolbar with icons for "Unmute", "Start Video", "Share Screen", "Record", "Reactions", and "Leave". A bottom bar shows the current slide number (5) and the title "A presentation by Wood. Eno-Haw Regional Hazard Mitigation Plan Update". On the right side, there is a "Participants (25)" list with names and status icons (e.g., "19193073318", "Lauren Johnson", "amy.crowley", "Ari Schein", "Ashley Moncado", "Dave Schmidt", "Diana N. Graham", "Edwardine Marrone", "Graham Summerson", "jcrew", "Justin Snyder", "kayladiacristina", "Kyle Smith", "RRouse", "Ryan Eaves", "Sarah Pickhardt - Orange Count...", "Sasha Godwin", "Sean Tuttle", "Sue Burke (Chapel Hill)", "Jerry Wagner").

**PLANNING STEP 2: INVOLVE THE PUBLIC****Table B.2 – Public Meeting Topics, Dates, Locations**

Meeting Title	Meeting Topic	Meeting Date	Meeting Location
Public Meeting #1	1) Introduction to DMA, CRS, and FMA requirements and the planning process 2) Review of HMPC responsibilities and the project schedule.	July 11, 2019 5:30 p.m.	Whitted Human Services Building, Room 230, 300 West Tryon Street, Hillsborough
Public Meeting #2	1) Review “Draft” Hazard Mitigation Plan 2) Solicit comments and feedback	May 28, 2020 5 p.m.	Zoom Video Conference Call

## APPENDIX B: PLANNING PROCESS DOCUMENTATION

### Public Meeting Agendas, Minutes, Sign-in Sheets, and Announcements

Public Meeting 1: July 11, 2019

#### Eno-Haw Regional Hazard Mitigation Plan Public Meeting #1


Thursday, July 11th, 5:30 PM

	Name	Organization (resident)	Phone	E-Mail
1.	DAVID STRAUSS	WOOD	919-325-6477	david.strauss@woodplc.com
2.	David Harris	Darlene Resident	919-906-2023	harris.dl2003@yahoo.com
3.	Abby Moore	Wood	919-768-4927	abigail.moore@woodplc.com
4.	Kayla Dignifying	ownage resident		
5.				
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B.24


**DURHAM COUNTY NC**  
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**DURHAM COUNTY HAZARD MITIGATION PLAN**

Font Size: [A] [A-] [A-2] Share & Bookmark Feedback Print

As the costs of disasters continue to rise, governments and ordinary citizens must find ways to reduce hazard risks to our communities and ourselves. Efforts made to reduce hazard risks are easily made compatible with other community goals; safer communities are more attractive to employers as well as residents. As communities plan for new development and improvements to existing infrastructure, mitigation can and should be an important component of the planning effort. Mitigation means taking action to reduce or eliminate long-term risk from hazards and their effects.

The Disaster Mitigation Act of 2000 and 44CFR 201.6 mandate counties and municipalities to construct and implement a hazard mitigation plan in order to receive state and Federal disaster and mitigation assistance funding. This plan will outline the hazards faced by Durham County and the municipalities located within the County. A rating is given to each hazard for the purposes of prioritizing the mitigation process. This rating is reflective of information from the State of North Carolina and the concerns of Durham County and it's municipalities. Not all mitigation is possible or cost effective.

Durham County and the municipalities face a number of hazards everyday. During the past decade and a half we have faced the effects of damaging tornadoes, severe winter storms, high winds, freezing temperatures, chemical spills and more. We have learned from each disaster and each incident and your emergency services and response forces are better trained and better equipped to deal with these hazards than ever before. Numerous hazard mitigation efforts have been ongoing in Durham County and continue to evolve to this day. As such, this Plan will act as a steering tool to focus future mitigation actions.

Beginning in 2014, Durham County joined with Alamance and Orange counties to develop a three-county regional hazard mitigation plan, supported and funded by the State of North Carolina. Approved by FEMA in August 2015, the Regional Plan became the official hazard mitigation plan for Durham County, adopted October 12, 2015, and for the City of Durham, adopted June 6, 2016.

The Draft [Eno-Haw Regional Hazard Mitigation Plan 2019](#) can be located here:

<http://www.enohawhmp.com/>

Durham County Hazard Mitigation Plan

Special Needs Shelter Registration

LEPC

Durham Joint Information Center

Pre-Disaster Planning Guide

Guía de Planeamiento Contra Desastres

Links



As the costs of disasters continue to rise, governments and ordinary citizens must find ways to reduce hazard risks to our communities and ourselves. Efforts made to reduce hazard risks are easily made compatible with other community goals; safer communities are more attractive to employers as well as residents. As communities plan for new development and improvements to existing infrastructure, mitigation can and should be an important component of the planning effort. Mitigation means taking action to reduce or eliminate long-term risk from hazards and their effects.

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Durham County and the municipalities face a number of hazards everyday. During the past decade and a half we have faced the effects of damaging tornadoes, severe winter storms, high winds, freezing temperatures, chemical spills and more. We have learned from each disaster and each incident and your emergency services and response forces are better trained and better equipped to deal with these hazards than ever before. Numerous hazard mitigation efforts have been ongoing in Durham County and continue to evolve to this day. As such, this Plan will act as a steering tool to focus future mitigation actions.



[WebEOC 8.4 Login](#)






Orange County Emergency Services - NC


Abby



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Orange County Emergency Services - NC
6 mins ·

It is time for us to update the Eno-Haw Hazard Mitigation Plan! This plan is used to identify and reduce risk to natural hazards in our community. There will be a Public Meeting July 11th at 5:30pm at the Whitted Human Services Building, 300 West Tryon St. Hillsborough, NC 27278

Your participation and input is valuable! Please come provide information on the planning process, the identified hazards, and additional opportunities for public involvement....

[See More](#)



**PUBLIC MEETING**  
Thursday | July 11, 2019 | 5:30 PM  
Whitted Human Services Building  
300 West Tryon Street  
Hillsborough, NC 27278


The Hazard Mitigation Plan is used to identify and reduce risk to natural hazards.

Please join us for the kick off meeting and provide your input! The meeting will include information on the planning process, identified hazards, and additional opportunities for public involvement.





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Countywide Radio Communications Project

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Emergency Medical Technicians

Emergency Services Partners

Employment

Eno-Haw Regional Hazard Mitigation Plan

Fire Marshal Division


Five Steps to Neighborhood Preparedness

Hurricane Florence information

Hurricane Michael Information

[Home](#) > [Government](#) > [Departments A - F](#) > [Emergency Services](#) > [Eno-Haw Regional Hazard Mitigation Plan](#)

### Eno-Haw Regional Hazard Mitigation Plan




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

**UPDATE May 2019:** The process to update the Eno-Haw Mitigation Plan has begun. To stay up to date on the planning process please visit the [Eno-Haw Multi-Jurisdictional Mitigation Plan Website](#)

**Other Resources**

- [Local Mitigation Planning Handbook \(PDF\)](#)
- [Mitigation Ideas \(PDF\)](#)
- [Integrating Hazard Mitigation Into Local Planning \(PDF\)](#)
- [Integrating Historic Property and Cultural Resource Considerations \(PDF\)](#)
- [Building a Disaster Resistant University \(PDF\)](#)

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1 hr ·

Alamance, Durham, Orange, and Person Counties are working together to update the Eno-Haw Regional Hazard Mitigation Plan and your participation and input is valuable! This plan update is required to maintain eligibility for future pre- and post-disaster funding from FEMA. This effort will also help the counties and incorporated municipalities to identify hazard risks, understand vulnerability, and develop ways to proactively mitigate these risks. A public meeting will be held on Thursday, July 11th at 5:30 p.m. at the Whitted Human Services Building at 300 West Tryon Street, Hillsborough, NC 27278 to provide information on the planning process, the identified hazards, and additional opportunities for public involvement, as well as to gather feedback from the public. For more information on the plan update, please visit [www.enohawhmp.com](http://www.enohawhmp.com).



Mitigation

**Eno-Haw Multi-Jurisdictional Hazard Mitigation Plan**

Eno-Haw Mu Plan

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Alamance, Durham, Orange, and Person Counties are working together to update the Eno-Haw Regional Hazard Mitigation Plan and your participation and input is valuable!

This plan update is required to maintain eligibility for future pre- and post-disaster funding from FEMA. This effort will also help the counties and incorporated municipalities to identify hazard risks, understand vulnerability, and develop ways to proactively mitigate these risks. Following the public meeting on July 11th, the Hazard Mitigation Plan Team has asked that citizens visit [www.enohawmp.com](http://www.enohawmp.com) and complete the public survey. This information is vital to ensuring that this plan represents the needs of all community members. The public survey closes August 23rd, 2019. Thank you for your participation!

ENOHAWMP.COM

[www.enohawmp.com](http://www.enohawmp.com)

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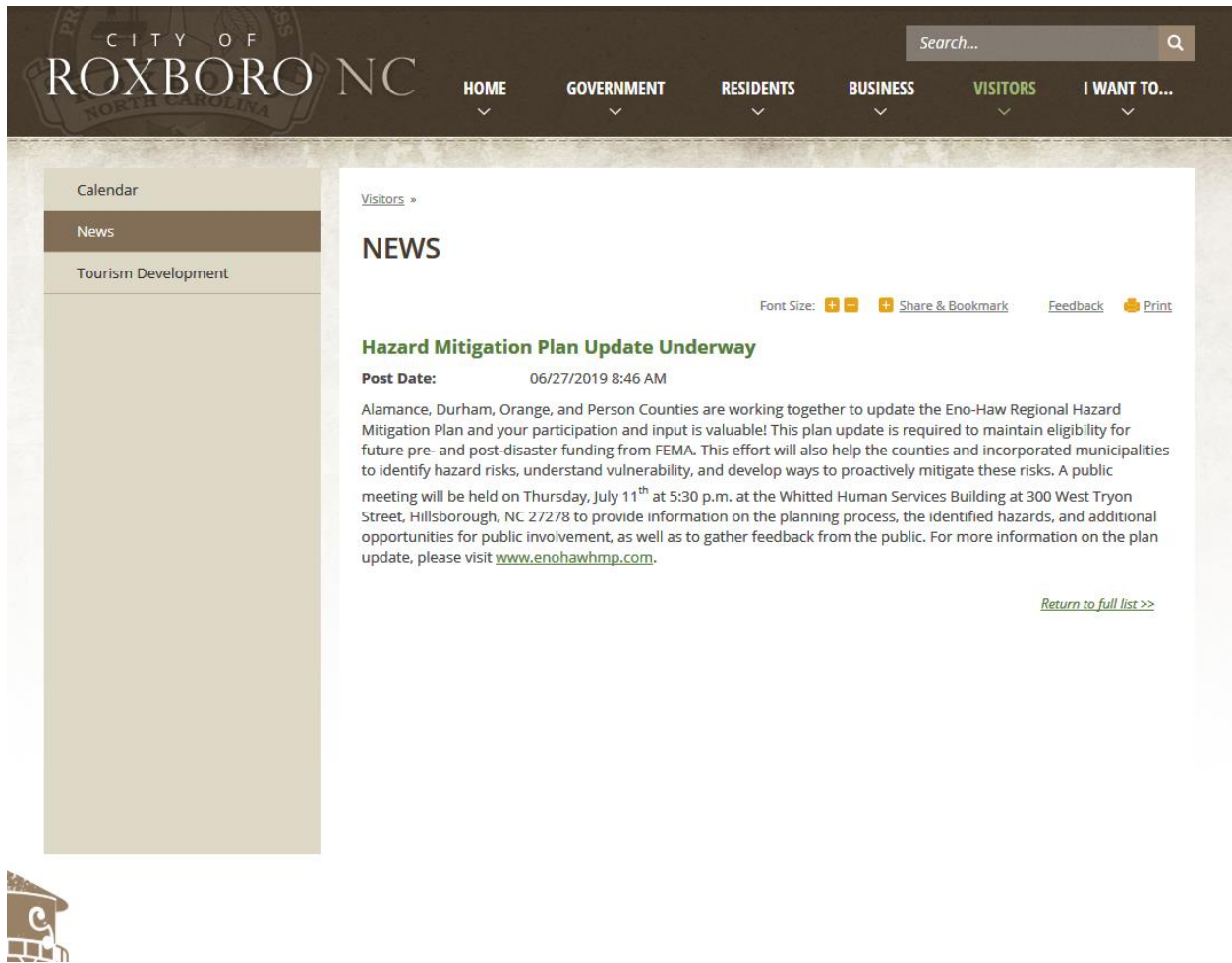
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Eno-Haw

Regional Hazard Mitigation Plan  
2020

B.31





Emergency Management Coordinator Kirby Saunders, Orange County ...



## Mitigate Disasters in Orange County, NC!

Good afternoon Orange County neighbors,

It is time to update the Eno-Haw Hazard Mitigation Plan and we need YOUR help! Please, take a brief moment to complete the public survey. Your feedback is instrumental in driving the planning process. Access this brief survey here <https://www.surveymonkey.com/r/EnoHawHMP>.

More Info:

The Eno-Haw Region is updating its 2015 plan to better protect the people and property of the county from the effects of natural and human-caused hazards and to maintain eligibility for mitigation funding from the Federal Emergency Management Agency (FEMA). You can find information about upcoming and past Hazard Mitigation Planning Committee meetings and public meetings, take a survey on hazard risk and mitigation options to inform the plan's development, and review draft documents and summaries of the hazards that affect the Eno-Haw Region all online. Just visit [www.enohawhmp.com](http://www.enohawhmp.com).

Stay safe! Stay Prepared! We are YOUR Orange County Emergency Services!

23 Jul · Subscribers of Orange County Emergency Services



Thank



Comment



11

**Justin Snyder**

---

**From:** Town of Hillsborough <no-reply@hillsboroughmail.org>  
**Sent:** Thursday, July 11, 2019 5:22 PM  
**To:** Justin Snyder  
**Subject:** Input Sought as Work Begins on Updating Regional Hazard Plan



## Input Sought as Work Begins on Updating Regional Hazard Plan

### Eno-Haw Region

THE COUNTIES OF: ALAMANCE, DURHAM, ORANGE, AND PERSON

A blue rectangular graphic with white text and a map. The text reads: "It's time to update the region's hazard mitigation plan." followed by "Take a survey on hazard risk and mitigation options to inform the plan's development." and the website "www.enohawhmp.com". To the right is a map of the Eno-Haw region showing the counties of Alamance, Durham, Orange, and Person, with one county highlighted in purple.

**It's time to update the region's hazard mitigation plan.**

Take a survey on hazard risk and mitigation options to inform the plan's development.

[www.enohawhmp.com](http://www.enohawhmp.com)

The process to update the Eno-Haw Regional Hazard Mitigation Plan has started, and a public meeting will take place from 5:30 to 7 p.m. today, July 11.

The meeting — in Room 230 of the Whitted Human Services Center Complex in Hillsborough — will provide information on the update's planning process and identified hazards for the Eno-Haw Region, which consists of Orange, Alamance, Durham and Person counties.



Feedback from the public will be gathered, and additional opportunities for public involvement will be available.

The community also is encouraged to take a [survey](#) on hazard risk and mitigation options to inform the plan's development. Summaries of the hazards that affect the Eno-Haw Region are available on the Eno-Haw Region [website](#). Draft documents of the plan also will be made available there.

The Eno-Haw Regional Hazard Mitigation Plan, last updated in 2015, identifies local policies and actions for reducing risk and losses from natural hazards, such as floods, severe storms, wildfires and winter weather. It builds upon separate hazard mitigation plans initially prepared in each county.

The plan also serves to meet key federal planning regulations, which require local governments to develop a hazard mitigation plan as a condition for receiving certain types of non-emergency disaster assistance, including funding for hazard mitigation projects. The update is required to maintain eligibility for future pre- and post-disaster funding from the Federal Emergency Management Agency.



Please add [no-reply@hillsboroughmail.org](mailto:no-reply@hillsboroughmail.org) to your list of approved senders.

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Town of Hillsborough  
PO Box 429, Hillsborough, NC 27278  
Phone: 919-732-1270  
Fax: 919-644-2390

## APPENDIX B: PLANNING PROCESS DOCUMENTATION

### Public Meeting 2: May 28, 2020

There were no attendees on this call. However, the prepared presentation was shared on the plan website, shown below.

Eno-Haw

HOME

AGENDAS, MINUTES, & MORE

DRAFT DOCUMENTS


HAZARDS

≡

Agenda	Date
Presentations	Date
HMPC Meeting 1 (Kickoff) ( <a href="#">PDF, 1.0MB</a> )	07/11/2019
Public Meeting 2 ( <a href="#">PDF, 1.0MB</a> )	05/28/2020


RESOURCES

Resources	Date
FEMA Mitigation Ideas ( <a href="#">PDF, 4.16MB</a> )	01/01/2013
Existing Eno-Haw HMP ( <a href="#">PDF, 23.1MB</a> )	2015
Capability Assessment Handout ( <a href="#">PDF, 146KB</a> )	03/20/2019
Eno-Haw 2015 Action Plans ( <a href="#">PDF, 1.9MB</a> )	07/11/2019
Person County-Roxboro 2015 Actions ( <a href="#">PDF, 208KB</a> )	07/11/2019
Action Reporting Spreadsheet ( <a href="#">Excel, 12KB</a> )	07/11/2019



Facebook

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**Alamance County Emergency Management**

Published by Michelle Mills [?] · 22 mins ·


The Eno-Haw Region has updated the Hazard Mitigation Plan and is seeking public input on the draft plan. A virtual public meeting is scheduled for Thursday, May 28 at 5 pm to be held via Zoom. To attend this meeting, please email [abigail.moore@woodplc.com](mailto:abigail.moore@woodplc.com) to request an email invitation. To review the draft plan and provide feedback, visit [www.EnoHawHMP.com](http://www.EnoHawHMP.com).

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**Alamance County, NC**

@AlamanceNC · 26m

The Eno-Haw Region has updated the Hazard Mitigation Plan and is seeking public input on the draft . A Zoom meeting is scheduled for Thur, May 28 at 5pm. To attend, please email [abigail.moore@woodplc.com](mailto:abigail.moore@woodplc.com) [EnoHawHMP.com](http://EnoHawHMP.com).

UPCOMING EVENTS:

The Eno-Haw Region has updated the Hazard Mitigation Plan and is seeking public input on the draft plan. A virtual public meeting is scheduled for Thursday, May 28 at 5 pm to be held via Zoom. To attend this meeting, please email [abigail.moore@woodplc.com](mailto:abigail.moore@woodplc.com) to request an email invitation. To review the draft plan and provide feedback, visit [www.EnoHawHMP.com](http://www.EnoHawHMP.com).

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## APPENDIX B: PLANNING PROCESS DOCUMENTATION

The screenshot shows the Town of Carrboro website with an "EMERGENCY ALERT" banner at the top. Below the banner, there are two main sections: "Meetings" and "Community Events".

**Meetings**

May 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
26	27	28	29	30	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	1	2	3	4	5	6

**Community Events**

- Thu May 28**  
Eno-Haw Region Public Input Meeting on Updated Hazard Mitigation Plan The Eno-Haw Region has updated its Hazard Mitigati...  
[Read More](#)
- Thu Jun. 4**  
Appearance Commission  
[Read More](#)
- Thu Jun. 4**  
Planning Board Meeting  
[Read More](#)
- Mon Jun. 1**  
Carrboro Tourism Development Authority  
[Read More](#)
- Thu Jun. 4**  
Northern Transition Area Advisory Committee  
[Read More](#)
- Tue Jun. 2**  
Town Council Meeting  
[Read More](#)

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The screenshot shows the "Event Details" page for the "Eno-Haw Region Public Input Meeting on Updated Hazard Mitigation Plan".

**Event Details** [Return to Previous](#) [View Map](#)

**Eno-Haw Region Public Input Meeting on Updated Hazard Mitigation Plan**

**Thursday, May 28, 2020**

The Eno-Haw Region has updated its Hazard Mitigation Plan and is seeking public input on the draft plan. A virtual public meeting is scheduled for Thursday, May 28th at 5 pm to be held via video conference. To attend this meeting, please email [abigail.moore@woodplc.com](mailto:abigail.moore@woodplc.com) to request an email invitation. To review the draft plan and provide feedback, visit [www.EnoHawHMP.com](http://www.EnoHawHMP.com).

**Date:** May 28, 2020

**Time:** 5:00 PM - 7:00 PM

**Time Details:** To attend this meeting, please email [abigail.moore@woodplc.com](mailto:abigail.moore@woodplc.com) to request an email invitation. To review the draft plan and provide feedback, visit [www.EnoHawHMP.com](http://www.EnoHawHMP.com).

**Address:** Carrboro, NC 27510

**Email:** [Email](#)

[f](#) [t](#) [m](#)



## APPENDIX B: PLANNING PROCESS DOCUMENTATION

The image is a screenshot of a web browser displaying two pages. The top page is a Facebook post from the 'Town of Carrboro, NC' page. The post, published by Rachel Ward Heggen on May 21 at 11:39 AM, is titled 'Eno-Haw Region Seeks Public Input on Updated Hazard Mitigation Plan'. The text of the post states: 'A virtual public meeting is scheduled for May 28th at 5 pm to be held via video conference. Please email [abigail.moore@woodplc.com](mailto:abigail.moore@woodplc.com) to request an email invitation. Review the draft plan [www.EnoHawHMP.com](http://www.EnoHawHMP.com).' The post features a large image of a smartphone with a purple puzzle piece on its screen that has the word 'feedback' written on it. The Facebook interface shows the page has 3,860 likes, 4,248 followers, and 7,215 check-ins. The bottom page is a web browser showing the 'Stormwater and Erosion Control' division of Durham County, NC. The URL is [dcon.gov/government/departments-a-e/engineering-and-environmental-services/stormwater-and-erosion-control-division](http://dcon.gov/government/departments-a-e/engineering-and-environmental-services/stormwater-and-erosion-control-division). The page header includes the Durham County logo and the tagline 'Live. Grow. Thrive.' There is a search bar and a menu icon. The main content area contains a paragraph: 'regardless of site conditions. This will be done in order to maintain the health, welfare, and safety of the public and of our staff. It is our goal to continue providing excellent service to keep as many of our partners moving forward in their business endeavors while simultaneously protecting public health and fully complying with the public health orders currently in effect.' Below this is an 'Announcements' section with the text: 'The Eno-Haw Region has updated the Hazard Mitigation Plan and is seeking public input on the draft plan. A virtual public meeting is scheduled for Thursday, May 28th at 5 pm to be held via Zoom. To attend this meeting, please email [abigail.moore@woodplc.com](mailto:abigail.moore@woodplc.com) to request an email invitation. To review the draft plan and provide feedback, visit [www.EnoHawHMP.com](http://www.EnoHawHMP.com).' At the bottom is a 'Letters to Industry' section with a list of links: 'December 2019 Letter to Industry: Erosion Control Ordinance Amendments', 'Letter to Industry: Durham County Stormwater Construction Drawing Submittals', 'Letter to Industry: Durham County Erosion Control Ordinance Amendments and Policy Changes', 'Durham County Stormwater Ordinance', 'Plan Submission Overview', 'Standard Details for Sedimentation and Erosion Control', and 'Summary of Latest S & E Ordinance Changes'.

**Town of Carrboro, NC**  
Published by Rachel Ward Heggen (P) · May 21 at 11:39 AM ·

**Eno-Haw Region Seeks Public Input on Updated Hazard Mitigation Plan**  
A virtual public meeting is scheduled for May 28th at 5 pm to be held via video conference. Please email [abigail.moore@woodplc.com](mailto:abigail.moore@woodplc.com) to request an email invitation. Review the draft plan [www.EnoHawHMP.com](http://www.EnoHawHMP.com).

**Community**  
Rebecca Clarridge Buzzard and 35 other friends like this or have checked in  
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regardless of site conditions. This will be done in order to maintain the health, welfare, and safety of the public and of our staff. It is our goal to continue providing excellent service to keep as many of our partners moving forward in their business endeavors while simultaneously protecting public health and fully complying with the public health orders currently in effect.

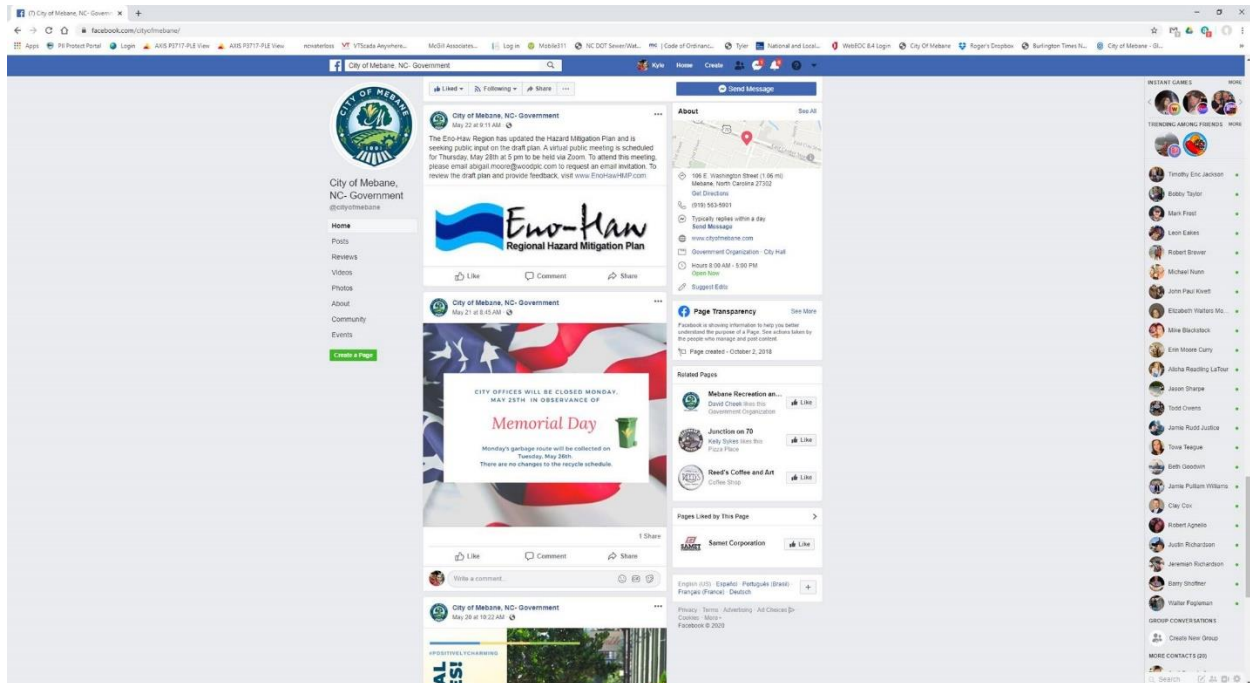
**Announcements:**

The Eno-Haw Region has updated the Hazard Mitigation Plan and is seeking public input on the draft plan. A virtual public meeting is scheduled for Thursday, May 28th at 5 pm to be held via Zoom. To attend this meeting, please email [abigail.moore@woodplc.com](mailto:abigail.moore@woodplc.com) to request an email invitation. To review the draft plan and provide feedback, visit [www.EnoHawHMP.com](http://www.EnoHawHMP.com).

**Letters to Industry**

- December 2019 Letter to Industry: Erosion Control Ordinance Amendments
- Letter to Industry: Durham County Stormwater Construction Drawing Submittals
- Letter to Industry: Durham County Erosion Control Ordinance Amendments and Policy Changes
- Durham County Stormwater Ordinance
- Plan Submission Overview
- Standard Details for Sedimentation and Erosion Control
- Summary of Latest S & E Ordinance Changes

## APPENDIX B: PLANNING PROCESS DOCUMENTATION



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### ENO-HAW HAZARD MITIGATION PLAN PUBLIC MEETING



The Eno-Haw Region has updated the Hazard Mitigation Plan and is seeking public input on the draft plan. A virtual public meeting is scheduled for Thursday, May 28th at 5 pm to be held via Zoom. To attend this meeting please email [abigail.moore@woodplc.com](mailto:abigail.moore@woodplc.com) to request an email invitation. To review the draft plan and provide feedback, visit [www.EnoHawHMP.com](http://www.EnoHawHMP.com).  
Posted on 05/21/2020

Eno-Haw

Regional Hazard Mitigation Plan  
2020



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- About Emergency Services
- CERT Program
- Countywide Radio Communications Project
- Disaster / Emergency Preparedness
- Emergency Medical Technicians
- Emergency Services Partners
- Employment
- Eno-Haw Regional Hazard Mitigation Plan
- Fire Marshal Division
- Five Steps to Neighborhood Preparedness
- Hurricane Florence information
- Hurricane Michael Information

[Home](#) » [Government](#) » [Departments A - F](#) » [Emergency Services](#) » Eno-Haw Regional Hazard Mitigation Plan

## Eno-Haw Regional Hazard Mitigation Plan

### PUBLIC MEETING

Thursday | May 29, 2020 | 5 PM

Held Virtually

Contact Abigail Moore to RSVP at [abigail.moore@woodplc.com](mailto:abigail.moore@woodplc.com)

The Hazard Mitigation Plan is used to identify and reduce risk to natural hazards. The Eno-Haw Region has updated the Hazard Mitigation Plan and is seeking public input on the draft plan at the upcoming meeting.

To review the draft plan and provide feedback, visit [www.EnoHawHMP.com](http://www.EnoHawHMP.com)

### Other Resources

- [Local Mitigation Planning Handbook \(PDF\)](#)
- [Mitigation Ideas \(PDF\)](#)
- [Integrating Hazard Mitigation Into Local Planning \(PDF\)](#)
- [Integrating Historic Property and Cultural Resource Considerations \(PDF\)](#)
- [Building a Disaster Resistant University \(PDF\)](#)

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This is the official Facebook page for Person County, NC Government. Connect with us and see why everything is #BetterInPerson @PersonCountyNC

1,459 people like this including 2 of your friends

1,625 people follow this

### Create Post

[Photo/Video](#) [Check in](#) [Tag Friends](#)

**Person County Government**  
3 mins · [Public](#)

The Eno-Haw Region has updated the Hazard Mitigation Plan and is seeking public input on the draft plan. A virtual public meeting is scheduled for Thursday, May 28th at 5 pm to be held via Zoom. To attend this meeting, please email [abigail.moore@woodplc.com](mailto:abigail.moore@woodplc.com) to request an email invitation. To review the draft plan and provide feedback, visit [www.EnoHawHMP.com](http://www.EnoHawHMP.com)

[ENOHAWHMP.COM](http://ENOHAWHMP.COM)

**Eno-Haw Multi-Jurisdictional Hazard Mitigation Plan**

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## APPENDIX B: PLANNING PROCESS DOCUMENTATION

-New COVID-19 resource: [www.personcountync.gov/response](http://www.personcountync.gov/response)  
-Person County Operations Update April 29, 2020. [Click To Read More.](#)

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# Person County, North Carolina

Everything is Better in Person

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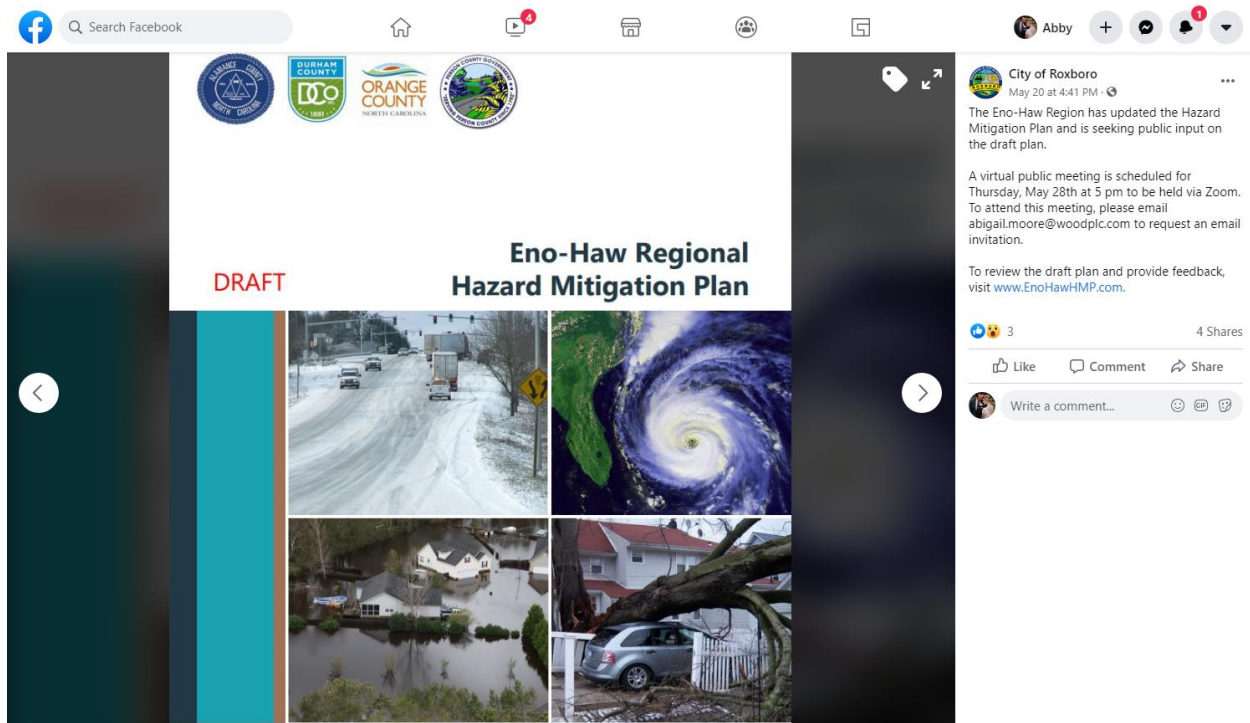
## CALENDAR

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(All Categories) ▼

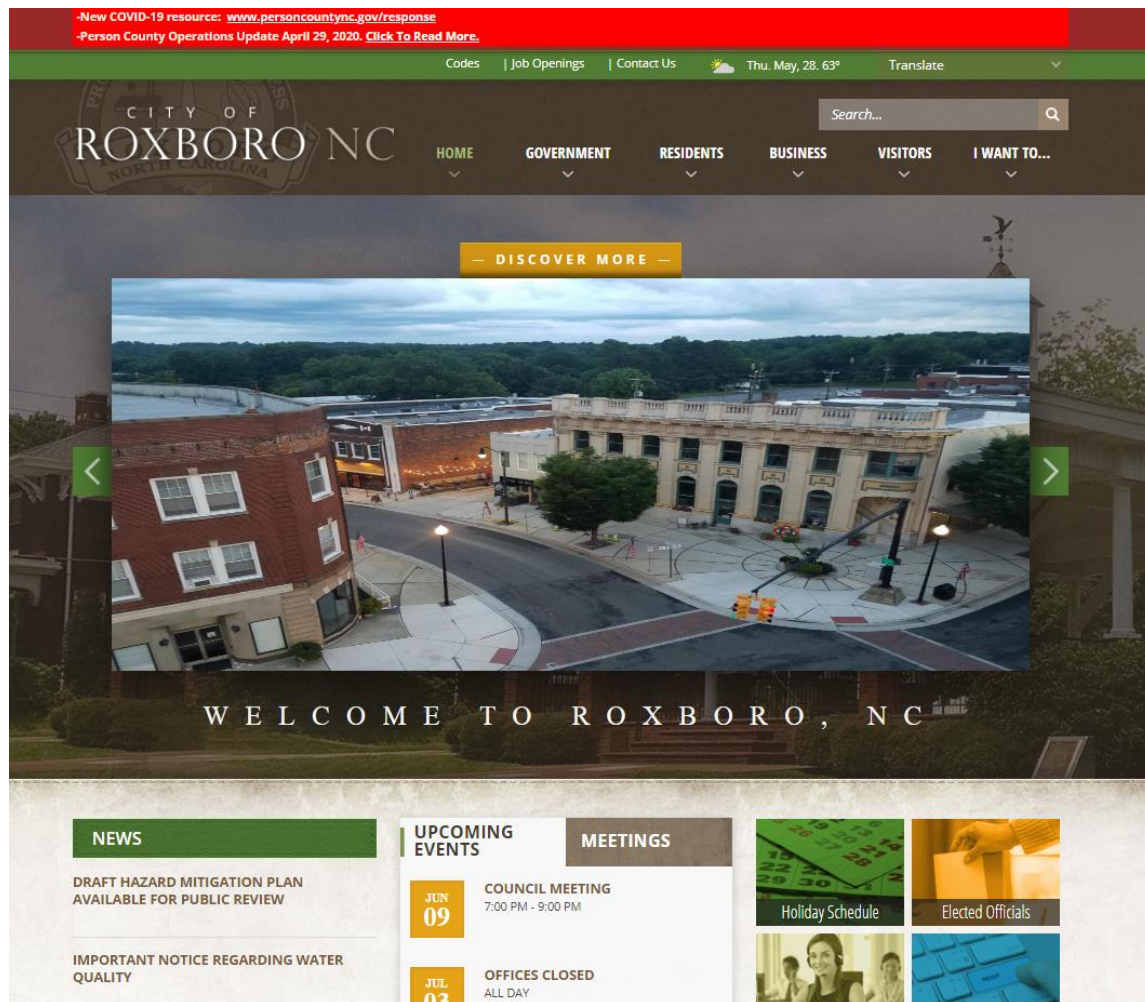
<< Previous Month May 2020 Next Month >>

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
26	27	28	29	30	1	2
3	4	5	6	7	8	9
10	11	12	13	14 7:00 PM CANCELED Planning Board Meeting	15	16
17	18	19 6:00 PM CANCELED Board of Adjustment Meeting	20	21	22	23
24	25	26	27	28 6:00 PM Eno-Haw Hazard Mitigation Plan Public Meeting	29	30
31	1	2	3	4	5	6

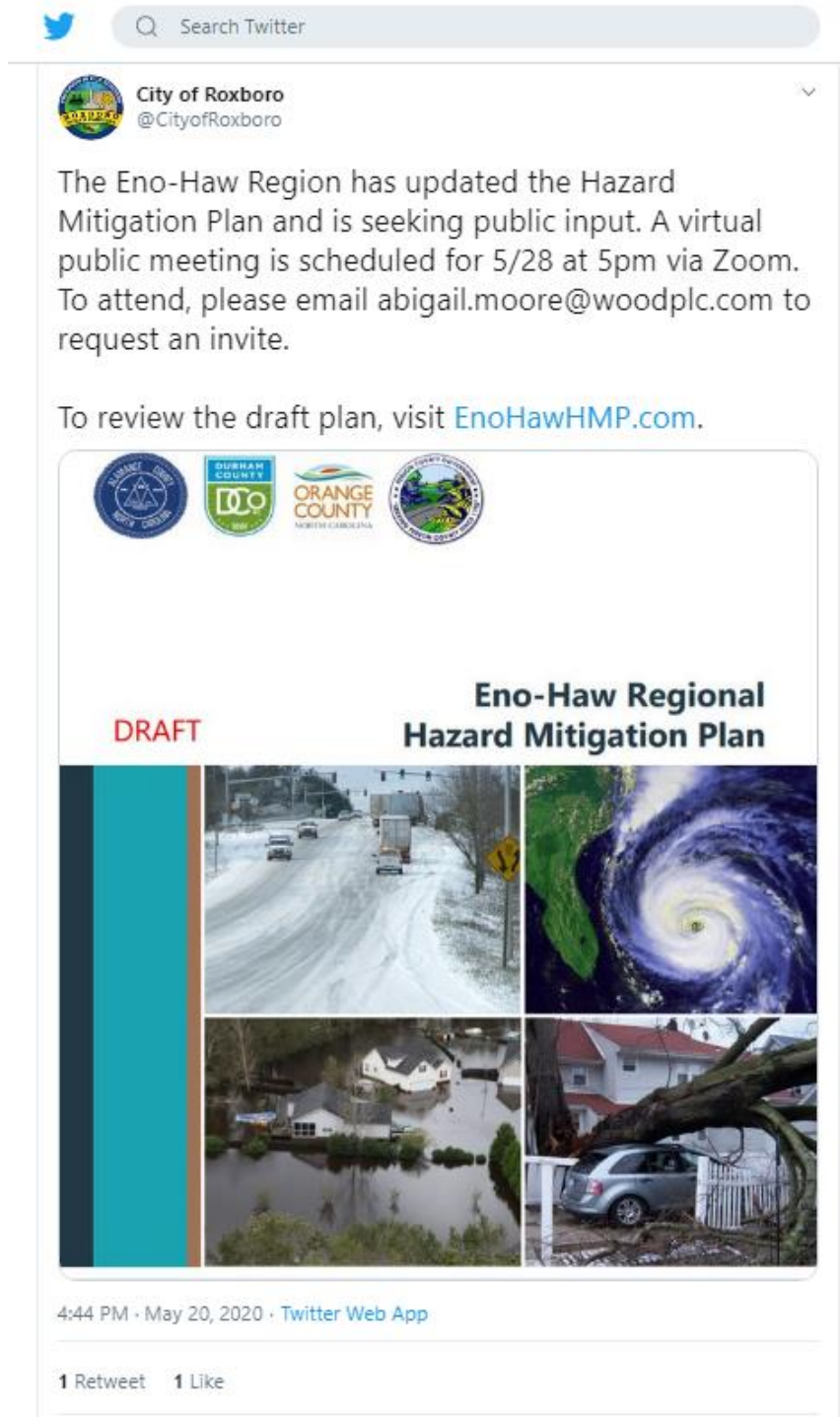




## APPENDIX B: PLANNING PROCESS DOCUMENTATION







## APPENDIX B: PLANNING PROCESS DOCUMENTATION

The image displays two screenshots of digital communication platforms used by the Town of Carrboro, NC.

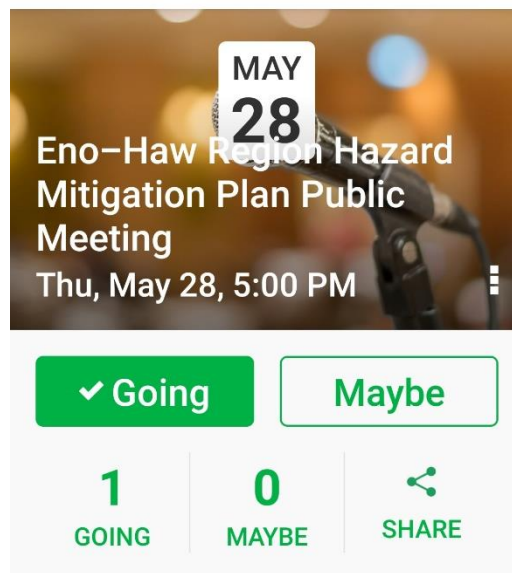
The top screenshot shows the Facebook page for the Town of Carrboro, NC. The page features a navigation menu on the left with options like Home, About, Photos, Reviews, Events, Videos, Posts, Services, Shop, Groups, Notes, and Offers. The main content area displays a post titled "Eno-Haw Region Seeks Public Input on Updated Hazard Mitigation Plan," published by Rachel Ward Heggen on May 26 at 5:53 PM. The post includes a map of the Eno-Haw region and text stating: "A virtual public meeting is scheduled for May 28th at 5 pm to be held via video conference. Please email [abigail.moore@woodplc.com](mailto:abigail.moore@woodplc.com) to request an email invitation. Review the draft plan [www.EnoHawHMP.com](http://www.EnoHawHMP.com)." The right sidebar shows "Page Transparency" information and a list of pages liked by this page, including Carrboro Business Alliance, West End Poetry Festival, and Orange County Animal Services.

The bottom screenshot shows the Nextdoor app interface. The top bar is green with a search bar and navigation icons. The main feed displays a post from the Communications Manager Rachel Heggen, Town of Carrboro, dated 6 days ago. The post is titled "Eno-Haw Region Seeks Public Input on Updated Hazard Mitigation Plan" and includes the same text and link as the Facebook post. Below the post, there are "Thank" and "Comment" buttons, and a note indicating "604 Impressions". A second post is partially visible below, titled "Memorial Day Yard Waste & Loose Leaf Collection Schedule".

## APPENDIX B: PLANNING PROCESS DOCUMENTATION



### ← Event Details



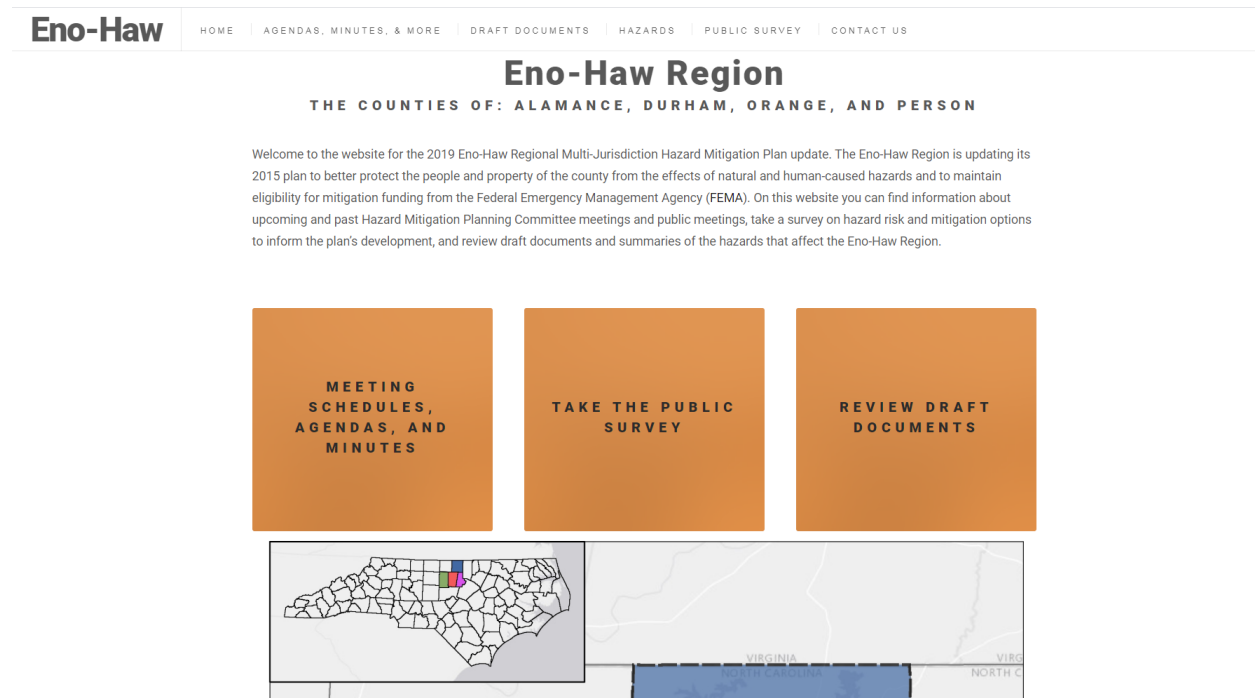
### Details

- 🕒 Thu, May 28, 5:00 PM – 7:00 PM
- 📍 Zoom Virtual Meeting
- 📄 The Eno-Haw Region has updated the Hazard

### Eno-Haw

Regional Hazard Mitigation Plan  
2020

### Plan Website Outreach





### Public Survey

The Eno-Haw Region distributed a public survey, shown below, that requested public input into the Hazard Mitigation Plan planning process and the identification of mitigation activities that could lessen the risk and impact of future flood hazard events. The survey was announced at the first public meeting, provided via a link on participating jurisdictions web and social media accounts, and made available online on the plan website.

### Eno-Haw Regional Hazard Mitigation Plan Public Survey

Online version can be found at: <https://www.surveymonkey.com/r/EnoHawHMP>

Alamance, Durham, Orange, and Person Counties, along with their local jurisdictions, are updating the Eno-Haw Regional Hazard Mitigation Plan to assess and minimize risk to natural hazards. Your participation in this process is important to us. Your input will help us to better understand the vulnerabilities within the region and decide on how to best mitigate or reduce the impacts of these hazards. **Please help us by completing this survey by Friday, November 22<sup>nd</sup> and returning it to:**

Abby Moore, Wood  
4021 Stirrup Creek Drive, Suite 100, Durham, NC 27703  
Or by email to: [abigail.moore@woodplc.com](mailto:abigail.moore@woodplc.com)

This survey can also be completed online at: <https://www.surveymonkey.com/r/EnoHawHMP>

If you have any questions about this survey or want to learn about more ways to participate in the Eno-Haw Regional Hazard Mitigation Plan update, please contact the planning consultant for the project, David Stroud with Wood, at 919-765-9986 or by email at [david.stroud@woodplc.com](mailto:david.stroud@woodplc.com). You can also visit the project website at [www.EnoHawHMP.com](http://www.EnoHawHMP.com).

#### BACKGROUND INFORMATION

1. Where do you live?  
☐ Alamance County  
☐ Durham County  
☐ Orange County  
☐ Person County  
☐ Other: \_\_\_\_\_
2. Do you rent or own your home?  
☐ Rent  
☐ Own
3. How prepared do you feel for a hazard event?  
☐ Not at all prepared      ☐ Somewhat prepared      ☐ Very prepared
4. Do you know where evacuation centers or storm shelters are?  
☐ Yes  
☐ No
5. Are you able to evacuate or take shelter if necessary?  
☐ Yes  
☐ No
6. Do you know where/how to get more information on hazard risk and preparedness?  
☐ Yes  
☐ No

**HAZARD INFORMATION**

7. The hazards addressed in the Hazard Mitigation Plan are listed below. Please indicate the level of significance that you perceive for each hazard. Please rate these hazards 1 through 3 as follows: 1=low, 2=moderate, 3=high.

_____ Dam Failure	_____ Landslide
_____ Drought	_____ Severe Weather (Thunderstorm/Lightning/Hail)
_____ Earthquake	_____ Severe Winter Weather
_____ Extreme Heat	_____ Tornado
_____ Flood	_____ Wildfire
_____ Hurricane & Tropical Storm	_____ Other _____

8. Describe specific hazard issues/problem areas that you would like the planning committee to consider.

9. Describe any actions you have taken to mitigate hazard risk for your family, home, or neighborhood.

10. Which categories of mitigation actions do you feel would be most effective?

- ☐ Preventive activities (e.g. planning and zoning, building codes)
- ☐ Property protection (e.g. retrofitting, insurance, flood prone property buyout)
- ☐ Natural resource protection (e.g. wetlands protection, erosion control, forest health protection)
- ☐ Emergency services (e.g. hazard threat recognition, hazard warning systems, critical facilities protection)
- ☐ Structural projects (e.g. storm drain improvements, hazardous tree removal,
- ☐ Public information (e.g. outreach projects, environmental education, public education)

11. What is the best way for you to receive information about how to make your family, home, or neighborhood more resilient to hazards? Please check all that apply.

- |   |  |
|---|--|
| <input type="checkbox"/> Television News/Advertisements                               | <input type="checkbox"/> County/Local website      |
| <input type="checkbox"/> Radio News/Advertisements                                    | <input type="checkbox"/> County/Local social media |
| <input type="checkbox"/> Public Forums/Workshops                                      | <input type="checkbox"/> Email                     |
| <input type="checkbox"/> Public Library   | <input type="checkbox"/> Text messages             |
| <input type="checkbox"/> Print Media – newspaper, phone book, informational brochures | <input type="checkbox"/> Other _____               |

**Thank you for your input!**

Please provide your name and email below if you would like to be informed of future meetings related to the planning process.

Name: \_\_\_\_\_ Email: \_\_\_\_\_

The Region received 348 responses to the survey. The following bullet points summarize significant findings from the survey. Key questions and responses are detailed in Figure B.1 through Figure B.11.

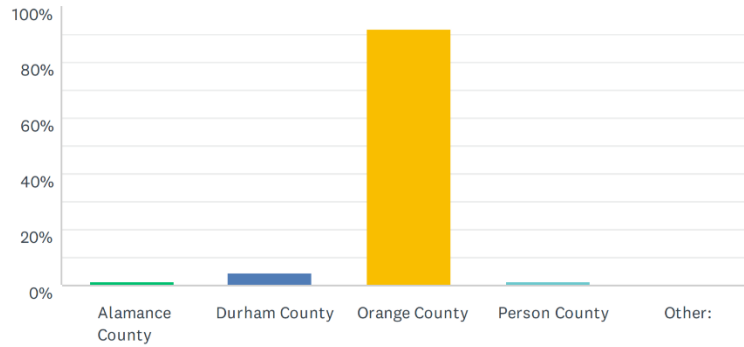
- ▶ 92% of responses came from residents of Orange County.
- ▶ Over 93% of respondents own their home, which indicates ability of those engaged in the mitigation process to implement mitigation on their own properties.
- ▶ Over 86% of respondents feel somewhat prepared or very prepared for a hazard event.
- ▶ 77% of respondents **do not** know where evacuation centers or storm shelters are located; 95.4% say they are able to evacuate or take shelter if necessary.
- ▶ Over 44% of respondents do not know where to get more information on hazard risk and preparedness. More outreach may be needed and it may be beneficial to pursue new methods of outreach.
- ▶ Hurricane was rated the most significant hazard, followed by tornado, severe weather, and extreme heat. Landslide was rated the least significant hazard, followed by earthquake and dam failure.
- ▶ Approximately half of the respondents reported taking steps to mitigate risk at home. Many reported preparedness actions such as emergency kits and supplies and evacuation plans. Some residents reported backup generators. Few respondents noted property protection actions; therefore, these may be important ideas to promote in outreach.
- ▶ Respondents favored natural resource protection, emergency services, and structural projects for mitigation; least favored option was property protection for individual homes.
- ▶ Text message and email were the most preferred methods of communication for information on hazard events.

Figure B.1 – Survey Response, Place of Residence

Eno-Haw Regional Hazard Mitigation Plan Survey

Q1 Where do you live?

Answered: 348 Skipped: 0



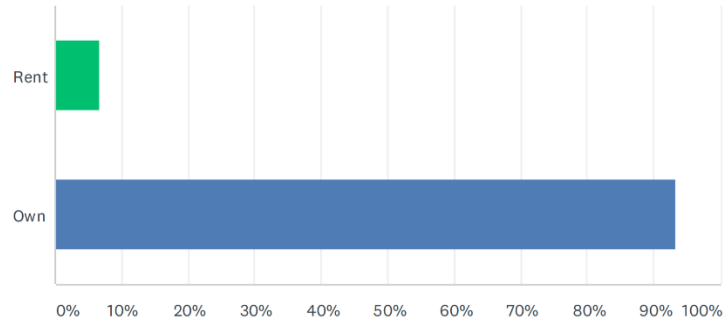
ANSWER CHOICES	RESPONSES	
Alamance County	1.44%	5
Durham County	4.31%	15
Orange County	91.95%	320
Person County	1.72%	6
Other:	0.57%	2
TOTAL		348



Figure B.2 – Survey Response, Home Ownership

Q2 Do you rent or own your home?

Answered: 347 Skipped: 1

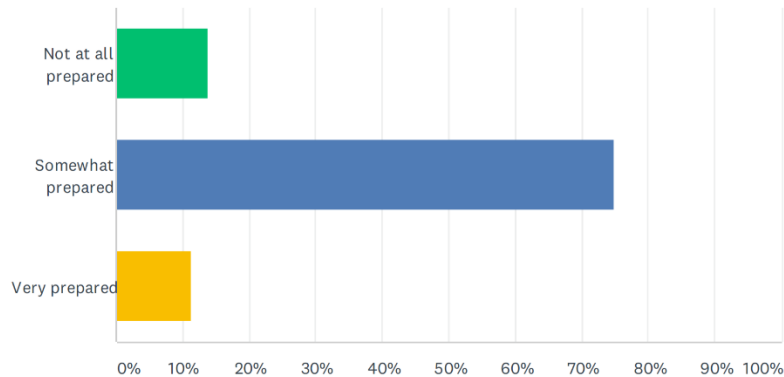


ANSWER CHOICES	RESPONSES	
Rent	6.63%	23
Own	93.37%	324
TOTAL		347

Figure B.3 – Survey Response, Preparedness

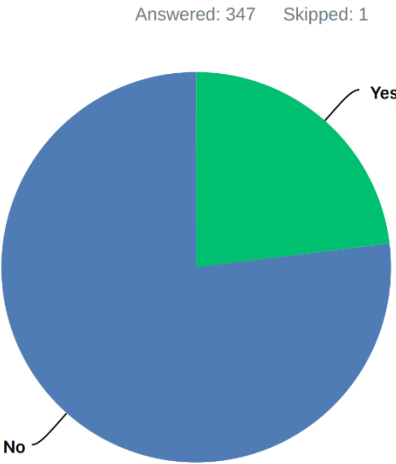
Q3 How prepared do you feel for a hazard event?

Answered: 347 Skipped: 1



ANSWER CHOICES	RESPONSES	
Not at all prepared	13.83%	48
Somewhat prepared	74.93%	260
Very prepared	11.24%	39
TOTAL		347

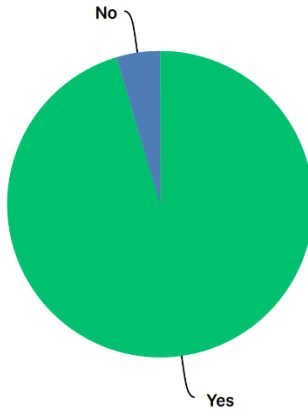
Figure B.4 – Survey Response, Evacuation Center/Shelter Awareness  
Q4 Do you know where evacuation centers or storm shelters are?



ANSWER CHOICES		RESPONSES	
Yes		23.05%	80
No		76.95%	267
TOTAL			347

**Figure B.5 – Survey Response, Ability to Evacuate/Take Shelter**  
**Q5 Are you able to evacuate or take shelter if necessary?**

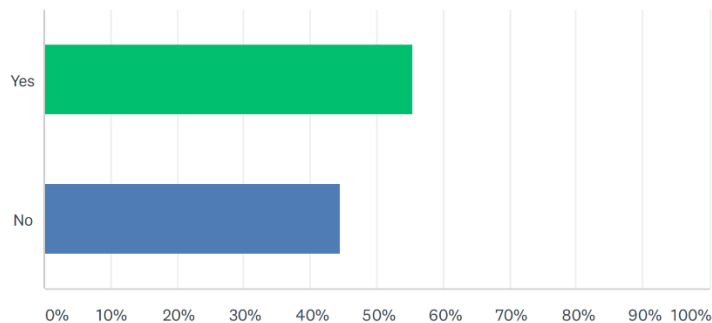
Answered: 347 Skipped: 1



ANSWER CHOICES	RESPONSES	
Yes	95.39%	331
No	4.61%	16
TOTAL		347

**Figure B.6 – Survey Response, Knowledge of Where to Find Hazard Information**  
**Q6 Do you know where/how to get more information on hazard risk and preparedness?**

Answered: 348 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	55.46%	193
No	44.54%	155
TOTAL		348

Figure B.7 – Survey Response, Hazard Significance Ratings

Q7 The hazards addressed in the Hazard Mitigation Plan are listed below. Please indicate the level of significance that you perceive for each hazard. Please rate these hazards 1 through 3 as follows: 1=low, 2=moderate, 3=high.

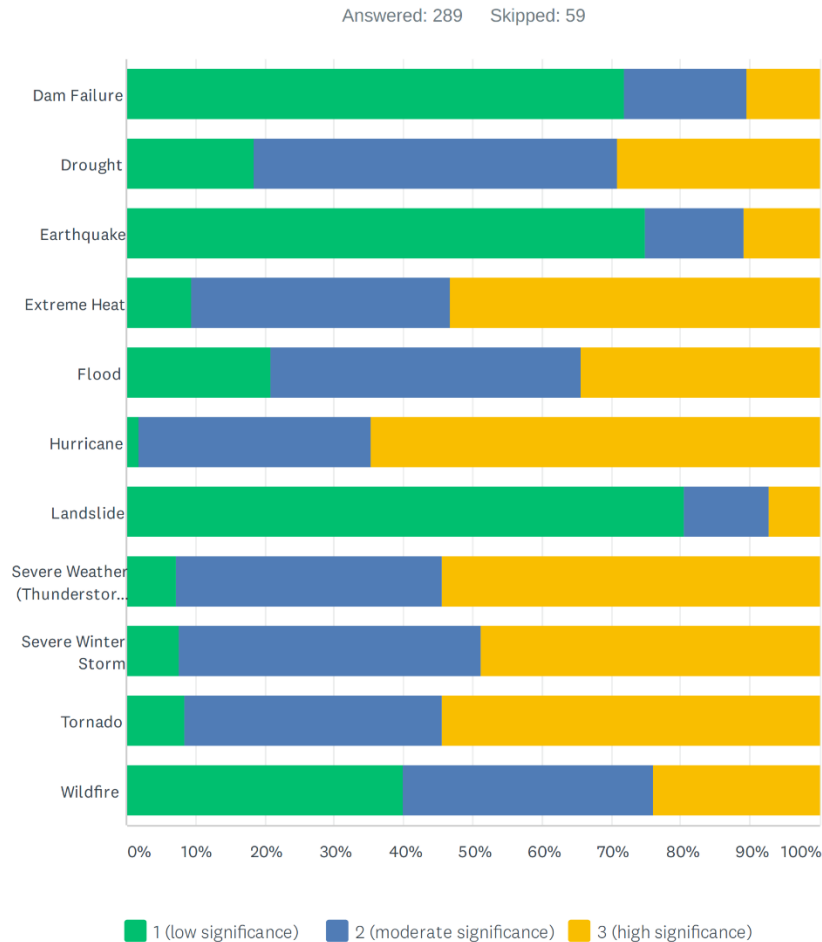
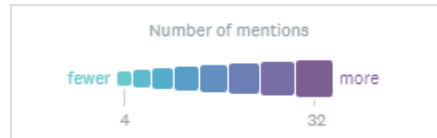
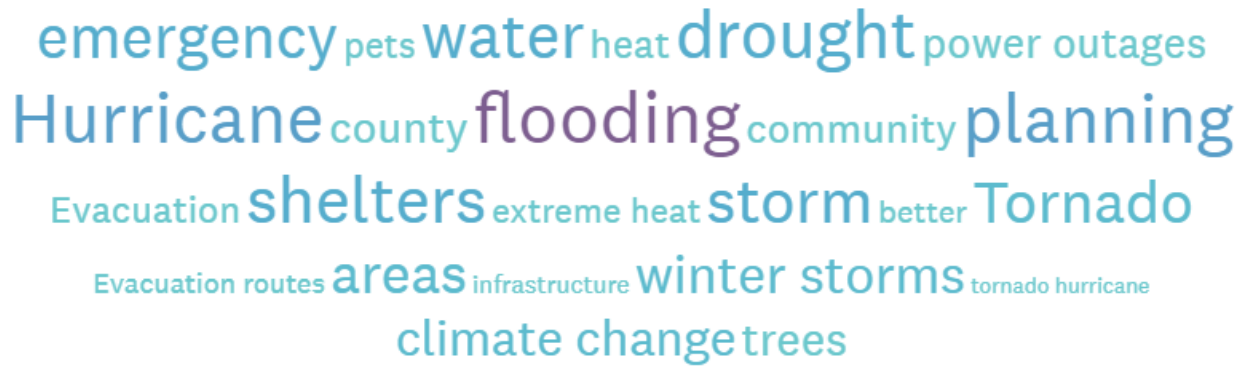




Figure B.8 – Survey Response, Key Hazard Issues/Concerns

Q8 Describe specific hazard issues/problem areas that you would like the planning committee to consider.

Answered: 177 Skipped: 171



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#	RESPONSES	DATE
1	Nuclear power plant event/terrorist activity	3/5/2020 10:20 AM
2	Infectious Disease outbreak	3/1/2020 11:01 PM
3	Create robust urban forest protections around urban FEMA flood plains, increase stormwater infrastructure carrying capacities	12/2/2019 1:09 AM
4	County and City planning keeps putting more development along busy corridors and near within 100 yr flood plains. But these areas are at ever increasing risk due to increased precipitation and climate change. Flooding is a huge issue.	10/15/2019 7:01 PM
5	Rural areas that may become isolated or suffer longer duration events	8/27/2019 7:35 PM
6	assault weapons	8/10/2019 11:10 AM
7	Tornado, snow/ice storm, hurricane. We are frequently without power for days (live near 157/57 intersect in Caldwell). Finding shelter is occasionally difficult.	7/31/2019 1:40 PM
8	I would like the committee to incorporate pets into emergency planning and educating people on not leaving their pets behind!	7/30/2019 6:27 PM
9	Numerous dead trees along the road right of ways pose an ongoing threat to safety. Especially during severe, thunder, snow & ice and the occasional hurricane remnant that sweeps through Orange County.	7/29/2019 4:06 PM
10	?	7/29/2019 6:20 AM
11	Flight patterns in dry conditions Not over forest I lived in Colorado and witnessed Evacuations and had to help my family evacuate. We have several helicopters that fly below the hard deck in the 88 acres behind Mill Creek we are in the orange county area of Mill Creek Mebane North Carolina . There are several dead trees that have fallen riddled with termites additional leaves and if I lightning strike happens or a helicopter goes down it will strike a large fire and that is our fear	7/28/2019 10:36 AM
12	Community Flooding	7/27/2019 1:30 PM
13	There are a lot of cars parked along the sides of two streets in my community. There is only one way out. I think every emergency response team should be aware of which communities have parking issues like this so they can react effectively to our community when there is an emergency.	7/26/2019 10:43 AM
14	Hurricane	7/26/2019 8:46 AM
15	Fire - hurricane	7/25/2019 5:22 PM
16	Evacuation routes	7/25/2019 2:33 PM
17	Water treatment plant failure	7/25/2019 10:44 AM
18	Climate change! Storms, severe weather, heat. Prolonged power outages would mean no access to water for many residents! Emergency vehicles take gas and supplies can be interrupted. Consider getting the electric trucks that are coming out. The county needs to go solar and have back up power capacity for fire stations, but also to decrease fossil fuel use every day to mitigate extreme events related to climate change!	7/25/2019 10:32 AM
19	Flooding is most significant Hazards are more disastrous when utilities are not resilient (notably electric and water), the vulnerabilities in utilities must also be remedied You must consider the impacts of climate change and heightening risk and severity of disasters! 100yr flood level planning is not good enough	7/25/2019 10:01 AM
20	Hurricane	7/25/2019 8:46 AM
21	Flooding, tornadoes, hurricanes	7/25/2019 5:40 AM
22	Flooding	7/25/2019 5:02 AM
23	Loss of drinking water due to electrical outage or pollution of treatment system.	7/24/2019 11:16 PM
24	Drought and what steps to take in an emergency.	7/24/2019 9:11 PM

## APPENDIX B: PLANNING PROCESS DOCUMENTATION

25	All of the above	7/24/2019 6:55 PM
26	animals: having pets protected as well as their people; and evacuating horses/cows/pigs/etc if the barn roof blows off or collapses	7/24/2019 5:02 PM
27	Hurricane/tornado, winter storms would be the most likely to impact where I live	7/24/2019 3:56 PM
28	N/A	7/24/2019 2:13 PM
29	DROUGHT - long term planning on what to do if it happens. RECOVERY from a storm or other disaster - make sure people can get financial assistance AND qualified personnel to do the repairs, and maybe get bill collectors (including the State and County!) to back off until people are back on their feet.	7/24/2019 1:46 PM
30	none	7/24/2019 1:29 PM
31	how to get info. out when internet/phones are down	7/24/2019 1:18 PM
32	A wild fire.	7/24/2019 1:18 PM
33	effect of climate change, lack of basements for shelter against tornados in our area	7/24/2019 12:38 PM
34	At my property 8701 Dodson's Crossroads we were hit hard by the tornado in April. Many of our trees fell into the stream that is in the back of our house. I am concerned about the effect it will have on others downstream from us. But we were told there was nothing that could be done to help us.	7/24/2019 12:14 PM
35	updates on shelter locations	7/24/2019 10:52 AM
36	Heavy rain runoff/drainage and flooding of roads, re-assessment of road/land grading to assist drainage and prevent damage in hilly areas where settling or shifting has occurred.	7/24/2019 10:27 AM
37	excessive heat	7/24/2019 10:18 AM
38	traffic patterns to get in or out of community in a disaster	7/24/2019 10:04 AM
39	Nuclear fallout shelters	7/24/2019 8:52 AM
40	better communication with residents during power outages related to winter storms, etc	7/24/2019 8:13 AM
41	Tornadoes and hurricanes	7/24/2019 8:13 AM
42	Clearing roadways after storm events.	7/24/2019 7:35 AM
43	Severe Winter and Severe Storms,	7/24/2019 6:17 AM
44	I think your survey covers them all	7/24/2019 5:40 AM
45	Fire, hurricane, drought—but we need to be prepared for other things given the state of the world- cyber war, nuclear attack, etc. what would happen if the power grid shuts down for weeks or longer?	7/24/2019 5:39 AM
46	Don't know	7/24/2019 4:41 AM
47	Heat, flooding, & stormwater mitigation.	7/24/2019 1:26 AM
48	Blackwood	7/24/2019 12:05 AM
49	Extreme weather	7/23/2019 11:59 PM
50	all of the above is sufficient	7/23/2019 11:54 PM
51	Flooding in neighborhoods south of Eastgate.	7/23/2019 11:45 PM
52	Recovery...it took us 4 months to finally get help for repairs post Fran...6 months before work completed. Post flood recovery quickly and complete.	7/23/2019 11:38 PM
53	severe weather and heat	7/23/2019 9:32 PM
54	With climate change, planning should include drought, extreme heat, flooding and hurricanes.	7/23/2019 9:31 PM
55	Plan for pets in emergencies. Provision of vegan/vegetarian foods. Thanks	7/23/2019 9:17 PM
56	Flooding and impacts of climate change	7/23/2019 8:54 PM

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57	Riots	7/23/2019 8:47 PM
58	All types of severe weather	7/23/2019 8:29 PM
59	Drought considerations for rural individuals with wells	7/23/2019 8:17 PM
60	Prolonged water or electric service interruption	7/23/2019 7:54 PM
61	Civil Unrest	7/23/2019 7:53 PM
62	None	7/23/2019 7:39 PM
63	Evacuation notification & routes	7/23/2019 7:33 PM
64	NA	7/23/2019 7:28 PM
65	Evacuation plan. It's difficult enough getting through rush hour traffic. How can we all evacuate?	7/23/2019 7:10 PM
66	What to have on hand at all times, specific to highly possible hazard situations.	7/23/2019 7:04 PM
67	hurricane	7/23/2019 7:03 PM
68	none	7/23/2019 7:00 PM
69	flooding	7/23/2019 6:45 PM
70	Ice storms, hurricanes, wind storms, nuclear plant, trees falling, lack of communication, cyberattacks. Why do they allow low-income housing to continue in flood-prone areas?	7/23/2019 6:38 PM
71	Na	7/23/2019 6:33 PM
72	.	7/23/2019 6:31 PM
73	Drought	7/23/2019 6:21 PM
74	Severe weather, location of emergency shelters	7/23/2019 6:20 PM
75	housing pets (of all sorts)	7/23/2019 6:15 PM
76	Droughts	7/23/2019 6:10 PM
77	You're doing a great job!	7/23/2019 6:01 PM
78	Informing the public about locations of shelters and other hazard mitigation practices.	7/23/2019 6:00 PM
79	Hurricanes	7/23/2019 5:49 PM
80	Over-development leading to flooding/erosion	7/23/2019 5:34 PM
81	toxic water sources	7/23/2019 5:14 PM
82	Tornado/hurricane shelters. We don't have a basement in the house, and don't know where we could safely hide in case of a serious tornado/hurricane.	7/23/2019 5:00 PM
83	People want to keep their pets. Some way must be found for them to have food, water & a place to bathroom is owners are in shelters.	7/23/2019 4:47 PM
84	Falling trees from storms.	7/23/2019 4:42 PM
85	Civil unrest	7/23/2019 4:33 PM
86	Major outage in the Regional Electrical Supply system. Major outage in one of the Public Water Supply systems	7/23/2019 4:31 PM
87	Lack of water - if the county or a city within the county were to run out of water	7/23/2019 4:17 PM
88	Roads	7/23/2019 4:10 PM
89	Evacuation routes	7/23/2019 4:10 PM
90	Severe weather	7/23/2019 4:09 PM
91	Care for the vulnerable during extreme weather.	7/23/2019 4:04 PM
92	Flooding	7/23/2019 4:00 PM



## APPENDIX B: PLANNING PROCESS DOCUMENTATION

93	Flooding	7/23/2019 4:00 PM
94	/a	7/23/2019 3:54 PM
95	Stormwater management. Helping home owners do a better job of making their own homes more resilient - i.e. planting drought resistant species.	7/23/2019 3:31 PM
96	?	7/23/2019 3:30 PM
97	Power outages, downed trees	7/23/2019 3:30 PM
98	Flooding	7/23/2019 3:27 PM
99	Planning for extreme heat and drought.	7/23/2019 3:20 PM
100	Mosquito vectors (Aedes) with climate change	7/23/2019 3:20 PM
101	Transportation out	7/23/2019 3:18 PM
102	Publicize location of emergency shelters, e.g. are all public schools shelters?	7/23/2019 3:17 PM
103	moving electrical wires underground, so not so many power outages	7/23/2019 3:16 PM
104	Prolonged power outage scenario impacting rural communities includes water (well pump stops) possibly septic if on a pump versus gravity. Heating, cooling, medical equipment, cooking needs all require backup plans and adequate supplies (batteries, solar powered cell phone chargers, etc). The power grid infrastructure is outdated, fragile and very hackable.	7/23/2019 3:16 PM
105	Ensuring all residents receive timely and useful information to prepare for and respond in emergencies.	7/23/2019 3:15 PM
106	Where I live the biggest threat is falling trees causing damage to homes and power lines and blocking roads.	7/23/2019 3:09 PM
107	Easy to understand printed details of available shelter, rescue, and transportation resources that are planned by government to be available during severe emergencies such as tornadoes, floods, wildfires, or earthquakes.	7/23/2019 3:08 PM
108	Downed trees that close roads. Loss of power.	7/23/2019 3:04 PM
109	Winter Storm preparedness (including keeping the power grid active)	7/23/2019 3:03 PM
110	weather issues that will pollute well water	7/23/2019 2:55 PM
111	Are there any Tornado/Storm Shelters in the vicinity of Meadowmont? (Many of us lack a basement.)	7/23/2019 2:54 PM
112	N/A	7/23/2019 2:53 PM
113	power outages because of storms	7/23/2019 2:52 PM
114	.	7/23/2019 2:51 PM
115	Flooding in rural areas near creeks,rivers.	7/23/2019 2:51 PM
116	Road usage during an emergency	7/23/2019 2:47 PM
117	Small stream flooding. Side road flooding, specifically Efland-Cedar Grove rd and side streets off of it.	7/23/2019 2:47 PM
118	Hurricane	7/23/2019 2:44 PM
119	flooding is a major issue for anyone near a creek or storm drain. over development has worsened this.	7/23/2019 2:44 PM
120	increased runoff due to clearcutting and construction causing flooding	7/23/2019 2:44 PM
121	For my pets to have a safe place too	7/23/2019 2:44 PM
122	ensure electricity is available - effort needs to be made by Piedmont Electric to clear trees that are hazards to power lines	7/23/2019 2:43 PM
123	Power failure during winter storms	7/23/2019 2:41 PM

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124	flooding, drought	7/23/2019 2:39 PM
125	Power outages created by winter storm.	7/23/2019 2:39 PM
126	Plan to restrict development in and near flood plains. Program to plant trees and native plants to reduce runoff. Invasive removal from creek areas.	7/23/2019 2:38 PM
127	How to get disabled people and their pets to safety	7/23/2019 2:37 PM
128	Severe storm damage where many people loose power for extended time.	7/23/2019 2:34 PM
129	Trees falling is our biggest fear since we are in the county.	7/23/2019 2:32 PM
130	Man made disaster	7/23/2019 2:29 PM
131	The degree to which construction and new building increases flooding, extreme heat (trees and plantings cool the Earth), and the impact severe winter weather through over crowding. New construction needs to be REQUIRED to mitigate these hazards.	7/23/2019 2:29 PM
132	Alien invasion	7/23/2019 2:27 PM
133	With all the growth around the west ten buckhorn area look at the traffic now and how to evacuate the area of needed?	7/23/2019 2:27 PM
134	Hurricane	7/23/2019 2:26 PM
135	clean water during times of emergency	7/23/2019 2:24 PM
136	Better consideration of communication and utilities restoration	7/23/2019 2:24 PM
137	Preventive action to ensure utility services and infrastructure is prepared to handle likely disasters with a minimum of disruption.	7/23/2019 2:22 PM
138	Hurricanes	7/23/2019 2:21 PM
139	disruption of drinking water supply, multiple simultaneous blocked roads	7/23/2019 2:21 PM
140	Right-wing violence	7/23/2019 2:20 PM
141	Hurricane e and Tornado	7/23/2019 2:19 PM
142	Climate Change	7/23/2019 2:17 PM
143	tornado & hurricane preparedness	7/23/2019 2:17 PM
144	Flooding of the Eno River in Hillsborough	7/23/2019 2:17 PM
145	Micro grid (renewable) backup power for critical infrastrucure.	7/21/2019 12:39 PM
146	Flooding (flash floods), winter storm events, severe thunderstorms	7/18/2019 3:11 PM
147	Contaminated groundwater for homes on wells.	7/17/2019 9:46 PM
148	Drinking water safety and availability; cyber security of our resources/ability to execute our hazard mitigation plans	7/17/2019 8:59 PM
149	Haven't thought about it before but thanks for doing this!	7/17/2019 11:54 AM
150	Cyber incidents involving utilities. Food and health emergencies.	7/15/2019 3:50 PM
151	Chemical/radiological spills/release	7/15/2019 11:34 AM
152	Wildfire education	7/15/2019 11:13 AM
153	Evacuation routes and service plans to distribute food/water/shelter if required	7/14/2019 12:58 AM
154	No	7/12/2019 7:43 PM
155	Help for low-income families to find shelter before, during, and after a hazard as well as assistance to recover.	7/12/2019 3:45 PM
156	Protection of the environment (land, air, water, wildlife)	7/12/2019 12:17 PM
157	Hurricanes, flood events, and winter storms seem to be the most pressing issues, especially as event intensity increases with climate change.	7/12/2019 11:17 AM

## APPENDIX B: PLANNING PROCESS DOCUMENTATION

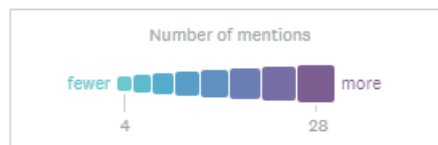
158	wildfires during droughts	7/12/2019 11:07 AM
159	Severe flooding and impacts from winter weather (particularly when it comes to infrastructure)	7/12/2019 9:47 AM
160	Hurricane, tornado, drought	7/12/2019 7:21 AM
161	In case of severe flooding, it would be great if I knew in advance of leaving my home of whether or not certain roads are flooded. Is there a way to warn folks in specific locations that they are essentially stranded due to high water on all surrounding roads?	7/12/2019 12:30 AM
162	Evacuation routes	7/11/2019 8:43 PM
163	While I remember last year seeing signs indicating that some areas were no longer considered at risk from floods, I'm not sure if new flood prone areas are identified.	7/11/2019 8:38 PM
164	airborne dangers such as gas or chemical spills.	7/11/2019 8:03 PM
165	Traffic flow and parking if evacuation is required. Knowing where the nearest shelter is located isn't all that helpful if you can't get there.	7/11/2019 7:39 PM
166	Tornado/windstorm warning	7/11/2019 7:27 PM
167	Flash flooding	7/11/2019 6:47 PM
168	transportation for older residents trapped in homes	7/11/2019 5:51 PM
169	Storm water-related flooding due to inadequate ordinances and outdated infrastructure.	7/11/2019 3:42 PM
170	Severe Weather	7/11/2019 3:17 PM
171	Na	7/1/2019 10:11 AM
172	Communities that are more vulnerable to severe weather events such as mobile home parks and other low income housing.	6/18/2019 3:41 PM
173	Evacuation of elderly and disabled	5/29/2019 4:09 PM
174	Drought, wells going dry	5/20/2019 8:40 PM
175	flooding and extreme heat	5/20/2019 4:26 PM
176	Hazardous Chemicals and Radioactive sources are moved throughout the region on a daily basis. What plans/public education do we have to mitigate/minimize/eliminate the hazards associated with these materials. For instance, the gas explosion in downtown. (Not exactly a traditional mode of transit for material, but a pipeline could as easily have caused such a disaster had it been struck by building crews, and that is one method of transporting a hazardous chemical.)	5/20/2019 3:56 PM
177	Flooding of streams and rivers cutting off transportation due to bridges being out. Lack of high speed internet access to northern parts of the county make access to information difficult.	5/20/2019 3:25 PM

Figure B.9 – Survey Response, Personal Actions Taken for Mitigation

Q9 Describe any actions you have taken to mitigate hazard risk for your family, home, or neighborhood.

Answered: 195 Skipped: 153

gas etc bottled water power outages power heat hand well plans kit  
trees removed keep emergency kit food batteries  
generator storm water flashlights supplies family  
home stocked emergency Alerts prepared evacuation  
food water CERT trained none weather alerts house





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#	RESPONSES	DATE
1	safety plan, discussion	3/5/2020 10:20 AM
2	air filter, water filter, flash light, canned foods, weather radio	3/1/2020 11:01 PM
3	We participate(d) in urban stream cleanups, reduce water usage, protect trees, report water main and sewer breaks, and subscribe to emergency notifications	12/2/2019 1:09 AM
4	Discussing the issue.	8/27/2019 7:35 PM
5	bottled water supply, canned goods	8/10/2019 11:10 AM
6	CERT trained, OC alerts & other notification systems, keep 3 days of supplies in go bag or shelter in place, back up water and power	8/4/2019 3:17 PM
7	Purchased a portable generator that runs the whole house. Stash of supplies, e.g., gallon jugs of water, canned and dried foods.	7/31/2019 1:40 PM
8	I have an emergency preparedness kit as well as an evacuation plan if necessary	7/30/2019 6:27 PM
9	As an active CERT team member, I have applied my training to improve our level of preparedness for extreme event, volunteered to assist county EM Services and helped my immediate elderly neighbors prepare and tide out such events.	7/29/2019 4:06 PM
10	?	7/29/2019 6:20 AM
11	In North Carolina the residence for some reason think it's OK to dump dead trees in the woods instead of having them hold off so we do not have forest fires this is what my plan my families plan has been we take out the dead leaves we have removed dead trees and limbs from the forest but yesterday I literally watched a neighbor cut up a tree and haul the dead items to the woods and leave it . In Colorado and in California the wildfires were devastating and yes, they can jump Streets And roads/ highways! There is no public service in North Carolina to stop dumping in the forest. To clean up the forest and to hold people accountable for when trees die and fall in their property.	7/28/2019 10:36 AM
12	Box for hurricane/winter weather preparedness.	7/27/2019 1:30 PM
13	Good drainage, few tall trees, supplies for the home, people, and pets. Cash and cars gassed when danger imminent.	7/26/2019 12:03 PM
14	None	7/26/2019 10:43 AM
15	Just insurance on home, nothing else	7/26/2019 8:46 AM
16	Know where to go and what to take	7/26/2019 8:18 AM
17	Power generator - home on a higher level - gas in container on site - food available	7/25/2019 5:22 PM
18	I don't live in a flood area. I live in a neighborhood where we cooperate and take care of each other when necessary.	7/25/2019 2:33 PM
19	We have a safe room in our basement in case of tornado or hurricane and we have a generator for power outages.	7/25/2019 1:01 PM
20	Solar array with Tesla power walls. Can self power in outages to run my well, etc. am shifting as many farm tools over to electric charged battery power. Ex- just got a battery powered chain saw. I am planning to but an electric truck when they come out and then an electric car so could self power vehicles locally in emergency and to decrease fossil fuel use. Just got a battery powered electric riding lawn mower which I use to haul items about the farm... could also be handle in clearing trees or debris if access to gas is unavailable	7/25/2019 10:32 AM
21	There is not much that I can do because I am a short term renter, apart from having my own emergency kit	7/25/2019 10:01 AM
22	None	7/25/2019 8:46 AM
23	Preparing with supplies (food, water, etc). Planning to stay elsewhere if our home is at risk.	7/25/2019 5:40 AM
24	food and water supply. alternative cooking methods like propane or wood.	7/24/2019 11:16 PM
25	Generator & transfer switch, water & non perishable food	7/24/2019 9:11 PM

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26	Emergency supplies, contact info of family members, evacuation plan	7/24/2019 6:55 PM
27	none	7/24/2019 6:15 PM
28	organized disaster supplies in one place; installed a whole-house generator; will soon remove a tree leaning toward the house; got some education about disaster preparedness; started a Community Watch and have improved communications within our neighborhood	7/24/2019 5:02 PM
29	Compiling drinking water, evacuation kit, etc.	7/24/2019 3:56 PM
30	Prepared for up to a month without services. CERT training.	7/24/2019 2:13 PM
31	New roof; cutting back trees which might damage the house; recent replacement of HVAC (should help with heat spells).	7/24/2019 1:46 PM
32	all drainage is not blocked, dead limbs have taken care of. We have a basement with water, flashlights, and medicine	7/24/2019 1:29 PM
33	have bottled water& flashlights	7/24/2019 1:18 PM
34	Assigning places to take cover.	7/24/2019 1:18 PM
35	extra bottled water	7/24/2019 12:38 PM
36	I would very much appreciate any help that can be given to clear any of the tree debris. Not just current concern over the downstream effect of the trees but also wildfire concern over the next few years as the trees decompose and become a hazard for us as well as our neighbors. I have requested help but again have been told there is nothing that can be done. I have no money to pay to have any of these trees to be cleared. So am unable to do anything at this point.	7/24/2019 12:14 PM
37	Stash water, we have a wood stove to provide heat if we lose power, keep car gas tank at least 1/3 full	7/24/2019 10:56 AM
38	generator, emergency supplies of food and water	7/24/2019 10:52 AM
39	I have had a stone wall put in to prevent my uphill neighbor's bad runoff from washing away my driveway. I have had some drains put in next to the house that steer water to the drainage creek. I will be having some grading work done next to parts of the house to prevent heavy rain getting into the crawl space or pooling in the yard.	7/24/2019 10:27 AM
40	Joined CERT	7/24/2019 10:18 AM
41	none	7/24/2019 10:04 AM
42	awareness of low-lying areas; stocking of firewood; emergency supplies--food, medicine, coolers, ice, batteries, water, etc.--receive alerts from Weather Underground, UNC and Orange County	7/24/2019 8:59 AM
43	Emergency and first aid kits, storm radio, fire extinguishers, iodine tabs, Cipro, camp gear	7/24/2019 8:52 AM
44	have a generator	7/24/2019 8:13 AM
45	Neighborhood has loose plan for checking on each other. We have plenty of provisions, a generator and are prepared for extended periods without power.	7/24/2019 8:13 AM
46	Try to keep trees that are dead or leaning toward house cut.	7/24/2019 7:35 AM
47	Have access to a generator, and made general plans with near by family members	7/24/2019 6:17 AM
48	Listen to radio. Know neighbors. Have fire extinguishers. Have metal collapsible ladder for second floor. Have fire alarms and CO detectors.	7/24/2019 5:44 AM
49	storm and winter preperation	7/24/2019 5:40 AM
50	The usual ... storage of some food and water, first aide supples etc. not prepared the way FEMA would advise.	7/24/2019 5:39 AM
51	Emergency water and food supplies	7/24/2019 4:41 AM
52	Engaging community in stormwater mitigation policy and infrastructure management. Advocate for our local stormwater utility. Working with the NC DEQ Environmental Justice and Equity Advisory Board on climate change resilience, response and mitigation.	7/24/2019 1:26 AM

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53	Nothing	7/24/2019 12:05 AM
54	First aid, water, check house for hazard	7/23/2019 11:59 PM
55	none	7/23/2019 11:54 PM
56	Have water stored along with hand crank radio.	7/23/2019 11:45 PM
57	Keep trees away from house. Have bag prepped for 24 hours no electricity. Alert on phone. Flashlights.	7/23/2019 11:38 PM
58	procurement of generator	7/23/2019 11:12 PM
59	We installed a generator.	7/23/2019 10:43 PM
60	none	7/23/2019 9:32 PM
61	Assessing tree health on property annually, have evacuation plan in case of hurricanes, devises are connected with OC alerts, have list of contact information of neighbors and checking in protocol.	7/23/2019 9:31 PM
62	Try to keep mobile phone charged	7/23/2019 9:17 PM
63	Just moved in no actions taken yet	7/23/2019 8:54 PM
64	clearing trees/branches from around our house.	7/23/2019 8:41 PM
65	Back up electrical power. Safe room in lower level.	7/23/2019 8:29 PM
66	Storm preparedness. Saws and such	7/23/2019 8:17 PM
67	Keep bottled water and food pantry at home, keep gas in car, register for emergency alerts, share info with neighbors on Nextdoor	7/23/2019 7:54 PM
68	Discussed plans for self, husband and 4 dogs wthusband and brother & family	7/23/2019 7:53 PM
69	Ice storms have taken down tall trees near house. One grazed house. Plan to remove tall leaners near house. Have gas camping stoves, fuel, canned goods, tents, sleeping bags, flashlights, water set aside.	7/23/2019 7:39 PM
70	Able to be self-sufficient for 1-2 weeks	7/23/2019 7:33 PM
71	Extra water bottles, water for flushing when power out, kids all know Safe Spot in house, canned foods and shoes by door, meeting place designated in case we are separated	7/23/2019 7:28 PM
72	Family knows where to go in bad weather. Keep bottled water, lamps, flashlights and batteries on hand.	7/23/2019 7:13 PM
73	Smoke detectors, CO detectors, exit routes from house, plans to met if we get separated, who to contact.	7/23/2019 7:04 PM
74	weather alerts, emergency kit, CERT	7/23/2019 7:03 PM
75	no action but know what to do.	7/23/2019 7:00 PM
76	disaster preparedness supplies home repairs/remodeling	7/23/2019 6:45 PM
77	Installing a whole-house backup generator	7/23/2019 6:38 PM
78	Pay attention to reports from officials. Heed warnings. Prepare for event accordingly.	7/23/2019 6:33 PM
79	.	7/23/2019 6:31 PM
80	Extra water on hand for power outages to drink, flush commode, bathe.	7/23/2019 6:21 PM
81	Brush and overgrowth removal, CERT kits and training, water and food supply, bought house above100 year flood plane	7/23/2019 6:20 PM
82	?	7/23/2019 6:15 PM
83	Food, water and alternate power source	7/23/2019 6:10 PM
84	Staying informed and prepared in advance whenever possible.	7/23/2019 6:01 PM

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85	Keeping emergency food,water, and medical supplies on hand and keeping a gas tank at least half full.	7/23/2019 6:00 PM
86	Bought generator	7/23/2019 5:49 PM
87	We try to leave nature as it is exists on our property.	7/23/2019 5:34 PM
88	none	7/23/2019 5:14 PM
89	additional food storage, a lantern, and a power bank	7/23/2019 5:00 PM
90	None	7/23/2019 4:47 PM
91	Draw water for loss of power. Allow slow drip for frozen pipes.	7/23/2019 4:42 PM
92	Stored moderate amount of food and water	7/23/2019 4:33 PM
93	Think about potential hazards and think about potential solutions.	7/23/2019 4:31 PM
94	We have some emergency supplies	7/23/2019 4:17 PM
95	Generator	7/23/2019 4:10 PM
96	Shelter in place and go bags	7/23/2019 4:10 PM
97	Helped form a neighborhood action plan in case of an emergency event.	7/23/2019 4:09 PM
98	Gathered extreme weather/hurricane supplies.	7/23/2019 4:04 PM
99	Always keep generator half full of gas, spare propane tanks, canned food, garden going, Skilled sportsman and dresser of meat, etc	7/23/2019 4:04 PM
100	Had a perimeter drain installed around my home and had a drainage ditch dug to drain into the creek behind my house	7/23/2019 4:00 PM
101	N/a	7/23/2019 3:54 PM
102	Planting drought resistant species, buying a generator	7/23/2019 3:31 PM
103	?	7/23/2019 3:30 PM
104	Prepare before hurricane severe winter storms, store water, havea medications, gas for generator	7/23/2019 3:30 PM
105	Proper drainage away from home	7/23/2019 3:27 PM
106	Stash of cash, gas, chain saw, generator, water.	7/23/2019 3:25 PM
107	Information	7/23/2019 3:20 PM
108	Cellphone	7/23/2019 3:18 PM
109	Trimmed trees. Got new roof.	7/23/2019 3:17 PM
110	installed generator	7/23/2019 3:16 PM
111	Permanent generator, solar panels (will not produce if grid is down), water supply if well pump out, propane cooktop, grill, hot water. Solar cooking oven, wood for outdoor fire for cooking, distilling water (have supplies) wood also for woodstove for heat indoors. Variety of batteries for weather radio, flashlights. Canned food with hand can opener, non-perishable foods and drinks that are rotated. Key meds are kept stocked and rotated. First aid kits. Looking at compost toilet for backup if septic fails (first hand experience). Chain saws for downed trees, tractor to move or pull things. Let me know if you think of anything else!	7/23/2019 3:16 PM
112	Home and car preparation kits. Follow local government and emergency services on Facebook and a Twitter.	7/23/2019 3:15 PM
113	Having vulnerable trees and branches removed.	7/23/2019 3:09 PM
114	We've a supply of bottled water, spare batteries, fire extinguishers, alarms, access to a church facility, family in Raleigh, are fully insured, and have easy communication with nearby neighbors & HOA.	7/23/2019 3:08 PM
115	Maintain a 72 hour kit.	7/23/2019 3:04 PM



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116	have supplies	7/23/2019 3:03 PM
117	have chainsaws, generator, axes, saws, other tools	7/23/2019 3:03 PM
118	store water, gas stove, wood stove	7/23/2019 2:55 PM
119	I get Orange County weather alerts (phone) and watch WRAL when weather threatens. Also keep an eye on surroundings, e.d., building drainage, post deluge, and notify appropriate folks when I see things that don't look right.	7/23/2019 2:54 PM
120	Keep trees trimmed, have extra water and batteries on hand, have tarps.	7/23/2019 2:53 PM
121	emergency kit	7/23/2019 2:52 PM
122	.	7/23/2019 2:51 PM
123	Signed up for updates on our phones and email, watch the news...also have prepared evacuation kits, discussed routes to use.	7/23/2019 2:51 PM
124	We have a generator	7/23/2019 2:47 PM
125	We have water stored up. If we lose power we lose our well pump. We have some food stored up. We try to keep our trees trimmed.	7/23/2019 2:47 PM
126	Émergence supplies stashed	7/23/2019 2:44 PM
127	properly stage irrigation, properly trim trees, additional undisclosed preparations	7/23/2019 2:44 PM
128	cut down trees that look like they are not healthy, installed a generator	7/23/2019 2:44 PM
129	Have stocked food and pet food. Extra medication. A generator in place	7/23/2019 2:44 PM
130	have water and food resources	7/23/2019 2:43 PM
131	Food supply, meeting location, safer area in case of tornadoes	7/23/2019 2:41 PM
132	reduce water usage in time of drought and stockpile water in times of need.	7/23/2019 2:39 PM
133	Portable generators	7/23/2019 2:39 PM
134	Maintain tree canopy and reduce lawn. No pesticides. Compost Now subscription. Keep supply of potable water.	7/23/2019 2:38 PM
135	Fire extinguisher, security system, food in the pantry, water, generator	7/23/2019 2:37 PM
136	Prepare for power outages and keep supplies on hand.	7/23/2019 2:34 PM
137	We leave when hurricanes predicted	7/23/2019 2:32 PM
138	We have a rope ladder for the third floor, food and water supplies for the whole family for one week and we never let the cars get below half a tank of gas. We keep flashlights and first aid kits in location that everyone knows.	7/23/2019 2:29 PM
139	Storm prep	7/23/2019 2:27 PM
140	Installed a generator	7/23/2019 2:26 PM
141	storing water, having back up food and ways to heat our home and cook without electricity	7/23/2019 2:24 PM
142	Water and food on hand.	7/23/2019 2:24 PM
143	Go bag, emergency supplies, generator. escape plans, rendezvous plans, pet considerations Situational awareness. Participation with local FD	7/23/2019 2:24 PM
144	I keep trees away from the house and have a rock barrier around it.	7/23/2019 2:23 PM
145	prepare emergency kit	7/23/2019 2:23 PM
146	Selecting a home well above the 100-year flood zone, and installation of a generator.	7/23/2019 2:22 PM
147	Stock items at home such as food n watet	7/23/2019 2:21 PM
148	emergency shelter access within home, emergency water and food and medical supplies, up to date vaccines,	7/23/2019 2:21 PM

## APPENDIX B: PLANNING PROCESS DOCUMENTATION

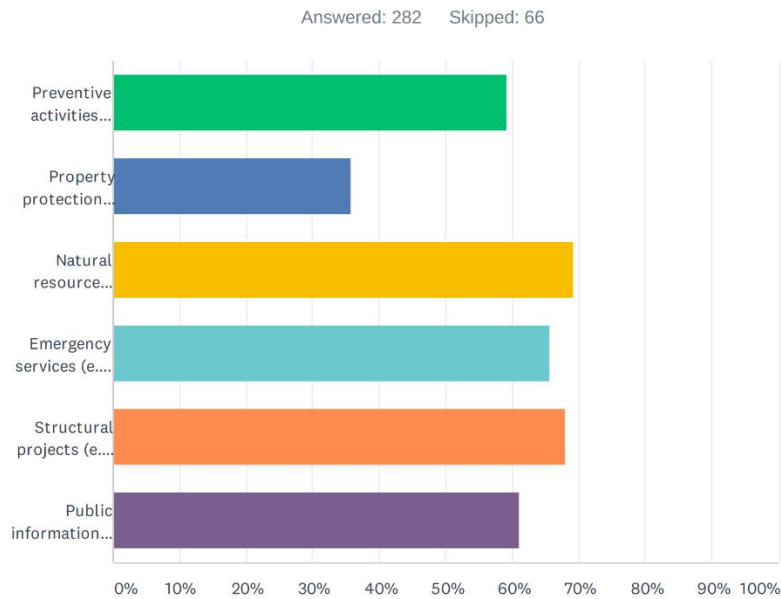
149	Generator, pellet stove, well stocked pantry	7/23/2019 2:20 PM
150	Planting a 2 acre forest garden, with rainwater collection, soil building, food, native plants and very carbon friendly processes.	7/23/2019 2:19 PM
151	None	7/23/2019 2:19 PM
152	We just moved and are establishing a plan.	7/23/2019 2:17 PM
153	?	7/23/2019 2:17 PM
154	We bought flood insurance for the first time this year	7/23/2019 2:17 PM
155	Backup generator, whole house, except HVAC. Includes well pump, and Jotul propane stove will heat the house.	7/23/2019 2:16 PM
156	Educate myself. aware of my surroundings. know my neighbors	7/21/2019 12:39 PM
157	Take down large tree in that could fall on property.	7/18/2019 10:45 AM
158	Established go-bags and a family kit for fast evacuation. Supply of cash on hand. Backup generator, and supply of bottled water. Cash and water bottles in each vehicle.	7/17/2019 9:46 PM
159	Plant trees and vegetation; conserve water; secured important papers; have cash on hand	7/17/2019 8:59 PM
160	Plan to improved drainage around house.	7/17/2019 11:54 AM
161	none	7/16/2019 9:06 AM
162	We built a house that far exceeds code requirements thus providing a safe place for most emergencies. We have sufficient food and water on hand for 5 days at most times. We have emergency packs in progress for the two people and two dogs in the house. One member of the house is CERT trained.	7/15/2019 3:50 PM
163	Safe room, emergency supplies for 3 weeks, ability to quickly evacuate	7/15/2019 11:34 AM
164	We know where to go as a family in the home if there's a threat and we generally have water stored and propane to cook with. Also candles and extra batteries	7/14/2019 12:58 AM
165	No no	7/12/2019 7:43 PM
166	Neighborhood is well-connected and would reach out and help any in need. Alerts from Orange County and news would help us to prepare in advance.	7/12/2019 3:45 PM
167	Do not spray poisons, conserve water, sustainable plant-based diet, reduce waste, reuse & recycle.	7/12/2019 12:17 PM
168	Chose community, neighborhood, house with safety in mind.	7/12/2019 11:17 AM
169	proper supply of emergency supplies	7/12/2019 11:07 AM
170	Storm preparedness kits, important documents kept in a safe place, and advanced preparation (ex. gas in the car before a storm)	7/12/2019 9:47 AM
171	Emergency kit	7/12/2019 7:21 AM
172	prepare for most type storms	7/12/2019 5:39 AM
173	Solar Panels, weapon in the home,	7/11/2019 9:16 PM
174	Very little.	7/11/2019 8:43 PM
175	To mitigate flooding in my woods, I've removed debris (i.e. garbage from upstream) jamming up the small stream and stop moving more areas to retain and slow water from flowing downstream.	7/11/2019 8:38 PM
176	Emergency kit with food, hand-crank radio, and other supplies	7/11/2019 8:30 PM
177	We have a go-bag, a crank-powered radio, a solar cell phone charger.	7/11/2019 8:03 PM
178	Pruning of branches around my house (mitigates fire risk); installed new roof and new HVAC in the last few years (mitigates against storm damage and excess heat).	7/11/2019 7:39 PM

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179	Flashlights, power cellphones in advance	7/11/2019 7:27 PM
180	Removed trees near home, prepared to-go bags, have a family safety plan for tornado, fire, evacuation, etc., keep battery radios, chargers, etc. on hand, try to be weather alert & signed on to national & local alert systems	7/11/2019 7:19 PM
181	Have a generator with extra fuel. Trimmed tree limbs around the house.	7/11/2019 5:51 PM
182	sandbags, emergency supplies - food, water, evacuation packing list	7/11/2019 5:46 PM
183	Purchased flood insurance. Food and water for at least one week	7/11/2019 5:29 PM
184	Sealed and raised crawl space, snow and ice shield on roof, storm doors, action plan, weather radios, emergency and first aid supplies.	7/11/2019 3:42 PM
185	CERT Training	7/11/2019 3:17 PM
186	Removing overhanging trees/branches, maintaining private shared road, knowing neighbors, keeping emergency supplies on hand.	7/11/2019 7:42 AM
187	We have a generator for extended periods of power loss.	7/6/2019 9:36 AM
188	I have food and water stored and am working on getting a generator.	7/1/2019 10:11 AM
189	Clear trees around house, keep drains clear of obstruction, fire alarms/sprinklers	6/27/2019 9:43 AM
190	I receive weather alerts. I have a basement for things like tornadoes. I improved the drainage in the basement after it flooded in a big storm.	6/18/2019 3:41 PM
191	Stock supplies for sheltering in place, planned evacuation routes, eliminate potential hazards such as dead or dying trees around the property	5/29/2019 4:09 PM
192	Emergency generator, rain cisterns	5/20/2019 8:40 PM
193	planted trees	5/20/2019 4:26 PM
194	Prayer. First aid kit(s)/medical supplies & medication pls. Food/water packs. Pet food/water packs. Utensil packs. Heating source. Cooling source. Battery pack/charging station. Shovels. Blankets. Waterproof clothing.	5/20/2019 3:56 PM
195	Generator, non perishable foods, bottled water, 4-wheel drive vehicles	5/20/2019 3:25 PM

Figure B.10 – Survey Response, Preferred Mitigation Categories

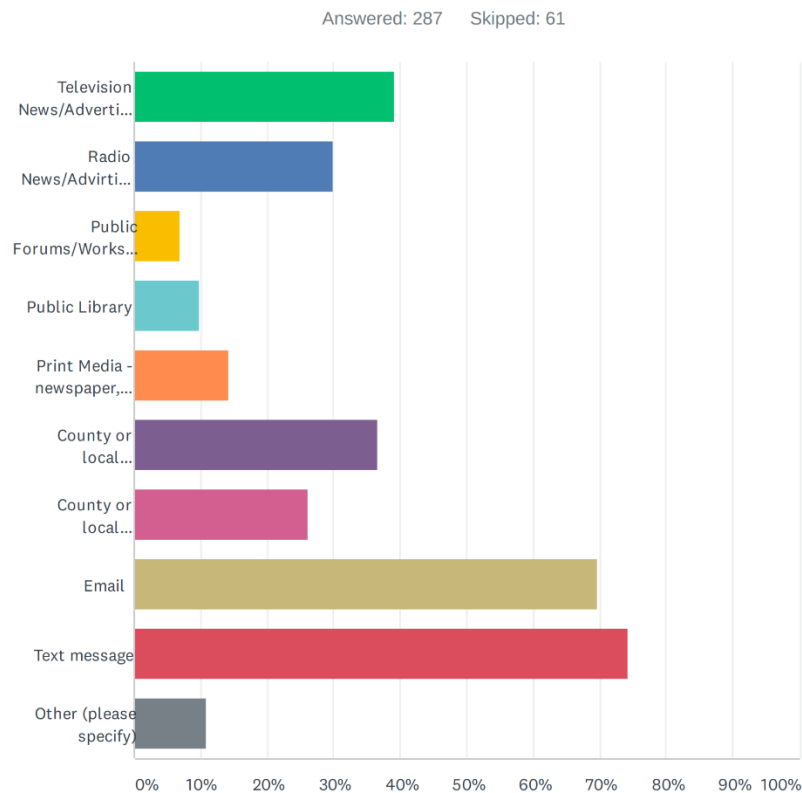
Q10 Which categories of mitigation actions do you feel would be most effective?



ANSWER CHOICES	RESPONSES	
Preventive activities (e.g. planning and zoning, building codes)	59.22%	167
Property protection (e.g. retrofitting, insurance, flood prone property buyout)	35.82%	101
Natural resource protection (e.g. wetlands protection, erosion control, forest health protection)	69.15%	195
Emergency services (e.g. hazard threat recognition, hazard warning systems, critical facilities protection)	65.60%	185
Structural projects (e.g. storm drain improvements, hazardous tree removal,	68.09%	192
Public information (e.g. outreach projects, environmental education, public education)	60.99%	172
Total Respondents: 282		

Figure B.11 – Survey Response, Preferred Public Outreach Methods

Q11 What is the best way for you to receive information about hazard events? Please check all that apply.





### PLANNING STEP 3: COORDINATE

This planning step credits the incorporation of other plans and other agencies' efforts into the development of the Hazard Mitigation Plan. Other agencies and organizations must be contacted to determine if they have studies, plans and information pertinent to the Hazard Mitigation Plan, to determine if their programs or initiatives may affect the community's program, and to see if they could support the community's efforts. To incorporate stakeholder input into the plan, a variety of stakeholders were identified by the HMPC and sent an email inviting them to attend a public meeting, review the draft plan, and provide feedback and comments. The coordination letter sent via email is provided below. A list of stakeholders detailing their involvement is provided in Table B.3.

Stakeholders were also involved through specific requests for data to support the development of the plan.

#### Moore, Abigail

**From:** Moore, Abigail  
**Sent:** Tuesday, May 26, 2020 1:17 PM  
**To:** bholman@conservationfund.org; NCWARN@NCWARN.ORG; kskinner@tno.org;  
 tania.dautlick@durhamnc.gov; ImpactAlamance@conehealth.com; barry.porter@redcross.org;  
 jony@communityef.org; rhows@triangleland.org; pbaldwin@chccs.k12.nc.us;  
 pascal.mubenga@dpsnc.net; petersonr@person.k12.nc.us; todd.wirt@orange.k12.nc.us;  
 william\_benson@abss.k12.nc.us; egsegianr@durhamtech.edu; david.prevatte@alamancecc.edu;  
 dhjeter@unc.edu; john.noonan@duke.edu; blynch@caswellcountync.gov;  
 mhoagland@caswellcountync.gov; jbowles@co.rockingham.nc.us; don@readyguilford.com;  
 jared.byrd@randolphcountync.gov; steve.newton@chathamnc.org; joshua.creighton@wakegov.com;  
 doug.logan@granvillecounty.org; roy.mcclure@fema.dhs.gov; Edwardine.Marrone@fema.dhs.gov;  
 ktodd@ISO.com; jbratcher@iso.com; sharper@iso.com; ewstrom@usgs.gov;  
 Dan.Brubaker@ncdps.gov; jcrew@ncem.org; john.holley@ncdenr.gov; linda.culpepper@ncdenr.gov;  
 tim.baumgartner@ncdenr.gov; Thompson, Hannah; eugene.washington@duke.edu;  
 wburks@email.unc.edu; jsimmons@carolinachamber.org; matt@downtownchapelhill.com;  
 jessica@burlingtondowntown.com; chamber@roxboronc.com; geoffdurham@durhamchamber.org  
**Cc:** Stroud, David A  
**Subject:** Eno-Haw HMP Final Public Meeting

Good afternoon,

Alamance, Durham, Orange, and Person Counties have developed an update to the 2015 Eno-Haw Regional Hazard Mitigation Plan and the 2015 Person-Roxboro Hazard Mitigation Plan. To assist with this process, the Counties and the Hazard Mitigation Planning Committee are seeking your input and expertise to support our planning effort.

We invite you to attend a public information meeting on the draft plan to be held on Thursday, May 28<sup>th</sup> at 5 p.m. via a Zoom conference call. In an effort to maintain security of the call, **please reply to this email if you would like to receive a link to access the call.** Additionally, a full draft of the plan has been posted for review at <http://www.enohawhmp.com/draftDocuments.html>. Please email any comments or feedback on the draft plan to me at [abigail.moore@woodplc.com](mailto:abigail.moore@woodplc.com). We appreciate any input you may have!

Thank you for your assistance in this important effort to make our communities safer and more resilient to hazards!

**Abby Moore, CFM**  
 Hazard Mitigation & Resiliency Planner  
 Direct: +1 (919) 768 9927  
[www.woodplc.com](http://www.woodplc.com)



**Table B.3 – Stakeholder List**

First Name	Last Name	Organization, Title
<i>Non-Profit Organizations</i>		
Bill	Holman	The Conservation Fund, North Carolina State Director
Connie	Leeper	NC WARN
Katherine	Skinner	The Nature Conservancy, Executive Director North Carolina
Tania	Dautlick	Keep Durham Beautiful, Executive Director
Tracey	Grayzer	Impact Alamance, President
Barry	Porter	American Red Cross Triangle Area - Regional CEO
Jon	Young	Community Empowerment Fund, Co-Director
Bo	Howes	Triangle Land Conservancy, Director
<i>Educational Institutions</i>		
Dr. Todd	Wirt	Orange County Schools, Superintendent
Dr. Pamela	Baldwin	Chapel Hill-Carborro City Schools, Superintendent
Dr. Pascal	Mubenga	Durham Public Schools, Superintendent
Dr. Rodney	Petermson	Person County Schools, Superintendent
W. Bruce	Benson	Alamance Burlington School System, Superintendent
Randall	Egsegian	Durham Tech Public Safety Services Dean
David	Prevatte	Alamance County Community College, Director of Public Safety
Darrell	Jeter	UNC-CH Emergency Management and Planning Director
John	Noonan	Duke University, Vice President Facilities
<i>Surrounding Municipalities</i>		
Barry	Lynch	Caswell County Emergency Management Coordinator
Matthew	Hoagland	Caswell County Planning Director
Johnny	Bowles	Rockingham County Emergency Management Director
Don	Campbell	Guilford County Emergency Management Division Director
Major Jared	Byrd	Randolph County Emergency Management, Major
Steve	Newton	Chatham County Emergency Management Director
Joshua	Creighton	Wake County Emergency Management Deputy Director
Doug	Loan	Granville County Emergency Services Director
<i>Federal Government</i>		
Roy	McClure	FEMA NFIP/CRS Specialist
Edwardine	Marrone	FEMA Mitigation Planning Specialist
Mandy	Todd	ISO/CRS Specialist
Mike	Bratcher	ISO/CRS Specialist
Sherry	Harper	ISO/CRS Technical Coordinator
Eric	Strom	USGS - Raleigh Field Office
<i>State Government</i>		
Dan	Brubaker	State NFIP Coordinator
Chris	Crew	State Hazard Mitigation Officer
John	Holley	NCDENR - Land Quality Section Regional Office
Linda	Culpepper	DEQ Division of Water Resources, Director
Tim	Baumgartner	DEQ Division of Mitigation Services, Director
Hannah	Thompson-Welch	NC Forest Service, Wildfire Mitigation Specialist
Andy	Brown	NCDOT Division 4
<i>Business Community</i>		
Eugene	Washington	Chancellor for Health Affairs, Duke Hospital

## APPENDIX B: PLANNING PROCESS DOCUMENTATION

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First Name	Last Name	Organization, Title
Wesley	Burks	CEO of UNC Health Care
Justin	Simmons	Vice President, Chapel Hill-Carborro Chamber
Matt	Gladdek	Downtown Chapel Hill, Executive Director
Jessica	Pasion	Burlington Downtown Corporation, Executive Director
Lisa	Busjahn	Roxboro Chamber of Commerce, Director
Geoff	Durham	Greater Durham Chamber of Commerce, President

## Appendix C Mitigation Alternatives

**44 CFR Subsection D §201.6(c)(3)(ii): [The mitigation strategy section shall include] a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new buildings and infrastructure. All plans approved by FEMA after October 1, 2008, must also address the jurisdiction's participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.**

As part of the process of developing the mitigation action plans found in Section 7, the HMPC reviewed and considered a comprehensive range of mitigation options before selecting the actions identified for implementation. This section summarizes the full range of mitigation measures evaluated and considered by the HMPC, including a review of the categories of mitigation measures outlined in the 2017 CRS Coordinator's Manual, a discussion of current local implementation and CRS credits earned for those measures, and a list of the specific mitigation projects considered and recommended for implementation.

Mitigation alternatives identified for implementation by the HMPC were evaluated and prioritized using the criteria discussed in Section 6 of this plan.

### C.1 CATEGORIES OF MITIGATION MEASURES CONSIDERED

Once it was determined which flood hazards warranted the development of specific mitigation actions, the HMPC analyzed viable mitigation options that supported the identified goals and objectives. The HMPC was provided with the following list of mitigation categories which are utilized as part of the CRS planning process.

- ▶ Prevention
- ▶ Property Protection
- ▶ Natural Resource Protection
- ▶ Structural Projects
- ▶ Emergency Services
- ▶ Public Information and Outreach

### C.2 ALTERNATIVE MITIGATION MEASURES PER CATEGORY

Note: the CRS Credit Sections are based on the 2017 CRS Coordinator's Manual.

#### C.2.1 Preventative and Regulatory Measures

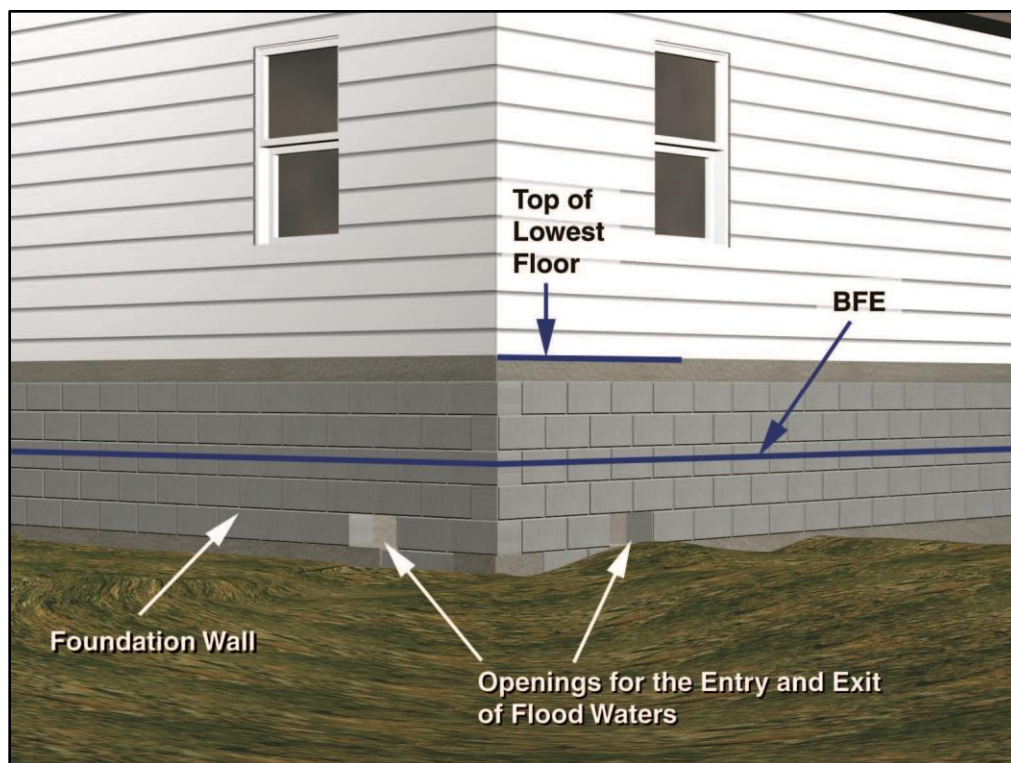
Preventative measures are designed to keep a problem - such as flooding - from occurring or from getting worse. The objective of preventative measures is to ensure that future development is not exposed to damage and does not cause an increase in damages to other properties. Building, zoning, planning and code enforcement offices usually administer preventative measures. Some examples of types of preventative measures include:

- ▶ Building codes
- ▶ Zoning ordinance
- ▶ Comprehensive or land use plan
- ▶ Open space preservation
- ▶ Floodplain regulations
- ▶ Subdivision regulations
- ▶ Stormwater management regulations

### Building Codes

Building codes provide one of the best methods for addressing natural hazards. When properly designed and constructed according to code, the average building can withstand many of the impacts of natural hazards. Hazard protection standards for all new and improved or repaired buildings can be incorporated into the local building code. Building codes can ensure that the first floors of new buildings are constructed to be higher than the elevation of the 100-year flood (the flood that is expected to have a one percent chance of occurring in any given year). This is shown in Figure B.1.

Just as important as having code standards is the enforcement of the code. Adequate inspections are needed during the course of construction to ensure that the builder understands the requirements and is following them. Making sure a structure is properly elevated and anchored requires site inspections at each step.



Source: FEMA Publication: *Above the Flood: Elevating Your Floodprone House*, 2000

**Figure B.1 – Building Codes and Flood Elevations**

ASCE 24 is a referenced standard in the International Building Code. Any building or structure that falls within the scope of the IBC that is proposed in a flood hazard area is to be designed in accordance with ASCE 24. Freeboard is required as a function of the nature of occupancy and the flood zone. Dwellings and most other buildings have 1-foot of freeboard; certain essential facilities have 2-3 feet; only agricultural facilities, temporary facilities and minor storage facilities are allowed to have their lowest floors at the BFE.

### Comprehensive or Land Use Plan

Building codes provide guidance on how to build in hazardous areas. Planning and zoning activities direct development away from these areas, particularly floodplains and wetlands. They do this by designating



land uses that are compatible with the natural conditions of land that is prone to flooding, such as open space or recreation.

### **Open Space Preservation**

Keeping the floodplain and other hazardous areas open and free from development is the best approach to preventing damage to new developments. Open space can be maintained in agricultural use or can serve as parks, greenway corridors and golf courses.

Comprehensive and capital improvement plans should identify areas to be preserved by acquisition and other means, such as purchasing an easement. With an easement, the owner is free to develop and use private property, but property taxes are reduced or a payment is made to the owner if the owner agrees to not build on the part set aside in the easement.

Although there are some federal programs that can help acquire or reserve open lands, open space lands and easements do not always have to be purchased. Developers can be encouraged to dedicate park land and required to dedicate easements for drainage and maintenance purposes.

### **Zoning Ordinance**

Zoning enables a community to designate what uses are acceptable on a given parcel. Zoning can ensure compatibility of land use with the land's level of suitability for development. Planning and zoning activities can also provide benefits by allowing developers more flexibility in arranging improvements on a parcel of land through the planned development approach. Zoning regulations describe what type of land use and specific activities are permitted in each district, and how to regulate how buildings, signs, parking, and other construction may be placed on a lot. Zoning regulations also provide procedures for rezoning and other planning applications. The zoning map and zoning regulations provide properties with certain rights to development.

### **Floodplain Regulations**

A Flood Damage Prevention Ordinance sets development standards for Special Flood Hazard Areas (SFHAs). Communities participating in the National Flood Insurance Program (NFIP) are required to adopt a flood damage prevention ordinance that meets at least the minimum standards of the NFIP; however, a community can incorporate higher standards for increased protection. For example, communities can adopt higher regulatory freeboard requirements, cumulative substantial damage definitions, fill restrictions, and other standards.

Another important consideration in floodplain regulations is the protection of natural and beneficial functions and the preservation of natural barriers such as vegetation. Vegetation along a stream bank is extremely beneficial for the health of the stream. Trees and other plants have an extensive root system that strengthen stream banks and help prevent erosion. Vegetation that has sprouted up near streams should remain undisturbed unless removing it will significantly reduce a threat of flooding or further destruction of the stream channel.

### **Stormwater Management Regulations**

Stormwater runoff is increased when natural ground cover is replaced by urban development. Development in the watershed that drains to a river can aggravate downstream flooding, overload the community's drainage system, cause erosion, and impair water quality. There are three ways to prevent flooding problems caused by stormwater runoff:

- 1) Regulating development in the floodplain to ensure that it will be protected from flooding and that it won't divert floodwaters onto other properties;

- 2) Regulating all development to ensure that the post-development peak runoff will not be greater than it was under pre-development conditions; and
- 3) Set construction standards so buildings are protected from shallow water.

### Reducing Future Flood Losses

Zoning and comprehensive planning can work together to reduce future flood losses by directing development away from hazard prone areas. Creating or maintaining open space is the primary way to reduce future flood losses.

Planning for open space must also be supplemented with development regulations to ensure that stormwater runoff is managed and that development is protected from flooding. Enforcement of the flood damage prevention ordinance and the flood protection elevation requirement provides an extra level of protection for buildings constructed in the planning area.

Stormwater management and the requirement that post-development runoff cannot exceed pre-development conditions is one way to prevent future flood losses. Retention and detention requirements also help to reduce future flood losses.

### CRS Credit

The CRS encourages strong building codes. It provides credit in two ways: points are awarded based on the community's Building Code Effectiveness Grading Schedule (BCEGS) classification and points are awarded for adopting the International Code series. In North Carolina, communities are limited by the State Building Code Council which has not implemented the most current version of the International Building Code.

CRS credits are available for regulations that encourage developers to preserve floodplains or other hazardous areas away from development. There is no credit for a plan, only for the enforceable regulations that are adopted pursuant to a plan. Communities in the Eno-Haw Region could receive credit for Activity 430 – Higher Regulatory Standards and for Activity 420 – Open Space Preservation for preserving parcels within the SFHA as open space. Preserving flood prone areas as open space is one of the highest priorities of the Community Rating System. The credits in the 2017 manual have doubled for OSP (Open Space Preservation). The participating communities could also receive credit for Activity 450 – Stormwater Management for enforcing regulations for stormwater management and soil and erosion control. Several prevention actions considered by the HMPC are detailed below.

**Table C.1 – Prevention Mitigation Options and Recommended Projects**

Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
<b>Prevention Measures Considered by HMPC and Not Recommended</b>			
-	Continue enforcement of state building codes and more stringent local building requirements	The City and County has established this as an ongoing policy and does not need to commit additional resources through this plan update process to complete this activity.	n/a
-	Continued enforcement of zoning and development regulations	The HMPC has established this is an ongoing policy and is unlikely to need additional resources to continue pursuing this preventative measure	n/a

## APPENDIX C: MITIGATION ALTERNATIVES

Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
<b>Prevention Measures and Funding Recommended for Implementation</b>			
Durham P-1	Implement a Stormwater Utility Fee for all properties within the unincorporated areas of Durham County	Implementing this fee will ensure the County has resources to implement projects throughout unincorporated areas to meet the Falls Lake and Jordan Lake Rules	Local
Orange P-2	Continue participation in the Community Rating System (CRS) and annual recertification in order to increase public safety, reduce property damage, avoid economic loss, and allow for a decrease in flood insurance premiums for Orange County Residents	By continuing participation in the CRS program, Orange County will continue to best protect its citizens from flood events.	Local

### C.2.2 Property Protection Measures

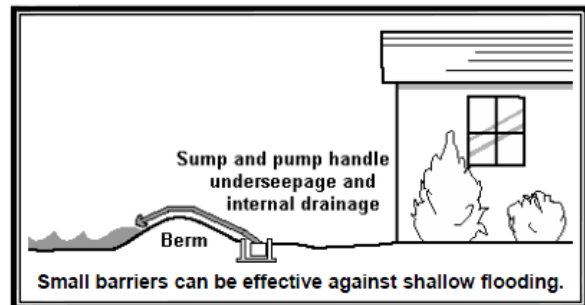
Property protection measures are used to modify buildings or property subject to damage. Property protection measures fall under three approaches:

- Modify the site to keep the hazard from reaching the building;
- Modify the building (retrofit) so it can withstand the impacts of the hazard; and
- Insure the property to provide financial relief after the damage occurs.

Property protection measures are normally implemented by the property owner, although in many cases technical and financial assistance can be provided by a government agency.

#### Keeping the Hazard Away

Generally, natural hazards do not damage vacant areas. As noted earlier, the major impact of hazards is to people and improved property. In some cases, properties can be modified so the hazard does not reach the damage-prone improvements. For example, a berm can be built to prevent floodwaters from reaching a house.



#### Flooding

There are five common methods to keep a flood from reaching and damaging a building:

- Erect a barrier between the building and the source of the flooding.
- Move the building out of the flood-prone area.
- Elevate the building above the flood level.
- Demolish the building.
- Replace the building with a new one that is elevated above the flood level.

The latter three approaches are the most effective types to consider for the planning area.

#### Barriers

A flood protection barrier can be built of dirt or soil (a "berm") or concrete or steel (a "floodwall"). Careful design is needed so as not to create flooding or drainage problems on neighboring properties. Depending on how porous the ground is, if floodwaters will stay up for more than an hour or two, the design needs

## APPENDIX C: MITIGATION ALTERNATIVES

to account for leaks, seepage of water underneath, and rainwater that will fall inside the perimeter. This is usually done with a sump or drain to collect the internal groundwater and surface water and a pump and pipe to pump the internal drainage over the barrier. Barriers can only be built so high. They can be overtopped by a flood higher than expected. Barriers made of earth are susceptible to erosion from rain and floodwaters if not properly sloped, covered with grass, and properly maintained.

### Relocation

Moving a building out of a flood prone area to higher ground is the surest and safest way to protect it from flooding. While almost any building can be moved, the cost increases for heavier structures, such as those with exterior brick and stone walls, and for large or irregularly shaped buildings. Relocation is also preferred for large lots that include buildable areas outside the floodplain or where the owner has a new flood-free lot (or portion of the existing lot) available.

### Building Elevation

Raising a building above the flood level can be almost as effective as moving it out of the floodplain. Water flows under the building, causing little or no damage to the structure or its contents. Raising a building above the flood level is cheaper than moving it and can be less disruptive to a neighborhood. Elevation has proven to be an acceptable and reasonable means of complying with floodplain regulations that require new, substantially improved, and substantially damaged buildings to be elevated above the base flood elevation.

### Demolition

Some buildings, especially heavily damaged or repetitively flooded ones, are not worth the expense to protect them from future damages. It is cheaper to demolish them and either replace them with new, flood protected structures, or relocate the occupants to a safer site. Demolition is also appropriate for buildings that are difficult to move – such as larger, slab foundation or masonry structures – and for dilapidated structures that are not cost-beneficial to protect.

### Pilot Reconstruction

If a building is not in good shape, elevating it may not be worthwhile or it may even be dangerous. An alternative is to demolish the structure and build a new one on the site that meets or exceeds all flood protection codes. FEMA funding programs refer to this approach as "pilot reconstruction." It is still a pilot program, and not a regularly funded option. Certain rules must be followed to qualify for federal funds for pilot reconstruction.

### Retrofitting

An alternative to keeping the hazard away from a building is to modify or retrofit the site or building to minimize or prevent damage. There are a variety of techniques to do this, as described below.



### ► **Dry Floodproofing**

Dry floodproofing means making all areas below the flood protection level watertight. Walls are coated with waterproofing compounds or plastic sheeting. Openings, such as doors, windows and vents, are closed, either permanently, with removable shields, or with sandbags. Dry floodproofing of new and existing nonresidential buildings in the regulatory floodplain is permitted under state, FEMA and local regulations. Dry floodproofing of existing residential buildings in the floodplain is also permitted as long as the building is not substantially damaged or being substantially improved. Owners of buildings located outside the regulatory floodplain can always use dry floodproofing techniques.

Dry floodproofing is only effective for shallow flooding, such as repetitive drainage problems. It does not protect from the deep flooding along lakes and larger rivers caused by hurricanes or other storms.

### ► **Wet Floodproofing**

The alternative to dry floodproofing is wet floodproofing: water is let in and everything that could be damaged by a flood is removed or elevated above the flood level. Structural components below the flood level are replaced with materials that are not subject to water damage. For example, concrete block walls are used instead of wooden studs and gypsum wallboard. The furnace, water heater and laundry facilities are permanently relocated to a higher floor. Where the flooding is not deep, these appliances can be raised on blocks or platforms.

## **Insurance**

Technically, insurance does not mitigate damage caused by a natural hazard. However, it does help the owner repair, rebuild, and hopefully afford to incorporate some of the other property protection measures in the process. Insurance offers the advantage of protecting the property, so long as the policy is in force, without requiring human intervention for the measure to work.

### ► **Private Property**

Although most homeowner's insurance policies do not cover a property for flood damage, an owner can insure a building for damage by surface flooding through the NFIP. Flood insurance coverage is provided for buildings and their contents damaged by a "general condition of surface flooding" in the area. Most people purchase flood insurance because it is required by the bank when they get a mortgage or home improvement loan. Usually these policies just cover the building's structure and not the contents. Contents coverage can be purchased separately. Renters can buy contents coverage, even if the owner does not buy structural coverage on the building. Most people don't realize that there is a 30-day waiting period to purchase a flood insurance policy and there are limits on coverage.

### ► **Public Property**

Governments can purchase commercial insurance policies. Larger local governments often self-insure and absorb the cost of damage to one facility, but if many properties are exposed to damage, self-insurance can drain the government's budget. Communities cannot expect federal disaster assistance to make up the difference after a flood.

## **Local Implementation/CRS Credit**

The CRS provides the most credit points for acquisition and relocation under Activity 520, because this measure permanently removes insurable buildings from the floodplain. Communities in the Eno-Haw Region could receive credit for Activity 520 – Acquisition and Relocation, for acquiring and relocating buildings from the SFHA. The HMPC recommended that communities pursue the purchase of repetitive loss buildings and other buildings which are subject to flood damage in order to return this land to open space.



The CRS also credits barriers and elevating existing buildings under Activity 530. The credit for Activity 530 is based on the combination of flood protection techniques used and the level of flood protection provided. Points are calculated for each protected building. Bonus points are provided for the protection of repetitive loss buildings and critical facilities. Communities could receive credit for Activity 360 – Flood Protection Assistance by providing advice and assistance to homeowners who may want to flood proof their home or business. Advice is provided both on property protection techniques and on financial assistance programs to help fund mitigation.

Flood insurance information for each community is provided in Section 5 and in greater detail in each community's annex. There is no credit for purchasing flood insurance, but the CRS does provide credit for local public information programs that, among other topics, explain flood insurance to property owners. The CRS also reduces the premiums for those people who do buy NFIP coverage. Communities in the Pamlico Sound Region could receive credit for Activity 330 – Outreach Projects. Property protection mitigation options considered by the HMPC are described below.

**Table C.2 – Property Protection Mitigation Options and Recommended Projects**

Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
<b>Property Protection Measures Considered by HMPC and Not Recommended</b>			
-	Look for opportunities to mitigate repetitive loss structures	No funding is available for this at the time. The HMPC decided to not include this action because it is unclear how it would be completed.	n/a
<b>Property Protection Measures and Funding Recommended for Implementation</b>			
Durham PP-1	Seek funding to install backup generators or quick connect hook ups for mobile generators on any newly constructed County or City critical facilities	This effort will help the Town and County protect its critical facilities to provide continuity of operations during a flood or other event.	Local, State, Federal
Orange PP-2	Continue participation in the National Flood Insurance Program (NFIP) to reduce the impact of a future flood event, mitigate effects of flooding, and allow citizens to be eligible for affordable flood insurance.	By continuing participation in the NFIP, the County ensures continued protection for its residents' property located within and beyond floodplains.	Local, State, Federal

### C.2.3 Natural Resource Protection

Resource protection activities are generally aimed at preserving (or in some cases restoring) natural areas. These activities enable the naturally beneficial functions of fields, floodplains, wetlands, and other natural lands to operate more effectively. Natural and beneficial functions of watersheds, floodplains and wetlands include:

- Reduction in runoff from rainwater and stormwater in pervious areas
- Infiltration that absorbs overland flood flow
- Removal and filtering of excess nutrients, pollutants and sediments
- Storage of floodwaters
- Absorption of flood energy and reduction in flood scour
- Water quality improvement
- Groundwater recharge

- Habitat for flora and fauna
- Recreational and aesthetic opportunities

As development occurs, many of the above benefits can be achieved through regulatory steps for protecting natural areas or natural functions. This section covers the resource protection programs and standards that can help mitigate the impact of natural hazards, while they improve the overall environment. Six areas were reviewed:

- Wetland protection
- Erosion and sedimentation control
- Stream/River restoration
- Best management practices
- Dumping regulations
- Farmland protection

### **Wetland Protection**

Wetlands are often found in floodplains and topographically depressed areas of a watershed. Many wetlands receive and store floodwaters, thus slowing and reducing downstream flows. They also serve as a natural filter, which helps to improve water quality, and they provide habitat for many species of fish, wildlife and plants.



### **Erosion and Sedimentation Control**

Farmlands and construction sites typically contain large areas of bare exposed soil. Surface water runoff can erode soil from these sites, sending sediment into downstream waterways. Erosion also occurs along stream banks and shorelines as the volume and velocity of flow or wave action destabilize and wash away the soil. Sediment suspended in the water tends to settle out where flowing water slows down. This can clog storm drains, drain tiles, culverts and ditches and reduce the water transport and storage capacity of river and stream channels, lakes and wetlands.

There are two principal strategies to address these problems: minimize erosion and control sedimentation. Techniques to minimize erosion include phased construction, minimal land clearing, and stabilizing bare ground as soon as possible with vegetation and other soil stabilizing practices.

### **Stream/River Restoration**

There is a growing movement that has several names, such as "stream conservation," "bioengineering," or "riparian corridor restoration." The objective of these approaches is to return streams, stream banks and adjacent land to a more natural condition, including the natural meanders. Another term is "ecological restoration," which restores native indigenous plants and animals to an area.

A key component of these efforts is to use appropriate native plantings along the banks that resist erosion. This may involve retrofitting the shoreline with willow cuttings, wetland plants, or rolls of landscape material covered with a natural fabric that decomposes after the banks are stabilized with plant roots.

In all, restoring the right vegetation to a stream has the following advantages:

- Reduces the amount of sediment and pollutants entering the water
- Enhances aquatic habitat by cooling water temperature
- Provides food and shelter for both aquatic and terrestrial wildlife
- Can reduce flood damage by slowing the velocity of water

- Increases the beauty of the land and its property value
- Prevents property loss due to erosion
- Provides recreational opportunities, such as hunting, fishing and bird watching
- Reduces long-term maintenance costs

Communities are required by state and federal regulations to monitor storm water drainage outfalls and control storm water runoff.

### **Best Management Practices**

Point source pollutants come from pipes such as the outfall of a municipal wastewater treatment plant. They are regulated by the US EPA. Nonpoint source pollutants come from non-specific locations and harder to regulate. Examples of nonpoint source pollutants are lawn fertilizers, pesticides, other chemicals, animal wastes, oils from street surfaces and industrial areas, and sediment from agriculture, construction, mining and forestry. These pollutants are washed off the ground's surface by stormwater and flushed into receiving storm sewers, ditches and streams.

The term "best management practices" (BMPs) refers to design, construction and maintenance practices and criteria that minimize the impact of stormwater runoff rates and volumes, prevent erosion, protect natural resources and capture nonpoint source pollutants (including sediment). They can prevent increases in downstream flooding by attenuating runoff and enhancing infiltration of stormwater. They also minimize water quality degradation, preserve beneficial natural features onsite, maintain natural base flows, minimize habitat loss, and provide multiple usages of drainage and storage facilities.

### **Dumping Regulations**

BMPs usually address pollutants that are liquids or are suspended in water that are washed into a lake or stream. Dumping regulations address solid matter, such as shopping carts, appliances and landscape waste that can be accidentally or intentionally thrown into channels or wetlands. Such materials may not pollute the water, but they can obstruct even low flows and reduce the channels' and wetlands' abilities to convey or clean stormwater.

Many cities have nuisance ordinances that prohibit dumping garbage or other "objectionable waste" on public or private property. Waterway dumping regulations need to also apply to "non-objectionable" materials, such as grass clippings or tree branches, which can kill ground cover or cause obstructions in channels. Regular inspections to catch violations should be scheduled.

Many people do not realize the consequences of their actions. They may, for example, fill in the ditch in their front yard without realizing that is needed to drain street runoff. They may not understand how re-grading their yard, filling a wetland, or discarding leaves or branches in a watercourse can cause a problem to themselves and others. Therefore, a dumping enforcement program should include public information materials that explain the reasons for the rules as well as the penalties.

### **Farmland Protection**

Farmland protection is an important piece of comprehensive planning and zoning throughout the United States. The purpose of farmland protection is to provide mechanisms for prime, unique, or important agricultural land to remain as such, and to be protected from conversion to nonagricultural uses.

Frequently, farm owners sell their land to residential or commercial developers and the property is converted to non-agricultural land uses. With development comes more buildings, roads and other infrastructure. Urban sprawl occurs, which can lead to additional stormwater runoff and emergency management difficulties.

Farms on the edge of cities are often appraised based on the price they could be sold for to urban developers. This may drive farmers to sell to developers because their marginal farm operations cannot afford to be taxed as urban land. The Farmland Protection Program in the United States Department of Agriculture's 2002 Farm Bill (Part 519) allows for funds to go to state, tribal, and local governments as well as nonprofit organizations to help purchase easements on agricultural land to protect against the development of the land.

#### **Local Implementation/CRS Credit**

There is credit for preserving open space in its natural condition or restored to a state approximating its natural condition. The credit is based on the percentage of the floodplain that can be documented as wetlands protected from development by ownership or local regulations. Communities in the Eno-Haw Region could receive credit for Activity 420 – Open Space Preservation for preserving a portion of the SFHA as open space.

Additionally, credit is available for Activity 540 – Drainage System Maintenance. Having a portion of the drainage system inspected regularly throughout the year and maintenance performed as needed would earn a community credit. Communities could also get credit under this activity for providing a listing of problem sites that are inspected more frequently, and for implementing an ongoing Capital Improvements Program.

**Table C.3 – Natural Resource Protection Mitigation Options and Recommended Projects**

Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
<b>Natural Resource Protection Measures Considered by HMPC and Not Recommended</b>			
-	Continued enforcement of soil erosion and sedimentation control ordinance.	The Town now has a program in place, and additional funding is not needed for continued enforcement.	n/a
<b>Natural Resource Protection Measures and Funding Recommended for Implementation</b>			
Durham NRP-1	Identify and obtain additional properties to increase protected pen space as a land-use tool to reduce adverse impacts from floods	Creation of open space through acquisition of flood prone properties protects natural resources and reduces potential future losses.	Federal w/ State/Local Match
Orange NRP-1	Ensure future development occurs in a manner that protects floodplains, streams, wetlands, and other natural features which work to reduce flood hazard susceptibility and continue to enforce existing regulations pertaining to stormwater management and erosion control standards	This action will continue to protect natural resources from future development and simultaneously ensure the continuation of natural floodplain functions	Local

## **C.2.4 Emergency Services Measures**

Emergency services measures protect people during and after a disaster. A good emergency management program addresses all hazards, and it involves all local government departments. This section reviews emergency services measures following a chronological order of responding to an emergency. It starts with identifying an impending problem (threat recognition) and continues through post-disaster activities.

### **Threat Recognition**

The first step in responding to a flood is to know when weather conditions are such that an event could occur. With a proper and timely threat recognition system, adequate warnings can be disseminated.

The National Weather Service (NWS) is the prime agency for detecting meteorological threats. Severe weather warnings are transmitted through NOAA's Weather Radio System. Local emergency managers can then provide more site-specific and timely recognition after the Weather Service issues a watch or a warning. A flood threat recognition system predicts the time and height of a flood crest. This can be done by measuring rainfall, soil moisture, and stream flows upstream of the community and calculating the subsequent flood levels.

On smaller rivers and streams, locally established rainfall and river gauges are needed to establish a flood threat recognition system. The NWS may issue a "flash flood watch." This is issued to indicate current or developing hydrologic conditions that are favorable for flash flooding in and close to the watch area, but the occurrence is neither certain nor imminent. These events are so localized and so rapid that a "flash flood warning" may not be issued, especially if no remote threat recognition equipment is available. In the absence of a gauging system on small streams, the best threat recognition system is to have local personnel monitor rainfall and stream conditions. While specific flood crests and times will not be predicted, this approach will provide advance notice of potential local or flash flooding.

### **Warning**

The next step in emergency response following threat recognition is to notify the public and staff of other agencies and critical facilities. More people can implement protection measures if warnings are early and include specific detail.

The NWS issues notices to the public using two levels of notification:

- Watch: conditions are right for flooding, thunderstorms, tornadoes or winter storms.
- Warning: a flood, tornado, etc., has started or been observed.

A more specific warning may be disseminated by the community in a variety of ways. The following are the more common methods:

- CodeRED countywide mass telephone emergency communication system
- Commercial or public radio or TV stations
- The Weather Channel
- Cable TV emergency news inserts
- Telephone trees/mass telephone notification
- NOAA Weather Radio
- Tone activated receivers in key facilities
- Outdoor warning sirens
- Sirens on public safety vehicles
- Door-to-door contact
- Mobile public address systems
- Email notifications

Just as important as issuing a warning is telling people what to do in case of an emergency. A warning program should include a public information component.

### **StormReady**

The National Weather Service (NWS) established the StormReady program to help local governments improve the timeliness and effectiveness of hazardous weather-related warnings for the public. To be officially StormReady, a community must:

- Establish a 24-hour warning point and emergency operations center





- Have more than one way to receive severe weather warnings and forecasts and to alert the public
- Create a system that monitors weather conditions locally
- Promote the importance of public readiness through community seminars
- Develop a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises

Being designated a NWS StormReady community is a good measure of a community's emergency warning program for weather hazards.

### Response

The protection of life and property is the most important task of emergency responders. Concurrent with threat recognition and issuing warnings, a community should respond with actions that can prevent or reduce damage and injuries. Typical actions and responding parties include the following:

- Activating the emergency operations center (emergency preparedness)
- Closing streets or bridges (police or public works)
- Shutting off power to threatened areas (utility company)
- Passing out sand and sandbags (public works)
- Holding children at school or releasing children from school (school superintendent)
- Opening evacuation shelters (the American Red Cross)
- Monitoring water levels (public works)
- Establishing security and other protection measures (police)

An emergency action plan ensures that all bases are covered and that the response activities are appropriate for the expected threat. These plans are developed in coordination with the agencies or offices that are given various responsibilities.

Emergency response plans should be updated annually to keep contact names and telephone numbers current and to ensure that supplies and equipment that will be needed are still available. They should be critiqued and revised after disasters and exercises to take advantage of the lessons learned and of changing conditions. The end result is a coordinated effort implemented by people who have experience working together so that available resources will be used in the most efficient manner possible.

### Evacuation and Shelter

There are six key components to a successful evacuation:

- Adequate warning
- Adequate routes
- Proper timing to ensure the routes are clear
- Traffic control
- Knowledgeable travelers
- Care for special populations (e.g., disabled persons, prisoners, hospital patients, schoolchildren)

Those who cannot get out of harm's way need shelter. Typically, the American Red Cross will staff a shelter and ensure that there is adequate food, bedding, and wash facilities. Shelter management is a specialized skill. Managers must deal with problems like scared children, families that want to bring in their pets, and the potential for an overcrowded facility.

### Local Implementation /CRS Credit

Flash flood warnings are issued by National Weather Service Offices, which have the local and county warning responsibility. Flood warnings are forecasts of coming floods, are distributed to the public by the NOAA Weather Radio, commercial radio and television, and through local emergency agencies. The

warning message tells the expected degree of flooding, the affected river, when and where flooding will begin, and the expected maximum river level at specific forecast points during flood crest.

Communities in the Eno-Haw Region could receive credit for Activity 610 – Flood Warning Program for maintaining a program that provides timely identification of impending flood threats, disseminates warnings to appropriate floodplain residents, and coordinates flood response activities. Community Rating System credits are based on the number and types of warning media that can reach the community's flood prone population. Depending on the location, communities can receive credit for the telephone calling system and more credits for additional measures, like telephone trees. Being designated as a StormReady community also provides additional credits.

**Table C.4 – Emergency Services Mitigation Options and Recommended Projects**

Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
<b>Emergency Services Measures Considered by HMPC and Not Recommended</b>			
-	Develop an Emergency Operations Plan	This was noted as a gap in the capability assessment but is not currently being pursued	n/a
<b>Emergency Services Measures and Funding Recommended for Implementation</b>			
Orange ES-1	Identify and implement strategies to increase swift water rescue capacity.	Training will support improved rescue and response capabilities	Local, Federal
Orange ES-2	Engage with regional stakeholders in comprehensive emergency response planning including Complex Coordinated Terror Attack response and Mass Casualty Incident response planning.	Such planning will improve inter-jurisdictional capacity to respond to events including but not limited to flooding.	Local

### C.2.5 Structural Projects

Four general types of flood control projects are reviewed here: levees, reservoirs, diversions, and dredging. These projects have three advantages not provided by other mitigation measures:

- They can stop most flooding, protecting streets and landscaping in addition to buildings.
- Many projects can be built without disrupting citizens' homes and businesses.
- They are constructed and maintained by a government agency, a more dependable long-term management arrangement than depending on many individual private property owners.

However, as shown below, structural measures also have shortcomings. The appropriateness of using flood control depends on individual project area circumstances.

- Advantages
  - They may provide the greatest amount of protection for land area used
  - Because of land limitations, they may be the only practical solution in some circumstances
  - They can incorporate other benefits into structural project design, such as water supply and recreational uses
  - Regional detention may be more cost-efficient and effective than requiring numerous small detention basins
- Disadvantages
  - They can disturb the land and disrupt the natural water flows, often destroying wildlife habitat

- They require regular maintenance
- They are built to a certain flood protection level that can be exceeded by larger floods
- They can create a false sense of security
- They promote more intensive land use and development in the floodplain

### Levees and Floodwalls

Probably the best-known flood control measure is a barrier of earth (levee) or concrete (floodwall) erected between the watercourse and the property to be protected. Levees and floodwalls confine water to the stream channel by raising its banks. They must be well designed to account for large floods, underground seepage, pumping of internal drainage, and erosion and scour.

### Reservoirs and Detention

Reservoirs reduce flooding by temporarily storing flood waters behind dams or in storage or detention basins. Reservoirs lower flood heights by holding back, or detaining, runoff before it can flow downstream. Flood waters are detained until the flood has subsided, and then the water in the reservoir or detention basin is released or pumped out slowly at a rate that the river can accommodate downstream.

Reservoirs can be dry and remain idle until a large rain event occurs. Or they may be designed so that a lake or pond is created. The lake may provide recreational benefits or water supply (which could also help mitigate a drought).



Retention pond

Flood control reservoirs are most commonly built for one of two purposes. Large reservoirs are constructed to protect property from existing flood problems. Smaller reservoirs, or detention basins, are built to protect property from the stormwater runoff impacts of new development.

### Diversion

A diversion is a new channel that sends floodwaters to a different location, thereby reducing flooding along an existing watercourse. Diversions can be surface channels, overflow weirs, or tunnels. During normal flows, the water stays in the old channel. During floods, the floodwaters spill over to the diversion channel or tunnel, which carries the excess water to a receiving lake or river.

### Local Implementation /CRS Credit

Structural flood control projects that provide at least 100-year flood protection and that result in revisions to the Flood Insurance Rate Map are not credited by the CRS so as not to duplicate the larger premium reduction provided by removing properties from the mapped floodplain. Other flood control projects can be accepted by offering a 25-year flood protection.

**Table C.5 – Structural Projects Mitigation Options and Recommended Projects**

Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
<b>Structural Project Measures Considered by HMPC and Not Recommended</b>			
-	Explore the possibility of retrofitting existing critical facilities with back-up generators.	Orange county has 20 total county facilities with backup generators installed and functioning. The County determined this action to be completed.	n/a

Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
<b>Structural Project Measures and Funding Recommended for Implementation</b>			
Durham SP-1	Seek funding to retrofit critical facilities and City- and County-owned facilities for improved resilience to all hazards with the use of the latest building materials and technology.	Structural improvements to City- and County-owned facilities will ensure resilience and continuity of operation from multiple hazards.	Local, State, Federal
Orange SP-2	Conduct a cost-benefit review during the planning and design phase of construction of new government owned facilities or critical facilities to determine the feasibility of equipping the facility with back-up generators, lightening protection, high wind protection, and/or 361 compliant tornado shelters.	Prioritizing resilience during the design and construction phase of new Government owned buildings enhances resilience longer term and prevents necessity of future retrofits.	Local, State, Federal

## C.2.6 Public Information

### Outreach Projects

Outreach projects are the first step in the process of orienting property owners to the hazards they face and to the concept of property protection. They are designed to encourage people to seek out more information in order to take steps to protect themselves and their properties.

Awareness of the hazard is not enough; people need to be told what they can do about the hazard. Thus, projects should include information on safety, health and property protection measures. Research has shown that a properly run local information program is more effective than national advertising or publicity campaigns. Therefore, outreach projects should be locally designed and tailored to meet local conditions.

Community newsletters/direct mailings: The most effective types of outreach projects are mailed or distributed to everyone in the community. In the case of floods, they can be sent only to floodplain property owners.

News media: Local newspapers can be strong allies in efforts to inform the public. Local radio stations and cable TV channels can also help. These media offer interview formats and cable TV may be willing to broadcast videos on the hazards.

### Libraries and Websites

The two previous activities tell people that they are exposed to a hazard. The next step is to provide information to those who want to know more. The community library and local websites are obvious places for residents to seek information on hazards, hazard protection, and protecting natural resources.

Books and pamphlets on hazard mitigation can be given to libraries, and many of these can be obtained for free from state and federal agencies. Libraries also have their own public information campaigns with displays, lectures and other projects, which can augment the activities of the local government. Today, websites are commonly used as research tools. They provide fast access to a wealth of public and private sites for information. Through links to other websites, there is almost no limit to the amount of up to date information that can be accessed on the Internet.

In addition to online floodplain maps, websites can link to information for homeowners on how to retrofit for floods or a website about floods for children.

### Technical Assistance

#### ***Hazard Information***

Residents and business owners that are aware of the potential hazards can take steps to avoid problems or reduce their exposure to flooding. Communities can easily provide map information from FEMA's FIRMs and Flood Insurance Studies. They may also assist residents in submitting requests for map amendments and revisions when they are needed to show that a building is located outside the mapped floodplain.

Some communities supplement what is shown on the FIRM with information on additional hazards, flooding outside mapped areas and zoning. When the map information is provided, community staff can explain insurance, property protection measures and mitigation options that are available to property owners. They should also remind inquirers that being outside the mapped floodplain is no guarantee that a property will never flood.

#### ***Property Protection Assistance***

While general information provided by outreach projects or the library is beneficial, most property owners do not feel ready to retrofit their buildings without more specific guidance. Local building department staffs are experts in construction. They can provide free advice, not necessarily to design a protection measure, but to steer the owner onto the right track. Building or public works department staffs can provide the following types of assistance:

- Visit properties and offer protection suggestions
- Recommend or identify qualified or licensed contractors
- Inspect homes for anchoring of roofing and the home to the foundation
- Explain when building permits are needed for home improvements.

#### **Public Information Program**

A Program for Public Information (PPI) is a document that receives CRS credit. It is a review of local conditions, local public information needs, and a recommended plan of activities. A PPI consists of the following parts, which are incorporated into this plan:

- The local flood hazard
- The property protection measures appropriate for the flood hazard
- Flood safety measures appropriate for the local situation
- The public information activities currently being implemented within the community, including those being carried out by non-government agencies
- Goals for the community's public information program
- The outreach projects that will be done each year to reach the goals
- The process that will be followed to monitor and evaluate the projects

#### **Local Implementation /CRS Credit**

Communities in the Eno-Haw Region could receive credit under Activity 330 – Outreach Projects as well as Activity 350 – Flood Protection Information. Credit is available for targeted and general outreach projects. Credit is also provided for making publications relating to floodplain management available in the reference section of the local library.



**Table C.6 – Public Information and Outreach Mitigation Options and Recommended Projects**

Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
<b>Public Information and Outreach Measures Considered by HMPC and Not Recommended</b>			
-	Continue All-Hazards Public Information campaign	This program is already in existence, and no additional funding is need to continue its operation	n/a
<b>Public Information and Outreach Measures and Funding Recommended for Implementation</b>			
Orange PEA-2	Engage in regional events, activities, and training opportunities related to natural hazards in order to improve communication, enhance, partnerships, and improve planning efforts with other local jurisdictions.	The County will enhance inter-jurisdictional capacity for education, outreach, and response.	Local
Orange PEA-3	Strive to improve communication and outreach in multiple languages to Orange County residents before, during, and after hazard weather event with the county's website, press releases, social media accounts, and the OC Alerts system in order to keep residents informed and improve public safety in and around the county.	The County will ensure as many residents as possible are included in communications and can act accordingly by utilizing multiple languages.	Local

## Appendix D      References

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