Mecklenburg County, North Carolina

Multi-Jurisdictional Hazard Mitigation Plan

November 2020

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1 Introduction

Section 1 provides a general introduction to hazard mitigation and an introduction to the Mecklenburg County Multi-Jurisdictional 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 Mecklenburg County, North Carolina and its incorporated municipalities.

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.

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 Mecklenburg County and its incorporated municipalities 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 Multi-Jurisdictional Hazard Mitigation Plan for Mecklenburg County. The planning areas includes all incorporated municipalities and unincorporated areas, which are as follows:

- Mecklenburg County
- City of Charlotte
- Town of Cornelius
- Town of Davidson
- Town of Huntersville
- Town of Matthews
- Town of Mint Hill
- Town of Pineville

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.

Mecklenburg County followed the planning process prescribed by FEMA and developed this plan 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 local vulnerability to these hazards, and examined each participating jurisdiction's capabilities to mitigate them. The following hazards are profiled in this plan:

- Dam & Levee Failure
- Drought
- Earthquake
- Extreme Heat
- Flood
- Hurricane and Tropical Storm
- Landslide
- Severe Weather (Thunderstorm Winds, Hail, and Lightning)

- Severe Winter Storm
- Sinkhole
- Tornado
- Wildfire
- Cyber Threat
- Hazardous Materials Incident
- Radiological Emergency
- Electro-Magnetic Pulse (EMP)

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 Mecklenburg County Multi-Jurisdictional 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 Mecklenburg County Multi-Jurisdictional 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 Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan is to identify, assess, and mitigate hazard risk to better protect the people and property within Mecklenburg County 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 County 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 County and participating jurisdictions will use to decrease vulnerability and increase resiliency.

The Mecklenburg County Hazard Mitigation Planning Committee (HMPC) met on March 13, 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 Mecklenburg County 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.

Mecklenburg County, along with the City of Charlotte, the Towns of Cornelius, Davidson, Huntersville, Matthews, Mint Hill, and Pineville, and other partners, will manage the community's continued growth by making informed, intentional, and planned decisions to create a community more resilient to current and future hazards, implement all future projects in an efficient, sustainable manner through effective coordination, and emphasize education for staff and the public that improves capabilities and understanding of risk.

This vision is underpinned by the following key principles which describe how the Mecklenburg County Hazard Mitigation Planning Committee hopes to characterize the future of the community.

Resilience and Managed Growth: When an event occurs, Mecklenburg County will sustain minimal damages and the community will be able to recover quickly. This will be accomplished through a two-pronged approach: 1) mitigating homes, businesses, and infrastructure currently at risk and 2) managing growth by regulating development and promoting the construction of new, resilient infrastructure.

Coordination: Mecklenburg County, in coordination with its partners, will coordinate locally, across jurisdictions, and among departments to ensure that goals and decisions made reinforce one another. Additionally, jurisdictions will work together to address issues that span beyond their boundaries, such as at a watershed or ecosystem level.

Implementation: Mecklenburg County, in coordination with its partners, will take responsibility to implement projects and make measurable progress on plans and projects that will be sustainable.

Education: Mecklenburg County and partner staff will be educated and trained to improve capabilities among and across departments. At the same time, public education will ensure residents understand their responsibilities for hazard mitigation as the county continues to grow.

2.2 WHAT'S CHANGED IN THE PLAN

This plan is an update to the 2015 Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan, which included participation from all jurisdictions involved in this plan update. The previous plan was approved by FEMA on October 14, 2015.

This hazard mitigation plan update involved a comprehensive review and update of each section of the existing plan and an assessment of the success of the County 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 multi-jurisdictional plan:

- 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 and the 2015 Mecklenburg County plan and provides the final decision made by the HMPC as to which hazards should be included in the updated 2020 Mecklenburg County Multi-Jurisdictional Plan.

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 North Carolina Emergency Management'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 2017 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 Mecklenburg County Multi-Jurisdictional 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
Phase I – Planning Process	
§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
Phase II – Risk Assessment	
§201.6(c)(2)(i)	Step 4. Assess the Hazard
§201.6(c)(2)(ii) & (iii)	Step 5. Assess the Problem
Phase III – Mitigation Strategy	
§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
Phase IV – Plan Maintenance	
§201.6(c)(5)	Step 9. Adopt the Plan
§201.6(c)(4)	Step 10. Implement, Evaluate and Revise the Plan

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 County'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 Charlotte-Mecklenburg Emergency Management Planner led the planning area's effort to reorganize and coordinate for the plan update. Consultants from Wood Environment and Infrastructure Solutions, Inc. assisted by leading the County and participating jurisdictions 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

The HMPC formed for development of the 2015 Plan was reconvened for this plan update. New members were added where needed, and citizens and stakeholders were also invited to participate. 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. 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. Mecklenburg County and its 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 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 (Charlotte-Mecklenburg Planning Department Area Plans and District Plans)	Area plans and District plans developed by the Charlotte-Mecklenburg Planning Department were referenced in the Planning Area Profile in Section 3. Other local comprehensive plans were incorporated into Mitigation Action Plans where applicable in Section 7 and referenced in the Capability Assessment in Section 5. Land use planning was also reviewed for all CRS communities and is discussed where applicable in the jurisdictional annexes.
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.
Mecklenburg County and Incorporated Areas Flood Insurance Study (FIS), Revised 11/16/2018	The FIS report was referenced in the preparation of flood hazard profile in Section 4.
Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan, June 2015	The previous plan was referenced in compiling 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 the North Carolina Division of Emergency Management (NCEM) and FEMA Region IV to review and approve, contingent upon final adoption by the County and its 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

As with the previous plan, this Hazard Mitigation Plan was developed under the guidance of a Hazard Mitigation Planning Committee (HMPC). The Committee's representatives included representatives of County, City, and Town departments, federal and state agencies, citizens, and other stakeholders.

To reconvene the planning committee, a letter was sent via email to all County, City, and Town HMPC contacts from the previous planning effort. 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 in order to improve the integration of stakeholder input into the plan. The HMPC was split into a CRS Steering Committee, comprised of CRS program participants who led the CRS planning process, and a Working Group, which supported the Steering Committee by providing information, attending meetings, reviewing draft materials, and coordinating jurisdictional adoption and implementation. Table 2.4 and Table 2.6 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 to satisfy multi-jurisdictional participation requirements, 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;
- 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 Mecklenburg County HMPC, "participation" meant the following:

- Providing facilities for meetings;
- Attending and participating in the HMPC meetings;
- Collecting and providing requested data (as available);
- Completing the Local Capability Self-Assessment;
- Providing an update on previously adopted mitigation actions;
- 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. In a few instances, including for the Town of Davidson and the Town of Pineville, none of the designated committee members were able to attend a meeting; in these cases, the County represented the Towns at the meeting and ensured that information from the meeting was shared with committee members via email, phone, and the plan website. 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 split into two groups: a CRS Steering Committee and a Working Group. Membership of each group is detailed in Table 2.4 and Table 2.5.

Table 2.4 – CRS Steering Committee Members

Jurisdiction	Representative	Department/Organization
Mecklenburg County	Ted Panagiotopoulos	County Fire Department
Mecklenburg County	David Love	County Stormwater
Mecklenburg County	Travis Cryan	Duke Energy
City of Charlotte	Tony Bateman	CMEMO
City of Charlotte	Matt Gustis	Charlotte Stormwater
City of Charlotte	Kevin Martin	UNC Charlotte
City of Charlotte	Josh Runfola	UNC Charlotte
City of Charlotte	Shawn Kiley	UNC Charlotte
Town of Pineville	Brian Elgort	Planning
Town of Pineville	Chip Hill	Public Works
Town of Pineville	Randy Smith	Resident
Town of Pineville	Gerelyn Garcia	Resident

Table 2.5 – Working Group Members

Jurisdiction	Representative	Department/Organization
Mecklenburg County	David Kroening	County Stormwater
Mecklenburg County	Tim Trautman	County Stormwater
Mecklenburg County	Dave Canaan	County Stormwater
Mecklenburg County	Matthew Bixler	County FMO
Mecklenburg County	Andrew Bridges	County FMO
Mecklenburg County	Andy Goretti	Mecklenburg County GIS
Mecklenburg County	John McCulloch	County Stormwater
City of Charlotte	Alex Alcorn	City Manager's Office
City of Charlotte	Tommy Wendelgass	Charlotte Water
City of Charlotte	Andy Babson	E&PM
City of Charlotte	Robert Graham	CMEMO
City of Charlotte	Tim Hartsell	Charlotte Fire
City of Charlotte	Andrew DeCristofaro	CMSWS
City of Charlotte	Daryl Hammock	Charlotte Stormwater
Town of Cornelius	Gary Fournier	Planning Department
Town of Cornelius	Jennifer Thompson	Police Department
Town of Cornelius	Ed Marxen	Resident
Town of Davidson	Bo Fitzgerald	Fire Department
Town of Davidson	Penny Dunn	Police Department
Town of Davidson	Jesse Bouk	Public Works
Town of Davidson	Brad Johnson	Davidson College
Town of Huntersville	Kevin Johnston	Police Dept.
Town of Huntersville	Steve Robbins	Public Works
Town of Huntersville	Dan Boone	Resident
Town of Matthews	Rob Kinniburgh	Fire Department
Town of Matthews	Clark Pennington	Police Department
Town of Matthews	CJ O'Neil	Public Works
Town of Mint Hill	David Leath	Mint Hill Fire
Town of Mint Hill	John Rowell	Mint Hill Police
Town of Pineville	Jack Edwards	Mayor

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.	January 24, 2019 3 p.m.	Charlotte Fire Department HQ, 500 Dalton Avenue, Charlotte, NC
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	March 13, 2019 2 p.m.	Charlotte Fire Department HQ, 500 Dalton Avenue, Charlotte, NC
HMPC Mtg. #3	1) Review Draft Hazard Identification & Risk Assessment (HIRA) 2) Draft objectives and Mitigation Action Plans	July 31, 2019 2 p.m.	Charlotte Fire Department HQ, 500 Dalton Avenue, Charlotte, NC
HMPC Mtg. #4	1) Review the Draft Hazard Mitigation Plan 2) Solicit comments and feedback	July 22, 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, which was shared on local community websites, 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.	January 24, 2019 5:30 p.m.	Charlotte Fire Department HQ, 500 Dalton Avenue, Charlotte, NC
Public Meeting #2	1) Review "Draft" Hazard Mitigation Plan 2) Solicit comments and feedback	July 22, 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	January 2019	Public Meeting #1 announcements posted
Kickoff Flyer	January 2019	Public Meeting #1 announcement and website information
Local community websites	Ongoing	Link to the plan website shared to expand reach
Public survey	January – October 2019	Survey hosted online and made available via shareable link
Plan website - HIRA draft	8/6/2019	Draft HIRA made available for review and comment online
Public Outreach Flyer	August 2019	Information on the Planning Process, HIRA, goals, and mitigation actions, and request for feedback.
Plan website - Draft Plan	7/14/2020	Full draft plan made available for review and comment online

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 January 2019 and remained open for response through October 2019. 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 online on the plan website and was given to HMPC representatives to make available in hard copy in their jurisdictions. In total, 35 survey responses were received.

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

- All respondents own their home, which indicates ability of those engaged in the mitigation process to implement mitigation on their own properties. However, this also indicates that responses may be skewed toward established residents with more long-term awareness of their local hazards.
- Nearly a quarter of respondents feel not at all prepared for a hazard event.
- 80% of respondents don't know where evacuation centers or storm shelters are located yet over 91% say they are able to evacuate or take shelter if necessary, which may indicate respondents do not intend to rely on public shelters or evacuation centers.
- Over 71% of respondents do not know where to get more information on hazard risk and preparedness. Respondents also favored public information projects for mitigation. More outreach may be needed, and it may be beneficial to pursue new methods of outreach.
- Severe weather and extreme heat were rated the most significant hazards. Landslide and levee failure were rated the least significant hazards.
- Many respondents who reported having taken steps to mitigate risk at home reported preparedness actions such as emergency kits and supplies and evacuation plans. A few respondents also noted property protection actions including flood mitigation; however, these may be important ideas to promote in outreach.

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 UNC Charlotte, Davidson College, Duke Energy, and local residents. Representatives from North Carolina Emergency Management also attended HMPC meetings. 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 representing 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 actions being carried forward is provided in Section 7: Mitigation Action Plans.

Table 2.9 – Status of Previous Mitigation Actions

Jurisdiction	Completed	Deleted	Carried Forward
Mecklenburg County	7	12	5
City of Charlotte	10	1	15
Town of Cornelius	2	7	2
Town of Davidson	2	0	8
Town of Huntersville	8	2	1
Town of Matthews	4	1	11
Town of Mint Hill	0	2	9
Town of Pineville	13	6	14
Total	**46**	**31**	**65**

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.

Table 2.10 – Completed and Deleted Actions from the 2015 Mecklenburg County Hazard Mitigation Plan

2015 Action #	Description	2020 Status	Status Comments/Explanation
Mecklenburg County			
2015-1	Provide public education to the general public regarding solar events and their potential impacts on the community.	Completed	Completed, addressed as necessary
2015-2	Participate in the InfraGard National EMP SIG table-top exercise and 1-day summit which addresses any high-impact threat that could cause long-term nationwide collapse of critical infrastructure.	Completed	Completed, addressed as necessary
2015-3	Build relationships and coordination with critical infrastructure partners, specifically power, utilities, and communications to build local resilience.	Completed	Completed, addressed as necessary
2015-5	Seek grant funding to install backup generators or quick connect hook ups for mobile generators on any newly constructed county/town critical facilities.	Delete	The County has no plans for future new critical facilities, so does not plan to seek grant funding for such. Do not carry forward to 2019 HMP.
2010-3	Complete and begin implementation of detailed Flood Hazard Mitigation Plan which will identify specific mitigation options based on risk factor scoring utilizing public and private funding.	Completed	Completed.
2010-4	Enhance Flood Zone website to better convey risk and mitigation alternatives.	Completed	Completed, remove from plan. Future enhancements will be made as maintenance task
2010-5	Inform public of flood risk by sending annual newsletter to owners and occupants of all buildings in floodplain.	Completed	On-going activity, remove as mitigation item and shift to capability assessment.
2010-6	Research possibility of using new H&H models to provide flood forecasting in the Flood Information Notification System (FINS).	Delete	Remove from plan. This activity will be combined with 2010 #7 into a new action to be defined in planning process.
2010-7	Research possibility of FINS system to provide inundation mapping based on results of Mitigation Action 6 above and explore alternate methods and expansion into other locations.	Delete	Remove from plan. This activity will be combined with 2010 #6 into a new action to be defined in planning process.
2010-10	As determined necessary and upon request from municipal jurisdictions, provide informative presentations and/or work sessions for newly elected officials and new appointees to planning commissions and appeals/variance boards to provide an overview of floodplain management, the importance of participating in the NFIP, and the implications of failing to enforce the requirements of the program or failing to properly handle variance requests.	Delete	Remove from plan. This action to be combined with #11 & #12 into a new item aligned with Program for Public Information.

2015 Action #	Description	2020 Status	Status Comments/Explanation
2010-11	On an annual basis, coordinate with Charlotte-Mecklenburg Emergency Management on a widespread public outreach activity to provide information on all natural hazards facing the area to local residents, including methods for mitigating and preventing damages from hazardous conditions and how to respond when an imminent hazard threatens.	Delete	In progress/ seasonal impacts, monthly CMEMO newsletter, homepage, social media outlets. This action to be combined with #10 & #12 into a new item aligned with Program for Public Information.
2010-12	On an annual basis, coordinate with Charlotte-Mecklenburg Emergency Management to provide information on all natural hazards facing the area to local planning staff and elected officials. This should be combined with an annual progress report on the status of local mitigation actions as identified in the Multijurisdictional Hazard Mitigation Plan.	Delete	In-progress/ annual meetings with county partners to update and advise on CMEMO activities, monthly and quarterly meetings with emergency response officials to provide jurisdictional information. This action to be combined with #10 & #11 into a new item aligned with Program for Public Information.
2005-1	Enhance automated flood warning system to include forecasting and inundation mapping.	Delete	Remove from plan. This action to be incorporated with 2010 #6 & #7 into new item.
2005-2	Gather and disseminate more information from Duke Power on lake levels and storage capacity.	Completed	Completed
2005-3	Acquire or elevate flood-prone structures.	Delete	Remove from plan, this action replaced by 2010 #9.
2005-4	Floodproofing of non-residential buildings.	Delete	Remove from plan, this action replaced by 2010 #9.
2005-5	Digitize smaller, non-FEMA floodplains (100+ areas) into county GIS and display on the Internet.	Delete	Remove from plan. This action will be incorporated into 2010 #8.
2005-7	Promote better coordination between floodplain management branch and building code officials through the hosting of a semi-annual meeting.	Delete	Remove from plan. See 2010 #10 above. This action to be combined with #11 & #12 into a new item aligned with Program for Public Information.
2005-24	Maintain the FACT program	Delete	Program discontinued.
City of Charlotte			
2015-3	Continue to identify, rank and prioritize capital improvement projects, flood control (FC) projects and pond projects, using pre- established criteria for each.	Completed	Complete: New capital improvement projects have been identified, ranked and prioritized on an as needed basis. The flood control capital improvement project ranking system has 32 unfunded flood control projects identified. Five projects were prioritized in fiscal year 2019. Pond capital improvement projects have been ranked on an as needed basis. The pond capital improvement ranking system has 145 unfunded pond projects identified. Eight projects were ranked and prioritized in fiscal year 2019.

2015 Action #	Description	2020 Status	Status Comments/Explanation
2015-4	Initiate (plan, design and construct) five (5) projects from the capital improvement project ranking system between 2015 and 2019.	Completed	Complete: In fiscal year 2018, two projects (Ashton and Severn) were initiated from the capital improvement project ranking system. In fiscal year 2019, nine projects (Bonwood, Camp Greene, Eaglewood, Elvis, Farmer, Foxrun, Hidden Valley, Toomey and Westbourne) were initiated from the capital improvement project ranking system.
2015-5	Identify and map known problem areas/streets subject to repetitive hazardous flooding that are outside of currently mapped floodplain areas based on: (1) recorded 311 calls for storm water assistance; and (2) past incident reports from the Fire Department and the Charlotte-Mecklenburg Police Department for flooding calls, road closings, swift water rescues, etc. This action includes the development of a geodatabase to be maintained and updated in GIS format and used as part of the City's routine inspection process for conveyance issues, capital planning decisions and particularly in advance of predicted severe storm events. This clearinghouse of data will also be used for future updates to this Plan.	Completed	Complete: A geodatabase is being maintained as well as a map containing hazard mitigation data. 311 calls are recorded and analyzed. We receive a monthly export from Fire for flooding rescue calls and also receive data from CDOT for road closures due to flooding. The data is updated monthly and we have added a Hazard Mitigation layer to the last update of Add Common Themes in ArcGIS.
2015-6	Develop a complete inventory of all stormwater control measures throughout the city.	Completed	Complete: All known SCMs have been entered into the database. A process is in place to enter new SCMs into the database upon construction and inspection.
2015-7	Create a GIS layer of the parcels that were created prior to regulation of subdivision development for flood protection. This will enable a "flag" for those interested in building on such lots to discuss flood protection provisions prior to commencing construction.	Completed	Complete: Parcels in GIS are flagged with approved permits that overlap with various GIS layers to better identify potential storm water and flood protection concerns. These GIS layers include channel and pipe features, easements and water quality buffers.
2015-8	Create GIS layer of all conservation easement areas granted to the City of Charlotte to protect natural and restored buffers.	Completed	Complete: Conservation easements are documented and included within the GIS layer as they acquired. Ongoing.
2015-9	Seek grant funding to 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.	Completed	Supported technical and financial questions for grant funding

2015 Action #	Description	2020 Status	Status Comments/Explanation
2015-10	Seek grant funding to install backup generators or quick connect hook ups for mobile generators on any newly constructed city/county critical facilities.	Completed	Supported technical and financial questions for grant funding
2010-8	Create media campaign/message to relay to local media and the general public prior to forecasted severe storm events.	Completed	Complete: Charlotte-Mecklenburg Storm Water Services continues to educate and expand awareness of hazards through a coordinated flood safety campaign. Messaging includes flood preparation and preparedness, flood risk reduction, and flood risk awareness. Major components of the strategic campaign include broadcast, print, web, social and digital media. Additional efforts include on camera interviews with local media before, during and after heavy thunderstorms or other major weather events. For example, in response to Hurricanes Florence and Michael Storm Water Services responded to 58 local and national media requests in the first 5 months of 2019 and participated in 6 live in-studio local interviews. Media advisories are also used to share flood related messages. With about 7,000 Facebook, 1,000 Twitter, and 600 Instagram followers, Charlotte-Mecklenburg Storm Water Services' shares several flood safety social media messages per month. At least two flood related messages are included in utility bill inserts per year, reaching over 150,000 residents each printing. Messages are shared and coordinated with others, including Emergency Management, CDOT, CLT Water, and Mecklenburg County as appropriate. Special efforts are made to co-promote messaging during key times of the year such as NC Severe Weather Preparedness Week (March) and National Hurricane Preparedness Week (May). Should an emergency situation arise, Storm Water Services' practice is to promote official messages from the lead agencies (for example Emergency Management) to ensure accurate, timely and consistent information reaches the residents of our community.

2015 Action #	Description	2020 Status	Status Comments/Explanation
2010-10	Review and incorporate revisions to the City's tree ordinance with the goal of preserving and enhancing pervious/natural areas along with urban tree populations in a manner that can minimize potential impacts of flooding, drought, winter storms, wildfires and high wind events. This includes consideration of strategies for proper species selection and planting practices as well as identification and removal of hazard trees per USDA best management practices.	Delete	This item was to be removed for 2015 update; the Tree Ordinance was revised in 2011.
2010-14	Conduct annual inspections on ponds/dams that City of Charlotte Storm Water Services has accepted maintenance responsibility.	Completed	Complete: Inspections of ponds have been completed on an annual basis. In addition, inspections have been completed prior to large storm events on an as needed basis (i.e., Hurricane Michael). Inspection activities of 38 ponds were completed by April 2019.
Town of Cornelius			
2015-1	Plan for development and appropriate flood mitigation strategies in the Land Development Code.	Completed	Floodplain management and flood mitigation is now addressed by provisions in the Land Development Code.
2015-2	Evaluate 2012 tree inventory with respect to tree size and vicinity to utilities to identify mitigation strategies.	Deleted	Addressing tree issues as they arise
2015-4	Work with power companies to educate and gain support for proper preventative tree pruning to reduce the chance of power outages.	Deleted	Combined with other outreach activities and replaced with new action
2015-5	Maintain continued compliance with the National Flood Insurance Program (NFIP) through implementation and periodic evaluation of the following higher regulatory standards (in addition to basic required compliance actions): a) Require critical facilities protection to 500-year flood levels b) Require parking lots to be elevated (no more than six inches deep in any parking space during Community Flood event) c) Require dry land access for new or substantially improved buildings (above Community Base Flood Elevation) d) Levee restrictions e) Floors of new or substantially improved buildings allowed by variance in the floodplain must be elevated at least one (1) foot above the Community (future) Base Flood Elevation. f) Prohibit basements below flood level on filled lots	Completed	

2015 Action #	Description	2020 Status	Status Comments/Explanation
2015-6	Seek grant 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	
2015-7	Seek grant funding to install backup generators or quick connect hook ups for mobile generators on any newly constructed county/town critical facilities. (Note: the Town of Cornelius already has generators at all Police Stations and Fire Stations; there is currently not one at Town Hall.)	Deleted	
2010-3	Continue NFIP and nuclear educational campaign for citizens living near lake areas.	Deleted	Combined with other outreach activities and replaced with new action
2010-7	On an annual basis, coordinate with Charlotte-Mecklenburg Emergency Management on a widespread public outreach activity to provide information on all natural hazards facing the area to local residents, including methods for preventing damages from hazardous conditions and how to respond when an imminent hazard threatens.	Deleted	Combined with other outreach activities and replaced with new action
2010-8	On an annual basis, coordinate with Charlotte-Mecklenburg Emergency Management to provide information on all natural hazards facing the area to local planning staff and elected officials. This should be combined with an annual progress report on the status of local mitigation actions as identified in the Multi-jurisdictional Hazard Mitigation Plan.	Deleted	Combined with other outreach activities and replaced with new action
Town of Davidson			
2015-1	Improve drainage in a public stormwater drainage area to prevent flooding of several homes in the Westside neighborhood.	Completed	
2010-2	Continue action items resulting from Emergency Table Top Exercise	Completed	Completed meeting. Had practice during last hurricane event when we set up a JIC in town hall that was manned to 48hr.
Town of Huntersville			
2015-1	Enhance use of CharMeck Alerts to warn people of impending hazards, potential emergencies, and disasters.	Completed	Currently Utilize Social Media such as; Facebook, Twitter, Town Web Site to push out alerts as needed
2015-03	Seek grant funding to install backup generators or quick connect hook ups for mobile generators on any newly constructed hook ups for mobile generators on any newly constructed	Delete	Combined with 2015-02

2015 Action #	Description	2020 Status	Status Comments/Explanation
2010-01	Maintain continued compliance with the National Flood Insurance Program (NFIP) through implementation and periodic evaluation of the following higher regulatory standards (in addition to basic required compliance actions): a- New residential buildings must be built with the lowest floor elevated at least one foot above the Community (Future) Base Flood Elevation. b-Require critical facilities protection to 500-year flood levels. c- Require parking lots for new, non single-family habitable buildings to be elevated (no more than six inches deep in any parking space during Community Flood event) d- Require dry land access for new or substantially improved habitable structures e- Levee restrictions f-Cumulative substantial damage improvement provision g- Prohibit basements below flood level on filled lots	Delete	Mecklenburg County does this on our behalf
2010-02	Coordinate with Charlotte-Mecklenburg Storm Water Services (CMSWS) to apply for and join FEMA's Community Rating System (CRS).	Completed	Town Applied through CMSWS
2010-03	Participate in NFIP educational campaign through increased coordination with Charlotte-Mecklenburg County Storm Water Services (CMSWS), including the posting of a hyperlink to their floodplain management website on Huntersville's town website.	Completed	We have a link on the Town of Huntersville web site to the County Floodplain Map and will continue to update it as needed.
2010-04	Enhance use of Connect-CTY® to warn people of impending hazards, potential emergencies and disasters.	Completed	The Towns are now part of CharMeck Alerts,
2010-05	Implement storm water mitigation projects, including the grading of ditches and replacing failing/potentially failing storm water structures.	Completed	Huntersville continues to administer Storm Water Programs
2010-06	Utilize barricades, barriers, cones and signs to adequately and efficiently control traffic flow during emergencies and disasters.	Completed	Huntersville continues to add to the current inventory as needed and inspects and investories assets annually.
2010-07	On an annual basis, coordinate with Charlotte-Mecklenburg Emergency Management Office (CMEMO) on a widespread public outreach activity to provide information on all natural hazards facing the area to local residents, including methods for mitigating and preventing damages from hazardous conditions and how to respond when an imminent hazard threatens.	Completed	CMEMO, Social Media, Web Site

2015 Action #	Description	2020 Status	Status Comments/Explanation
2010-08	On an annual basis, coordinate with Charlotte-Mecklenburg Emergency Management Office (CMEMO) to provide information on all natural hazards facing the area to local planning staff and elected officials. This should be combined with an annual progress report on the status of local mitigation actions as identified in the Multi Multijurisdictional Hazard Mitigation Plan.	Completed	Coordinated through CMEMO
Town of Matthews			
2015-3	Update the Matthews Tree Management Plan to assess current tree conditions along road sides and continue to implement the same to minimize potential impacts of ice and wind events.	Completed	Town landscape mgt mediates conditions within the right of way or notifies property owners of trees needing attention adjacent to RoW.
2010-4	Complete the development of a Town specific Emergency Operations plan to supplement County All-Hazards Plan.	Completed	Under revision to comply with County's Emergency Operations Plan
2010-8	Initiate project to mark all hydrants for easy location at night and by Mutual Aid Departments not familiar with Town streets and hydrant locations.	Completed	Hydrants have been painted. Discontinued installation of street markers. GIS mapping preferred and completed.
2005-2	Work with power companies to educate and gain support for proper preventative tree pruning to reduce the chance of power outages.	Completed	
Town of Mint Hill			
2010-3	Ensure the consideration of all natural hazards is integrated into local infrastructure and capital improvements planning.	Deleted	Combined with action #2010-2
2010-6	Coordinate with NCDOT on the identification of structurally deficient bridges that are more likely to sustain damage from future earthquake events and that should be addressed through future retrofit projects or bridge replacement.	Deleted	There are no Town-maintained bridges
Town of Pineville			
2010-3	Minimize the potential for future stormwater flooding throughout the Town by means of the following actions: 1. Encourage residents to keep storm drains clear of debris during/after storms; 2. Routinely clean storm water drains; and 3. Repair storm water drains as necessary.	Completed	Completed/Ongoing. Citizens are continually being notified about how it is important not to throw clippings and other items down storm drains. The Town actively cleans and maintains storm water drains
2010-5	Encourage clustering of residential lots outside of known hazard areas through the development and use of subdivision design and review guidelines.	Completed	Completed/In Progress. Town maintains Zoning and Subdivision Ordinances to attain this goal.

2015 Action #	Description	2020 Status	Status Comments/Explanation
2010-7	Limit the percentage of allowable impervious surface within developed parcels.	Completed	Achieved. The Town through the Zoning and Subdivision Ordinance as well as Mecklenburg County Stormwater and Land Development regulates and manages impervious coverage.
2010-9	Acquire or relocate structures subject to repetitive flooding.	Delete	Combined with Action #2010-6
2005-6	Advertise and promote the availability of flood insurance.	Delete	Combined with Action #2010-4
2005-7	Develop a “natural runoff” or “zero discharge” policy for storm water in subdivision design regulations.	Completed	As adopted in stormwater and land development ordinances
2005-8	Limit the percentage of allowable impervious surface within developed parcels.	Delete	Combined with Action #2010-7, which was completed.
2005-9	Routinely clean debris from support bracing underneath low-lying bridges.	Completed	Completed/In Progress. The Public Works Department in coordination with Mecklenburg County and NCDOT routinely checks the supports of the bridges in Town. If any material is stuck, they will clear it out to prevent any clogging and backups. No new actions have been implemented
2005-10	Routinely inspect the functioning of fire hydrants.	Completed	Completed/To Be Continued. The Volunteer Fire Department checks the fire hydrants regularly
2005-11	Provide training for 911 dispatchers during natural disasters.	Completed	Completed/To Be Continued. This continues to be a part of normal training practices for 911 dispatchers. No new action steps have been undertaken
2005-12	Train emergency responders and managers for flood emergencies.	Completed	Completed/To Be Continued. This continues to be a part of normal training practices for Police and Fire Departments. No new action steps have been undertaken.
2005-13	Equip emergency responders and managers for flood emergencies.	Completed	Completed/To Be Continued. The Town has now implemented a Capital Improvements Program to help pay for new equipment for the Police and Fire Departments and other major expenditures to prepare for flood and other emergencies.
2005-14	Train staff and educate the community on local vulnerability to hazards.	Completed	Completed/To Be Continued. Staff continues to work with CMSWS to educate citizens on different hazards. The bi-monthly newsletter is the main conduit through which education efforts are handled. No new efforts have been undertaken.

2015 Action #	Description	2020 Status	Status Comments/Explanation
2005-18	Improve the level of coordination between the GIS Department and other departments.	Completed	Completed. The Town has purchased, and regularly uses, a Large Format Scanner to assist with maps and general coordination as new information is available.
2005-20	Encourage clustering of residential lots outside of hazard areas through the use of subdivision design and review guidelines.	Completed	Completed. The Zoning Ordinance and overlay districts have been revised to control and organize development. The Subdivision Ordinance has been revised and updated to better reflect changes in Mecklenburg County's Land Development practices.
2005-21	Acquire or relocate structures subject to repetitive flooding.	Delete	Combined with Action #2010-6
2005-22	Preserve lands subject to repetitive flooding.	Delete	Combined with Action #2010-6
2005-24	Conduct cumulative impact analysis/studies for multiple development projects within the same watershed.	Delete	Combined with Action #2010-10
2005-25	Routinely clean stormwater drains	Completed	

3 Planning Area Profile

3.1 GEOGRAPHY AND ENVIRONMENT

Mecklenburg County is located in the south central portion of North Carolina along the border with South Carolina. It is surrounded by Iredell County to the north, Catawba and Lincoln Counties to the northwest, the Catawba River and Gaston County to the west, South Carolina to the south, Union County to the southeast, and Cabarrus County to the northeast. The Planning Area includes Mecklenburg County unincorporated areas, City of Charlotte, Town of Cornelius, Town of Davidson, Town of Huntersville, Town of Matthews, Town of Mint Hill, and Town of Pineville. A location map is provided in Figure 3.1.

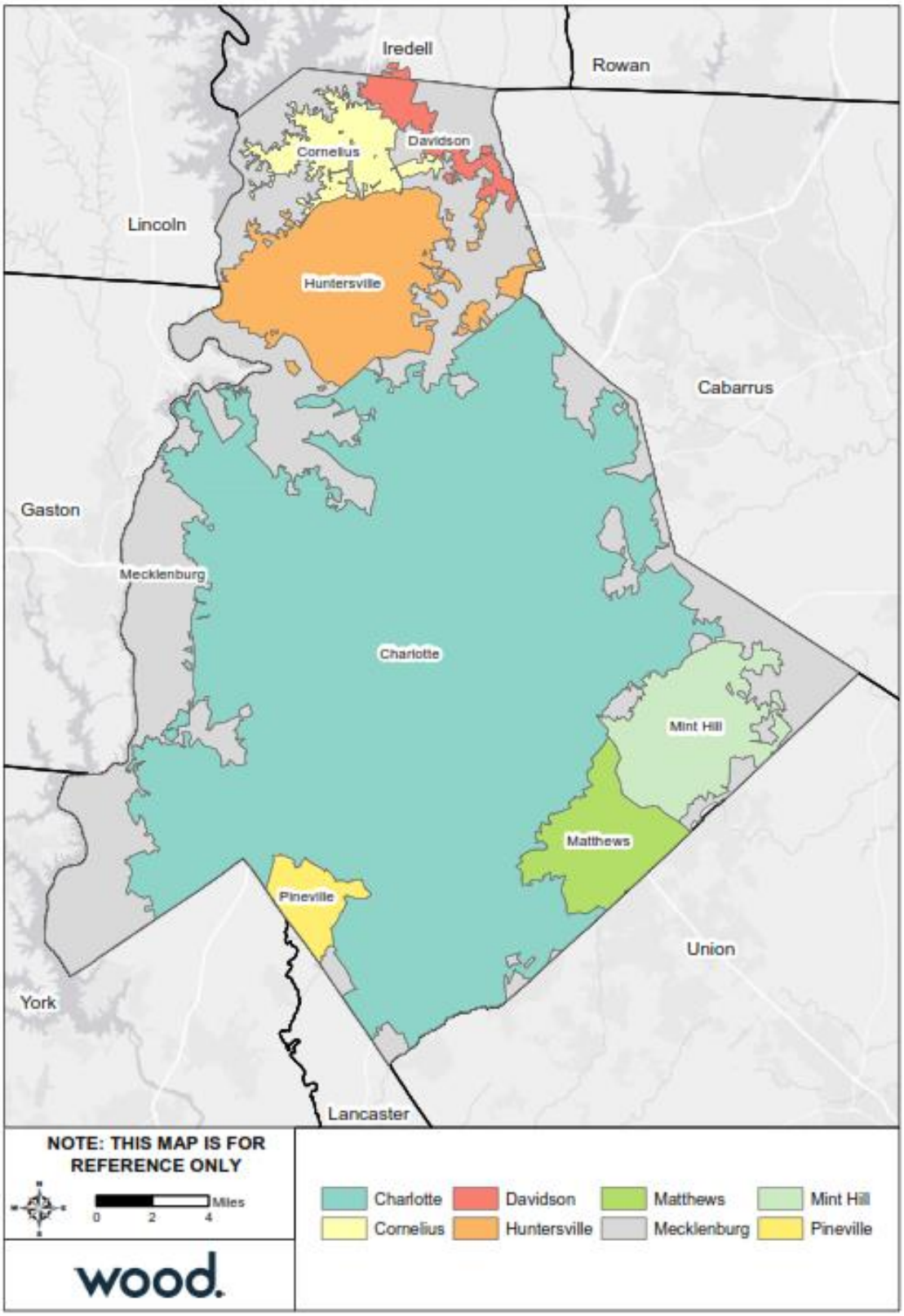
Mecklenburg County comprises a total land area of 524 square miles. The total land area of each participating jurisdiction is listed in Table 3.1.

Table 3.1 – Total Land Area of Participating Jurisdictions

Jurisdiction	Land Area
Mecklenburg County	**523.84 sq. mi.**
Unincorporated areas	121.07 sq. mi.
City of Charlotte	297.68 sq. mi.
Town of Cornelius	12.08 sq. mi.
Town of Davidson	5.75 sq. mi.
Town of Huntersville	39.61 sq. mi.
Town of Matthews	17.11 sq. mi.
Town of Mint Hill	23.92 sq. mi.
Town of Pineville	6.62 sq. mi.

Source: US Census Bureau, 2010

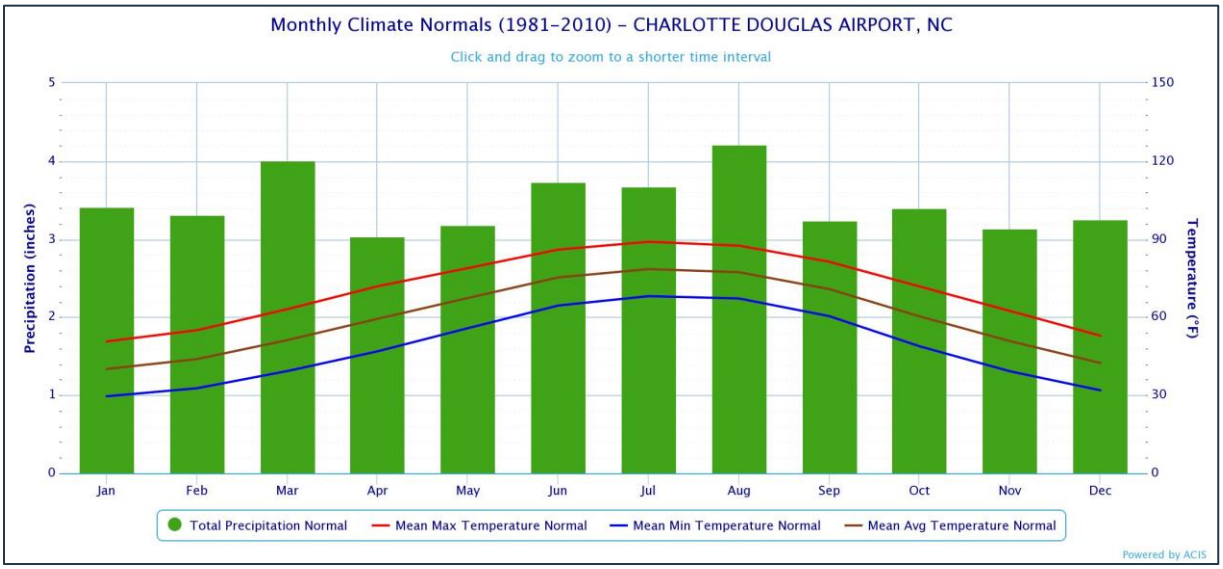
Figure 3.1 – Mecklenburg County and Participating Jurisdictions Location Map



Source: Mecklenburg County Open Mapping Data

According to the Köppen climate classification system, Mecklenburg County has a humid subtropical climate characterized by mild winters and hot humid summers with significant precipitation even during the driest month. The county experiences an average annual high temperature of 70.9°F and an average annual low of 48.7°F. Average annual rainfall is approximately 41.63 inches and average annual snowfall is 4.3 inches. Figure 3.2 shows the average monthly precipitation for the Charlotte Douglas Airport weather station, which approximates temperature and precipitation of the County.

Figure 3.2 – Average Monthly Precipitation



Source: Northeast RCC CLIMOD 2.

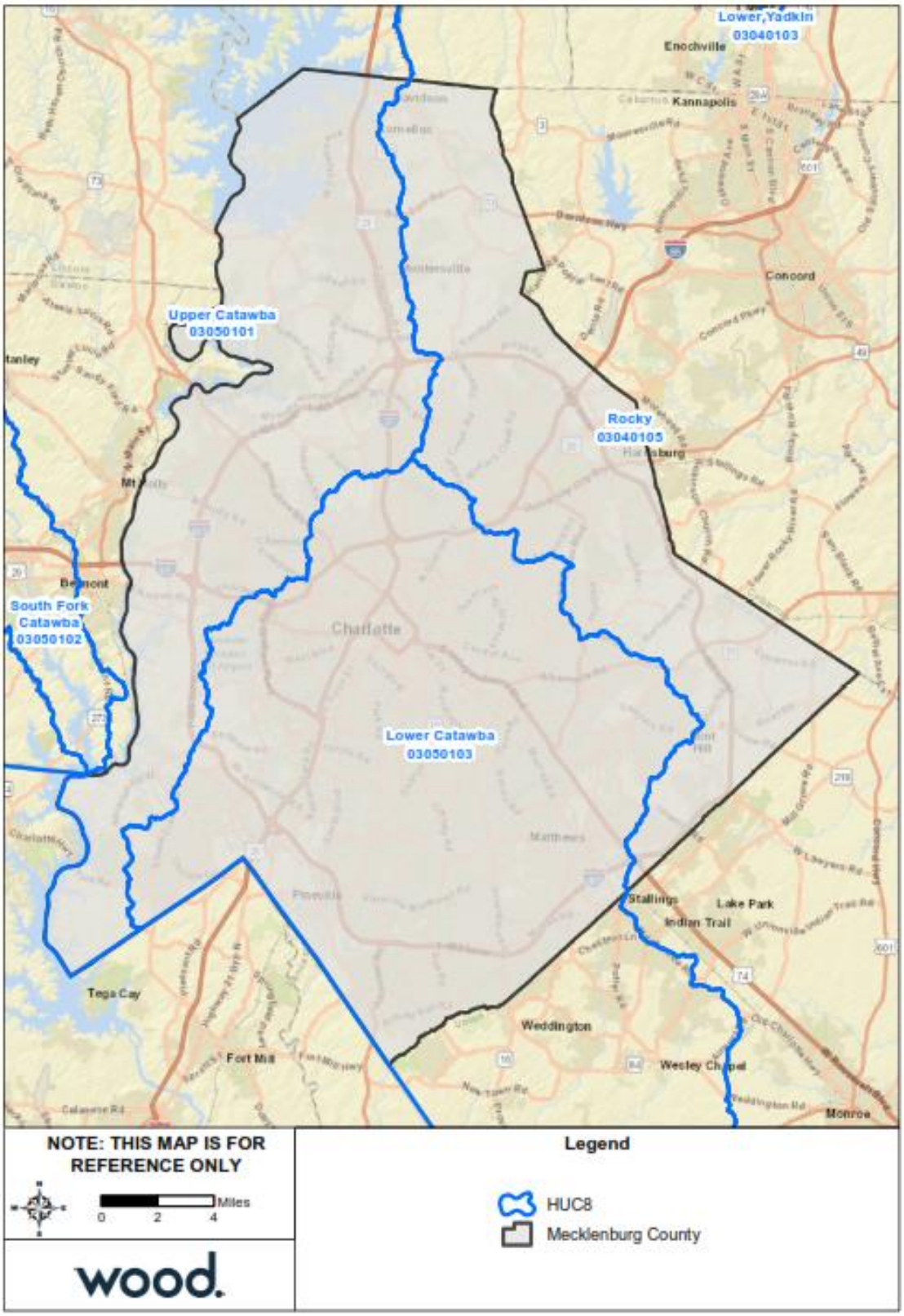
As shown in the map of HUC-8 watersheds in Figure 3.3, Mecklenburg County is split between three major watersheds, the Upper Catawba River basin, the Lower Catawba River basin, and the Rocky River basin.

Wetlands

According to data from the U.S. Fish and Wildlife Service's National Wetlands Inventory, there are approximately 167,779 acres of wetlands in the County. Wetlands areas and hydrologic features are shown by type in Figure 3.4.

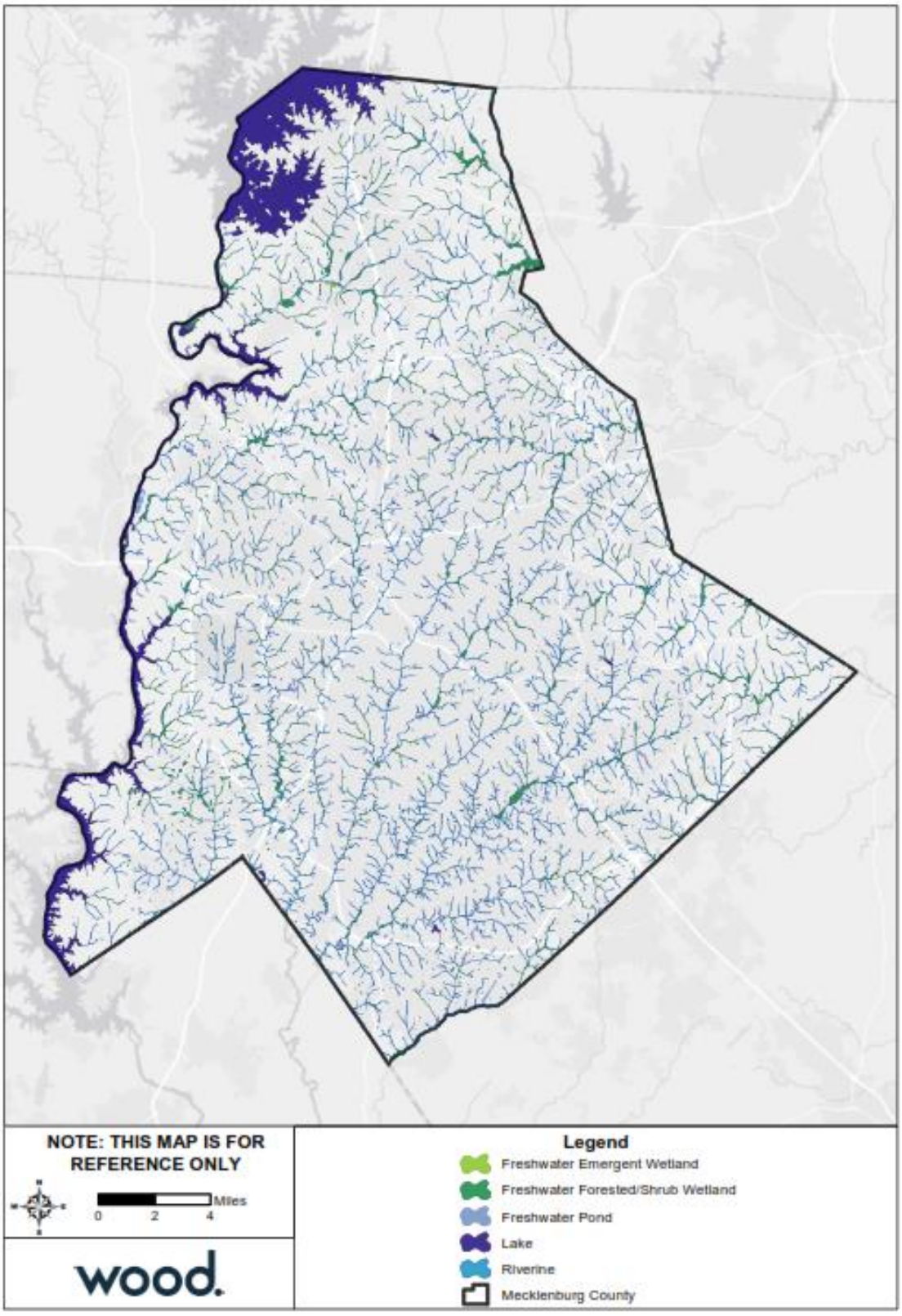
Natural and Beneficial Wetland Functions: The benefits of wetlands are hard to overestimate. They provide critical habitat for many plant and animal species that could not survive in other habitats. They are also critical for water management as they absorb and store vast quantities of storm water, helping 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.

Figure 3.3 – HUC-8 Drainage Basins



Source: USDA Natural Resources Conservation Service

Figure 3.4 – Wetlands by Type in Mecklenburg County



Source: U.S. Fish & Wildlife Service, National Wetlands Inventory - Version 2

Parks, Preserve, and Conservation

Mecklenburg County Park & Recreation Department manages over 210 parks and facilities covering over 21,000 acres throughout the County. Of these park areas, over 7,600 acres are designated as nature preserves and managed by the County's Division of Nature Preserves and Natural Resources. The County's nature preserves provide recreation and environmental education space while also serving to protect biological resources and natural areas. The County also has 49 miles of developed greenway trails and a Park and Recreation Master Plan with additional greenway trails planned for future construction.

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. Mecklenburg County has five species that are listed with the U.S. Fish and Wildlife Services. Table 3.2 below lists the species identified as threatened, endangered, or other classification.

Table 3.2 – Threatened and Endangered Species

Group	Common Name	Scientific Name	Federal Status
Clams	Carolina heelsplitter	Lasmigona decorata	Endangered
Conifers and Cycads	Carolina hemlock	Tsuga caroliniana	Under Review
Flowering Plants	Smooth coneflower	Echinacea laevigata	Endangered
Flowering Plants	Schweinitz's sunflower	Helianthus schweinitzii	Endangered
Flowering Plants	Michaux's sumac	Rhus michauxii	Endangered

Source: U.S. Fish & Wildlife Service (https://ecos.fws.gov/ecp0/reports/species-by-current-range-county?fips=37119)

3.2 POPULATION AND DEMOGRAPHICS

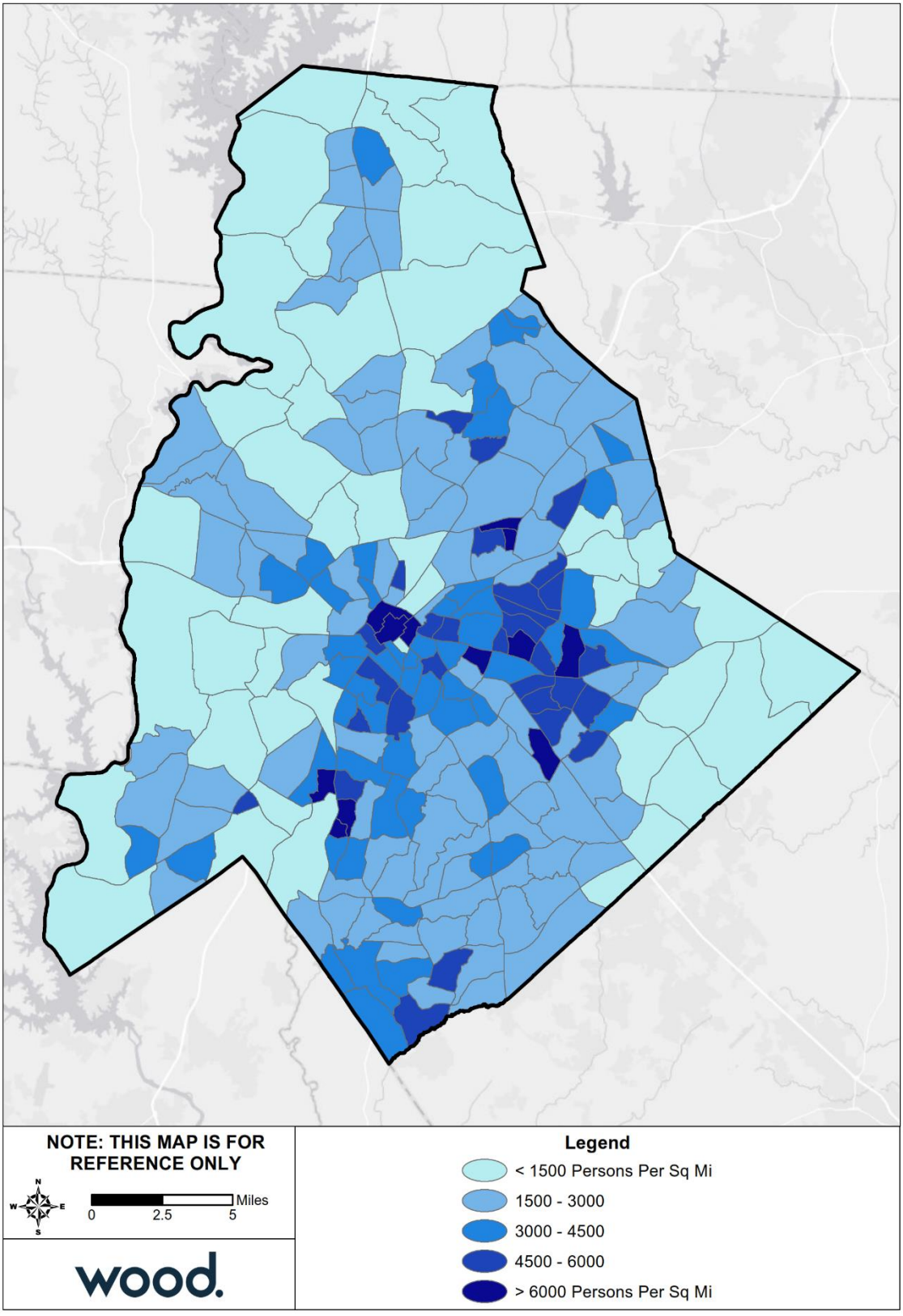
Mecklenburg County and its municipalities have grown substantially over the past two decades. Mecklenburg County had 919,628 residents at the time of the 2010 U.S. Census and an estimated population of 1,054,314 in 2018. Overall population density in the County increased from 1,755.6 persons per square mile in 2010 to 2,012.7 persons per square mile in 2018. Trends suggest that this number is likely to continue growing. Figure 3.5 shows population density across the county in persons per square mile. All areas experienced growth between 2010 and 2018, with an average growth rate across the County of 14.6 percent. All jurisdictions grew by more than 14 percent between 2010 and 2018, and the Town of Huntersville grew by nearly 17 percent. The decrease in population in the unincorporated areas from 2000 to 2010 is due to substantial annexations by the City of Charlotte over this period. Table 3.3 provides population counts from 2000, 2010, and 2017 for each of the participating jurisdictions.

Table 3.3 – Mecklenburg County Population Counts

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
Mecklenburg County	**695,454**	**919,628**	**1,054,314**	**134,686**	**14.6%**
Unincorporated areas	70,060	48,222	50,674	2,452	5.1%
City of Charlotte	540,828	731,424	841,611	110,187	15.1%
Town of Cornelius	11,969	24,866	28,649	3,783	15.2%
Town of Davidson	7,139	10,944	12,666	1,722	15.7%
Town of Huntersville	24,960	46,773	54,572	7,799	16.7%
Town of Matthews	22,127	27,198	31,400	4,202	15.4%
Town of Mint Hill	14,922	22,722	26,168	3,446	15.2%
Town of Pineville	3,449	7,479	8,574	1,095	14.6%

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

Figure 3.5 – Population Density, 2018



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

Table 3.4 details demographic and social characteristics of Mecklenburg County as compared to the State of North Carolina overall according to the 2018 ACS 5-Year Estimates. Per this data, Mecklenburg County has a younger population than the state and a higher population of individuals who speak English less than "very well." Educational Attainment is higher in Mecklenburg County as a whole and the percent of individuals with disability is lower. Details on these social characteristics by jurisdiction will be available in individual annexes. The racial characteristics of the participating jurisdictions are presented in Table 3.5.

Table 3.4 – Mecklenburg County Demographic Summary, 2018

Demographic & Social Characteristics	Mecklenburg County	North Carolina
Median Age	35	38.6
% of Population Under 5 years old	6.8	5.9
% of population Over 65 years old	10.6	15.5
% of Population Over 25 with high school diploma	90.1	87.4
% of Population Over 25 with bachelor's degree or higher	44.8	30.5
% with Disability	8.4	13.6
% Speak English less than "very well"	8.9	4.6

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

Table 3.5 – Racial Demographics of Mecklenburg County Jurisdictions, 2018

Jurisdiction	White, %	Black, %	Asian, %	Other Race, %	Two or More Races, %	Persons of Hispanic or Latino Origin*, %
Mecklenburg County	**54.5%**	**31.3%**	**5.8%**	**5.6%**	**2.9%**	**13.0%**
City of Charlotte	49.5%	35.1%	6.5%	6.0%	2.8%	14.0%
Town of Cornelius	86.0%	7.8%	2.4%	1.5%	2.3%	6.4%
Town of Davidson	92.4%	4.4%	1.2%	0.3%	1.6%	5.4%
Town of Huntersville	80.5%	11.7%	2.6%	2.5%	2.7%	7.1%
Town of Matthews	80.1%	9.6%	2.8%	4.5%	3.0%	8.9%
Town of Mint Hill	74.6%	15.8%	2.4%	3.2%	3.8%	7.8%
Town of Pineville	55.1%	34.6%	5.1%	3.2%	2.1%	11.2%
North Carolina	68.9%	21.5%	2.8%	4.3%	2.6%	9.2%

Source: US Census Bureau, ACS 2014-2018 5-Year Estimates

*Persons of Hispanic origin may be of any race, so also are included in applicable race categories

3.3 HISTORIC PROPERTIES

As of October 17, 2018, Mecklenburg County had 105 listings on the National Register of Historic Places. This list includes 14 Historic Districts located in Charlotte. 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.

Table 3.6 – Historic Properties, Mecklenburg County

Ref#	Property Name	Status Date	Category	City
70000461	Alexander, Hezekiah, House	4/17/1970	Building	Charlotte
72000973	Rosedale	9/11/1972	Building	Charlotte
73001359	Victoria	4/11/1973	Building	Charlotte
75001281	Biddle Memorial Hall, Johnson C. Smith University	10/14/1975	Building	Charlotte
75001282	Latta Arcade	10/29/1975	Building	Charlotte
76001330	Liddell-McNinch House	12/12/1976	Building	Charlotte
78001963	Duke, James Buchanan, House	1/20/1978	Building	Charlotte

Ref#	Property Name	Status Date	Category	City
78001966	White Oak Plantation	2/7/1978	Building	Charlotte
78001965	Jonas, Charles R., Federal Building	6/7/1978	Building	Charlotte
78001964	Independence Building	9/18/1978	Building	Charlotte
79001734	Mecklenburg County Courthouse	5/10/1979	Building	Charlotte
79003344	Hotel Charlotte	7/2/1979	Building	Charlotte
80002885	Carr, John Price, House	10/22/1980	Building	Charlotte
80002886	Fire Station No. 2	10/22/1980	Building	Charlotte
80002887	Seaboard Air Line Railroad Passenger Station	10/24/1980	Building	Charlotte
82003486	Mecklenburg Investment Company Building	8/19/1982	Building	Charlotte
82001300	First Presbyterian Church	11/12/1982	Building	Charlotte
83001896	Overcarsh House	7/21/1983	Building	Charlotte
83003971	VanLandingham Estate	10/13/1983	Building	Charlotte
83003970	Morrocroft	11/28/1983	Building	Charlotte
84002344	Merchants and Farmers National Bank Building	3/1/1984	Building	Charlotte
84002348	Charlotte Supply Company Building	3/1/1984	Building	Charlotte
84002408	Carey, Philip, Building	3/1/1984	Building	Charlotte
87000610	Dilworth Historic District	4/9/1987	District	Charlotte
87000655	Myers Park Historic District	8/10/1987	District	Charlotte
88001702	Hoskins Mill	10/5/1988	Building	Charlotte
88001855	Highland Park Manufacturing Company Mill No. 3	10/20/1988	District	Charlotte
88003003	Elizabeth Historic District	1/3/1989	District	Charlotte
90000367	North Charlotte Historic District	3/16/1990	District	Charlotte
90001314	Addison Apartments	8/23/1990	Building	Charlotte
90002186	Hayes--Byrum Store and House	1/31/1991	District	Charlotte
90002187	Craven, Dr. Walter Pharr, House	1/31/1991	Building	Charlotte
91000077	Hodges, Eugene Wilson, Farm	2/21/1991	District	Charlotte
91000079	McKinney, John Washington, House	2/21/1991	Building	Charlotte
91000080	Morris, Green, Farm	2/21/1991	District	Charlotte
91000082	Steele Creek Presbyterian Church and Cemetery	2/211991	District	Charlotte
91001376	Nebel Knitting Mill, Former	9/5/1991	Building	Charlotte
92001615	Commercial Building at 500 North Tryon Street	11/20/1992	Building	Charlotte
93000735	Mayes House	8/5/1993	Building	Charlotte
94000146	Parks--Cramer Company Complex, Former	3/7/1994	Building	Charlotte
94001049	Thrift Mill, Former	8/26/1994	District	Charlotte
95001397	Wesley Heights Historic District	11/29/1995	District	Charlotte
98000157	Charlotte Coca-Cola Bottling Company Plant, Former	2/26/1998	Building	Charlotte
99000091	Textile Mill Supply Company Building	2/5/1999	Building	Charlotte
99000670	McNinch, Frank Ramsay, House	6/3/1999	Building	Charlotte
99000699	Croft Historic District	6/10/1999	District	Charlotte
99001366	Billingsville School	11/12/1999	Building	Charlotte
99001447	Carolina Transfer and Storage Company Building, (Former)	11/30/1999	Building	Charlotte
00001495	Dilworth Historic District (Boundary Increase)	12/7/2000	District	Charlotte
00001640	Union Storage and Warehouse Company Building	1/11/2001	Building	Charlotte
01000341	Frederick Apartments	4/5/2001	Building	Charlotte
01000374	Carolina School Supply Company Building (Former)	4/12/2001	Building	Charlotte
01000422	Tompkins, Daniel A., Company Machine Shop, Former	5/8/2001	Building	Charlotte
01000423	Crane Company Building (Former)	5/8/2001	Building	Charlotte
02000057	Pharrsdale Historic District	2/20/2002	District	Charlotte

Ref#	Property Name	Status Date	Category	City
02000439	Jones III, Hamilton C., House	5/2/2002	Building	Charlotte
02001718	Alexander, William T., House	1/15/2003	Building	Charlotte
03000343	Sykes, Joseph, Brothers Company Building	5/1/2003	Building	Charlotte
03001275	Grinnell Company--General Fire Extinguisher Company Complex	12/10/2003	Building	Charlotte
04000906	Palmer Fire School	8/25/2004	Building	Charlotte
04001523	East Avenue Tabernacle Associated Reformed Presbyterian Church	1/20/2005	Building	Charlotte
04001530	Rozzell, Edward M., House	1/20/2005	Building	Charlotte
06000721	Orient Manufacturing Company--Chadwick--Hoskins No. 3	8/15/2006	Building	Charlotte
06000724	Grier, Sidney and Ethel, House	8/23/2006	Building	Charlotte
06000866	Lawrence, Elizabeth, House and Garden	9/14/2006	Building	Charlotte
06001141	Seifart, Fritz, House	12/20/2006	Building	Charlotte
07001011	Siloam School	9/28/2007	Building	Charlotte
07001499	Home Federal Building	1/30/2008	Building	Charlotte
07001500	Southern Asbestos Company Mills	1/30/2008	Building	Charlotte
08000381	Alexander, Neal Somers, House	5/7/2008	Building	Charlotte
08000412	Grace A.M.E. Zion Church	5/15/2008	Building	Charlotte
08001364	Kilgo, Bishop John C., House	1/22/2009	Building	Charlotte
08001365	Robinson Rock House Ruin and Plantation Site	1/22/2009	Site	Charlotte
10000603	Grier-Rea House	8/30/2010	Building	Charlotte
11000637	Barringer Hotel	8/29/2011	Building	Charlotte
13001027	Louise Cotton Mill	12/31/2013	Building	Charlotte
14000989	Savona Mill	12/2/2014	Building	Charlotte
15000530	Speas Vinegar Company	8/12/2015	Building	Charlotte
16000879	Charlotte Fire Station No. 4	12/22/2016	Building	Charlotte
100001632	Highland Park Mill No. 1	9/21/2017	Building	Charlotte
97001561	Potts Plantation	1/5/1998	District	Cornelius
72000974	Eumenean Hall, Davidson College	4/13/1972	Building	Davidson
72000975	Philanthropic Hall, Davidson College	4/13/1972	Building	Davidson
79001735	Beaver Dam Plantation House	3/19/1979	Building	Davidson
04000905	Blake, Chairman, House	8/25/2004	Building	Davidson
09000381	Davidson Historic District	6/1/2009	District	Davidson
72000976	Cedar Grove	2/1/1972	Building	Huntersville
72000978	Latta House	3/16/1972	Building	Huntersville
72000977	Holly Bend	3/24/1972	Building	Huntersville
76001331	Davidson, Benjamin W., House	4/26/1976	Building	Huntersville
84002410	St. Mark's Episcopal Church	3/1/1984	Building	Huntersville
91000023	Ewart, John F., Farm	2/4/1991	District	Huntersville
91000076	St. Mark's Episcopal Church (Boundary Increase)	2/21/1991	Building	Huntersville
91000078	McElroy, Samuel J., House	2/21/1991	Building	Huntersville
91000081	Ramah Presbyterian Church and Cemetery	2/21/1991	Building	Huntersville
96000198	Hopewell Presbyterian Church and Cemetery	3/1/1996	District	Huntersville
00001291	McCoy, Albert, Farm	11/2/2000	District	Huntersville
01000725	Gluyas, Thomas and Latitia, House	7/11/2001	Building	Huntersville
09000636	Huntersville Colored High School	8/20/2009	Building	Huntersville
82003487	Providence Presbyterian Church and Cemetery	6/1/1982	Building	Matthews
96000928	Matthews Commercial Historic District	8/22/1996	District	Matthews
15000183	Outen, R.F., Pottery	4/24/2015	Building	Matthews

Ref#	Property Name	Status Date	Category	City
11000510	Pineville Commercial Historic District	8/5/2011	District	Pineville
11000511	Pineville Mill Village Historic District	8/8/2011	District	Pineville
98000706	Blakeney, James A., House	6/18/1998	Building	Providence

Source: National Register of Historic Places

3.4 HOUSING

Table 3.7 provides details on housing characteristics for the County and incorporated jurisdictions as well as a comparison to the State of North Carolina and Table 3.8 provides further detail for Mecklenburg County. Counts by jurisdiction for these characteristics are in individual jurisdictional annexes.

According to the 2014-2018 ACS 5-Year Estimates, there are 435,7955 housing units in Mecklenburg County, of which 92.6 percent are occupied. Compared to the state, occupancy rates are higher across the county and all incorporated jurisdictions. Approximately 43.5% of occupied 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. The Town of Pineville has the highest rate of renter-occupied housing, at 67.6 percent. Higher rates of home ownership in some jurisdictions, including Davidson, Huntersville, Matthews, and Mint Hill, where owner-occupied housing rates are all above 73 percent, may indicate that more residents in these areas are able to implement certain types of mitigation in their homes.

Housing growth rates in the County and all jurisdictions except Pineville have exceeded the state average, especially those in Davidson, Huntersville, and Matthews, where total housing units have increased by over 10 percent compared to 2010 counts.

Median home value in Mecklenburg County is $219,800, approximately 32 percent higher than the state median. This number, however, is particularly skewed by significantly higher home values in the Town of Davidson. Of the County's owner-occupied housing units, 77.8 percent have a mortgage. More than 57 percent of householders moved into their current homes since the year 2010, and another 25.9 percent moved in between 2000 and 2009, which is indicative of the extreme growth the area has been experiencing and could indicate that many residents may be new to the area they live in. Householders of 5.9 percent of occupied housing units have no vehicle available to them; these residents may have difficulty in the event of an evacuation.

Nearly 60 percent of housing units in Mecklenburg County are detached single family homes. The next most common housing type is large multi-unit structures; structures with 20 or more units account for 12.1 percent of housing and structures with 10 to 19 units make up another 9.5 percent. Approximately 1.4 percent of units 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. Householders of approximately 5.9 percent of occupied housing units have no vehicle available to them; these residents may have difficulty in the event of an evacuation.

Most of the County's housing stock, over 60 percent, was built in the three decades between 1980 and 2009. Age can indicate the potential vulnerability of a structure to certain hazards. For example, Mecklenburg County first entered the National Flood Insurance Program in 1981. Therefore, based on housing age estimates approximately 30 percent of housing in the County was built before any floodplain development restrictions were required. The City of Charlotte entered the NFIP in 1978 but all other

jurisdictions did not enter the NFIP until years later; therefore, the actual percent of housing built without floodplain development restrictions may be higher.

Table 3.7 – Mecklenburg County and Incorporated Jurisdictions, Housing Characteristics, 2018

Jurisdiction	Housing Units (2010)	Housing Units (2016)	Housing Units Percent Change (2010-2016)	Percent Occupied (2016)	Occupied Units, % (2016)	Median Home Value (2016)
Mecklenburg County	**398,510**	**435,795**	**9.36%**	**92.6%**	**56.5%**	**$219,800**
City of Charlotte	319,918	351,143	9.76%	92.2%	52.9%	$200,500
Town of Cornelius	11,947	13,027	9.04%	92.8%	69.4%	$292,400
Town of Davidson	4,253	4,707	10.67%	90.8%	79.7%	$423,000
Town of Huntersville	18,477	20,850	12.84%	95.2%	75.2%	$283,300
Town of Matthews	11,021	12,265	11.29%	95.6%	73.2%	$249,200
Town of Mint Hill	9,149	9,736	6.42%	96.2%	77.8%	$252,800
Town of Pineville	4,051	4,183	3.26%	93.2%	32.4%	$208,300
North Carolina	4,327,528	4,573,066	5.67%	85.7%	65%	$165,900

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

Table 3.8 – Mecklenburg County Housing Characteristics, 2018

Housing Characteristics	Mecklenburg County	North Carolina
Average Household Size	2.56	2.52
% of Housing Units with no Vehicles Available	5.9%	5.9%
% of Housing Units that are mobile homes	1.4%	13.0%

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

3.5 INFRASTRUCTURE

3.5.1 Transportation

Mecklenburg County is served by the Charlotte Douglas International Airport in Charlotte.

The County is situated along the Norfolk Southern Railway, which has made it a major transportation and shipping center; the rail line receives twenty-five freight trains a day. The County is also a hub for the trucking industry due to the convergence of several major highways within the county. Major roadways that run through the county include interstate highways I-77, I-85, I-277, and I-485; US Highways US 21, US 29, US 74, and US 512; and state highways NC 16, NC 24, NC 27, NC 49, NC 51, NC 73, NC 115, NC 160, NC 218, and Route 4.

Passenger rail is also available via three Amtrak routes: the Crescent line, the Carolinian line, and the Piedmont line. Charlotte is also proposed as the southern terminus for the Southeast High Speed Rail Corridor to Washington D.C.

Mass transit options within the county include the LYNX rapid transit light rail system as well as the Charlotte Area Transit System (CATS) buses, which run throughout the County.

3.5.2 Utilities

Electric power for the county is provided by Duke Energy. Water and sewer service is provided by the Charlotte-Mecklenburg Utility Department. Natural gas is provided by Piedmont Natural Gas and PSNC Energy.

3.6 CURRENT AND FUTURE LAND USE

Land use in Mecklenburg County is managed by the Land Use & Environmental Services Agency (LUESA), an umbrella organization whose responsibilities include building and zoning code enforcement and natural resource management. Within LUESA, the Storm Water Services group is responsible land development, including reviewing plans for development, conducting erosion and water quality inspections, enforcing development ordinances, and managing floodplain mapping, floodplain development, flood mitigation, and drainage and maintenance. Mecklenburg County land development reviews site development plans and enforces development ordinances for the unincorporated county as well as the County's six incorporated Towns and their extra-territorial jurisdictions. The City of Charlotte performs code enforcement and land development reviews independently.

Future land use planning for the City and the unincorporated county is done by the Charlotte-Mecklenburg Planning Department. Currently, Charlotte and Mecklenburg County have small area plans and district plans that have been prepared and updated independently; however, many are decades old. Charlotte-Mecklenburg Planning Department is currently in the process of developing the 2040 Comprehensive Plan to create a growth strategy for the entire City of Charlotte and portions of the unincorporated county. This plan will incorporate the Capital Investment Plan, the 2030 Transit Plan, the Unified Development Ordinance, Vision Zero, Charlotte Walks, Charlotte Bikes, public art and more. The incorporated Towns manage their future land use planning independently.

3.7 EMPLOYMENT AND INDUSTRY

Mecklenburg County was once dominated by the textile industry but is now best known for the City of Charlotte's position as the third largest financial center in the country. Additionally, the Charlotte Metropolitan Statistical Area is home to six Fortune 500 companies and is a major center in the U.S. motorsports industry.

3.7.1 Wages and Employment

Per the 2018 ACS 5-Year Estimates, the median household income for Mecklenburg County was $64,312, which exceeds the state's median household income ($52,413). By jurisdiction, median household income is lower than that of the state only in Pineville. In Davidson, Huntersville, and Cornelius, median household income is higher than the state by 144 percent, 86 percent, and 69 percent, respectively. Per capita income statistics mirror this pattern, with the exception of Pineville which is above the State's per capita income. Compared to the state, a smaller population is living below the poverty level in the County and all incorporated jurisdictions, but more of the population lacks health insurance across the county and in Charlotte.

Table 3.9 shows economic statistics for each jurisdiction compared to the state average and Table 3.10 shows employment statistics for the county compared to the state average. Employment by industry statistics by participating jurisdiction can be found in each jurisdiction's annex.

Table 3.9 – Mecklenburg County Economic Statistics, 2018

Jurisdiction	Median Household Income	Per Capita Income	Unemployment Rate (%)	% of Individuals Below Poverty Level	% Without Health Insurance
Mecklenburg County	**$64,312**	**$37,298**	**5.8**	**12.7**	**11.9**
City of Charlotte	$60,886	$36,426	6.2	14	12.8
Town of Cornelius	$88,366	$51,953	4.0	7.4	8.3
Town of Davidson	$128,255	$56,358	3.2	3.0	3.4
Town of Huntersville	$97,320	$42,820	3.7	5.2	5.9

Jurisdiction	Median Household Income	Per Capita Income	Unemployment Rate (%)	% of Individuals Below Poverty Level	% Without Health Insurance
Town of Matthews	$78,971	$39,379	3.4	6.2	7.4
Town of Mint Hill	$70,425	$32,588	3.7	10.0	8.9
Town of Pineville	$48,324	$31,290	4.1	9.1	10.7
State of North Carolina	$52,413	$29,456	6.3	15.4	11.1

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

Table 3.10 – Mecklenburg County Employment by Industry, 2018

Industry	Mecklenburg County	North Carolina
Agriculture, forestry, fishing and hunting, and mining	0.3%	1.3%
Construction	6.3%	6.8%
Manufacturing	7.9%	12.4%
Wholesale trade	3.1%	2.5%
Retail trade	11.0%	11.7%
Transportation and warehousing, and utilities	5.7%	4.5%
Information	2.6%	1.8%
Finance and insurance, and real estate and rental and leasing	13.5%	6.4%
Professional, scientific, and management, and administrative and waste management services	14.1%	10.7%
Educational services, and health care and social assistance	18.4%	23.0%
Arts, entertainment, and recreation, and accommodation and food services	10.4%	9.6%
Other services, except public administration	4.7%	4.9%
Public administration	2.0%	4.3%

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

The largest industry sector in the County in 2018 was "educational services, and health care and social assistance," comprising 18.4 percent of employment across the County. This is followed closely by "professional, scientific, and management, and administrative and waste management services," comprising 14.1 percent of total employment. Additionally, compared to the state as a whole, the finance industry makes up a much larger percentage of employment in Mecklenburg County.

Table 3.11 summarizes the major employers in each county in Mecklenburg County from AccessNC as of the 2019 4th quarter.

Table 3.11 – Major Employers, Mecklenburg County

Company	Industry	Employment Range
Atrium Health	Health Care and Social Assistance	1000+
Wells Fargo Bank NA	Finance and Insurance	1000+
Charlotte-Mecklenburg Board of Education	Educational Services	1000+
Bank Of America NA	Finance and Insurance	1000+
American Airlines Inc.	Transportation and Warehousing	1000+
City Of Charlotte	Public Administration	1000+
Mecklenburg County Human Resources	Public Administration	1000+
Novant Medical Group Inc.	Health Care and Social Assistance	1000+
Presbyterian Hospital	Health Care and Social Assistance	1000+
Universal Protection Service LLC	Administrative and Support and Waste Management and Remediation Services	1000+

Company	Industry	Employment Range
Harris Teeter	Retail Trade	1000+
Charter Communications Inc.	Information	1000+
Crothall Healthcare Inc.	Accommodation and Food Services	1000+
University Of Nc At Charlotte	Educational Services	1000+
Wal-Mart Associates Inc.	Retail Trade	1000+
Teachers Insurance & Annuity Association	Finance and Insurance	1000+
Duke Energy Carolinas LLC	Management of Companies and Enterprises	1000+
Duke Energy Business Services LLC	Management of Companies and Enterprises	1000+
Young Mens Christian Association	Arts, Entertainment, and Recreation	1000+
United Parcel Service Inc.	Transportation and Warehousing	1000+
Insperity Peo Services LP	Professional, Scientific, and Technical Services	1000+
US Postal Service	Transportation and Warehousing	1000+
Piedmont Airlines Inc.	Transportation and Warehousing	1000+
Central Piedmont Community College	Educational Services	1000+
Belk Inc	Retail Trade	1000+

Source: AccessNC

Mecklenburg County accounts for the majority of its own employment, as approximately 86.9 percent of workers worked in their county of residence as of 2017.

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 Mecklenburg County Multi-Jurisdictional 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 hazard risk assessment covers all of Mecklenburg County, including the unincorporated County and all 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, Moderate, 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 and the 2015 Mecklenburg County Multi-jurisdictional 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 Mecklenburg County HMP?
Flooding	Yes	Yes
Hurricanes and Coastal Hazards	Yes	Yes
Severe Winter Weather (Freezing Rain, Snowstorms, Blizzards, Wind Chill, Extreme Cold)	Yes	Yes
Extreme Heat	Yes	No
Earthquake	Yes	Yes
Wildfire	Yes	Yes
Dam Failure	Yes	Yes
Levee Failure	No	Yes
Drought	Yes	Yes
Severe Thunderstorm (Tornado, Hailstorm, Torrential Rain, Thunderstorm Wind, High Wind, Lightning)	Yes	Yes (Tornado as separate hazard)
Landslide	Yes	Yes
Sinkholes	Yes	Yes
Erosion	Yes	No
Hazardous Materials Incident	Yes	No
Radiological Emergency	Yes	No
Terrorism	Yes	No

Hazard	Included in 2018 State HMP?	Included in 2015 Mecklenburg County HMP?
Infectious Disease	Yes	No
Cyber Threat	Yes	No
Electromagnetic Pulse	Yes	No
Solar Events	No	Yes

The HMPC evaluated the above list of hazards using existing hazard data, past disaster declarations, local knowledge, and information from the 2018 State Plan and the 2015 Mecklenburg County 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 641 records of storm/weather events that occurred in Mecklenburg County in the 20-year period from 1999 through 2018. Table 4.2 summarizes these events.

Table 4.2 – NCEI Severe Weather Reports for Mecklenburg County, 1999 – 2018

Type	# of Events	Property Damage	Crop Damage	Deaths	Injuries
Cold/Wind Chill	4	$0	$0	1	0
Drought	30	$0	$0	0	0
Extreme Cold/Wind Chill	1	$0	$0	0	0
Excessive Heat	0	$0	$0	0	0
Flash Flood	70	$12,199,500	$0	3	0
Flood	19	$2,078,500	$0	0	3
Frost/Freeze	3	$0	$1,000,000	0	0
Hail	134	$0	$0	0	0
Heat	3	$0	$0	0	0
Heavy Rain	20	$1,150,500	$0	0	0
Heavy Snow	10	$2,500,000	$0	0	0
High Wind	10	$675,000	$0	2	3
Hurricane	0	$0	$0	0	0
Ice Storm	3	$40,100,000	$0	0	0
Lightning	43	$2,395,000	$0	3	11
Strong Wind	6	$60,000	$0	1	0
Thunderstorm Wind	242	$1,452,500	$0	0	6
Tornado	7	$1,800,000	$0	0	4
Tropical Storm	1	$5,000	$0	0	0
Wildfire	0	$0	$0	0	0
Winter Storm	9	$0	$0	0	0
Winter Weather	26	$0	$0	0	0
Total:	**641**	**$64,416,000**	**$1,000,000**	**10**	**27**

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 Mecklenburg County 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 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, Mecklenburg County has been designated in five major disaster declarations, as detailed in Table 4.3.

Table 4.3 – FEMA Major Disaster Declarations, Mecklenburg County

Disaster #	Dec. Date	Incident Type	Event Title
1546	9/10/2004	Hurricane	Tropical Storm Frances
1448	12/12/2002	Severe Ice Storm	Severe Ice Storm
1312	1/31/2000	Severe Storm(s)	Severe Winter Storm
1087	1/13/1996	Snow	Blizzard of 96
844	9/25/1989	Hurricane	Hurricane Hugo

Source: FEMA Disaster Declarations Summary, October 16, 2018

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 focus in on a single hazard or to assess closely related hazards together. Table 4.4 summaries the determination made for each hazard.

Table 4.4 – Hazard Evaluation Results

Hazard	Included in this plan update?	Explanation for Decision
Flood	Yes	The 2018 State HMP and 2015 Mecklenburg County plan addressed this hazard. NCEI reports 111 flood-related events.
Hurricane & Tropical Storm	Yes	Mecklenburg County is not exposed to coastal hazards; therefore, storm surge, coastal flooding, and coastal erosion will not be assessed. However, past disaster declarations indicate that hurricane wind and rain are still a significant hazard for the County. The 2018 State HMP and 2015 Mecklenburg County plan addressed this hazard.
Severe Winter Weather	Yes	The 2015 Mecklenburg County plan addressed this hazard. NCEI reports 53 winter weather related storm events since 1998. The County has received three disaster declarations and one emergency declaration related to winter weather.
Extreme Heat	Yes	The 2018 State HMP addressed this hazard. NCEI reports 4 heat events for Mecklenburg County, which resulted in 2 fatalities.
Earthquake*	Yes	The 2015 Mecklenburg County plan and the 2018 State HMP addressed this hazard. Mecklenburg County could be impacted by the New Madrid fault and the Charleston fault.
Wildfire	Yes	The 2015 Mecklenburg County plan addressed this hazard and found moderate risk and a high probability of future occurrence. The State HMP also addressed this hazard.

Hazard	Included in this plan update?	Explanation for Decision
Dam & Levee Failure	Yes	The 2015 Mecklenburg County plan addressed this hazard. There are multiple high hazard dams in the County. The USACE's National Levee Database identifies one non-USACE levee in the County, though there are no historical failures reported.
Drought	Yes	The State HMP and 2015 Mecklenburg County plan addressed drought. NCEI reports 33 occurrences of drought over the past 20 years. The County has previously received emergency declarations for drought.
Severe Weather (Thunderstorm Wind, Lightning, Hail)	Yes	The 2015 Mecklenburg County plan addressed this hazard. NCEI reports 248 wind events, 45 lightning events, and 138 hail events in the past 20 years. Given this frequency, analysis is warranted.
Tornado	Yes	The 2015 Mecklenburg County plan addressed this hazard. NCEI reports 9 previous tornados causing over $1.8m in property damages.
Landslide*	Yes	The 2018 State HMP and 2015 Mecklenburg County plan addressed this hazard.
Sinkholes*	Yes	The 2018 State HMP and 2015 Mecklenburg County plan addressed this hazard.
Erosion	No	The 2015 Mecklenburg County plan identified this hazard but did not include a hazard analysis or vulnerability assessment because although it is a localized hazard it rarely threatens property or life safety in the county.
Hazardous Materials Incident	Yes	The 2018 State HMP addressed this hazard but the 2015 Mecklenburg County plan did not.
Radiological Emergency	Yes	The 2018 State HMP addressed this hazard but the 2015 Mecklenburg County plan did not. The County may face risks associated with the McGuire Nuclear Station in the county and the Catawba Nuclear Station in South Carolina.
Terrorism	No	The 2018 State HMP addressed this hazard but the 2015 Mecklenburg County plan did not.
Infectious Disease	No	The 2018 State HMP addressed this hazard but the 2015 Mecklenburg County plan did not. The County considers this hazard better addressed through emergency operations planning and local hospitals emergency planning.
Cyber Threat	Yes	The 2018 State HMP addressed this hazard but the 2015 Mecklenburg County plan did not. The County feels cyber threats pose a substantial risk and opted to assess vulnerability to the extent possible through this effort.
Electromagnetic Pulse	Yes	The 2018 State HMP addressed this hazard but the 2015 Mecklenburg County plan did not. The plan will assess vulnerability to the extent possible through this effort.
Solar Events	No	The 2018 State HMP does not address this hazard. The 2015 Mecklenburg County plan identified this hazard but did not find significant risk to this hazard to warrant a vulnerability analysis. Given the impact would be similar to that of an EMP, these risks will be addressed within that hazard.

*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 & Levee Failure
- Drought
- Earthquake
- Extreme Heat
- Flood
- Hurricane & Tropical Storm
- Landslide
- Severe Weather (Thunderstorm Wind, Lightning, & Hail)
- Severe Winter Storm
- Sinkhole
- Tornado
- Wildfire
- Cyber Threat
- Hazardous Materials Incident
- Radiological Emergency
- Electromagnetic Pulse (EMP)

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:

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 Mecklenburg County 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, describe how the severity of the hazard can be measured. Where available, the most severe event on record used as a frame of reference.

Historical Occurrences

This section contains information on historical events, including the location and consequences of all past events on record within or near the Mecklenburg County 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 or 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:

- 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 Mecklenburg County Multi-Jurisdictional 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 Mecklenburg County Multi-Jurisdictional 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 Mecklenburg County 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 4.5.

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

Table 4.5 – Priority Risk Index

RISK ASSESSMENT CATEGORY	LEVEL	DEGREE OF RISK CRITERIA	INDEX	WEIGHT
PROBABILITY 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 PROBABILTY	**4**	
IMPACT 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**	
SPATIAL EXTENT How large of an area could be impacted by a hazard event? Are impacts localized or regional?	**NEGLIGIBLE**	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**	
WARNING TIME 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**	
DURATION 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 x .30) + (IMPACT x .30) + (SPATIAL EXTENT x .20) + (WARNING TIME x .10) + (DURATION x .10)]

The purpose of the PRI is to categorize and prioritize all potential hazards for the Mecklenburg County 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 pulled from the 2010 Census and includes a breakdown of population into two subpopulations considered to be a greater risk than the general population, the elderly and children. Table 4.6 details the population counts by jurisdiction used for the vulnerability assessment.

Table 4.6 – Population Counts by Jurisdiction, 2010

Jurisdiction	2010 Census Population	Elderly (Age 65 and Over)	Children (Age 5 and Under)
Unincorporated Mecklenburg County	46,144	4,070	3,436
City of Charlotte	735,550	64,886	54,768
Town of Cornelius	23,911	2,109	1,780
Town of Davidson	10,481	935	777
Town of Huntersville	46,538	4,105	3,465
Town of Matthews	27,087	2,389	2,017
Town of Mint Hill	22,719	2,005	1,691
Town of Pineville	7,420	654	552
Total	**919,850**	**81,153**	**68,486**

Source: NCEM IRISK Database; 2010 Decennial Census

4.4.2 Buildings

Building counts were also provided by the IRISK database. These values were generated using locally-provided building footprint and parcel data and were last updated in 2018. The methodology for generating the building asset inventory is described in greater detail in Section 4.3. Note that Mecklenburg County has experienced continued growth and new development since 2018; therefore, the exposure reflected in the following tables may underestimate actual present-day exposure.

Table 4.7 – Building Counts and Values by Jurisdiction, 2018

Jurisdiction	Building Count	Building Value
Unincorporated Mecklenburg County	24,114	$5,887,969,839
City of Charlotte	246,117	$77,729,315,165
Town of Cornelius	10,558	$3,186,097,055
Town of Davidson	3,871	$1,476,802,476
Town of Huntersville	19,555	$5,227,753,979
Town of Matthews	10,030	$2,976,296,682
Town of Mint Hill	9,883	$1,961,562,978
Town of Pineville	2,731	$1,454,204,073
Total	**326,859**	**$99,900,002,247**

Source: NCEM IRISK Database

4.4.3 Critical Facilities and Infrastructure

The IRISK database also identifies Critical Infrastructure and Key Resources (CIKR) buildings as well as High Potential Loss Properties. These properties counts were also updated in 2018. These properties are detailed in Table 4.8 and Table 4.9, respectively.

Table 4.8 – Critical Infrastructure and Key Resources by Type and Jurisdiction

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	EM	Government Facilities	Healthcare	Transportation Systems	Energy	Emergency Services	Water	Total
Mecklenburg County	14	3	0	691	0	397	0	181	25	288	4	0	0	**1,603**
City of Charlotte	2	215	2	7,784	2	4,466	2	1,841	504	2,897	12	0	1	**17,728**
Town of Cornelius	0	17	0	406	0	111	0	44	10	128	0	0	0	**716**
Town of Davidson	0	3	0	101	1	35	0	35	9	137	0	0	0	**321**
Town of Huntersville	1	19	0	586	0	205	0	146	50	176	6	0	6	**1,195**
Town of Matthews	0	12	0	435	0	130	0	59	34	138	0	0	0	**808**
Town of Mint Hill	0	9	0	283	0	73	0	48	17	82	0	0	0	**512**
Town of Pineville	0	4	0	335	0	136	0	23	23	69	0	0	0	**590**
Total	**17**	**282**	**2**	**10,621**	**3**	**5,553**	**2**	**2,377**	**672**	**3,915**	**22**	**0**	**7**	**23,473**

Source: NCEM Risk Management Tool

Table 4.9 – High Potential Loss Properties by Use and Jurisdiction

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Mecklenburg County	80	201	87	24	2	66	3	**463**
City of Charlotte	2,723	2,577	1,430	476	0	364	5	**7,575**
Town of Cornelius	248	137	18	9	0	17	0	**429**
Town of Davidson	71	52	7	10	0	4	0	**144**
Town of Huntersville	81	213	39	39	0	33	1	**406**
Town of Matthews	47	122	36	14	0	28	0	**247**
Town of Mint Hill	8	62	13	10	0	14	0	**107**
Town of Pineville	81	90	42	3	0	5	0	**221**
Total	**3,339**	**3,454**	**1,672**	**585**	**2**	**531**	**9**	**9,592**

Source: NCEM Risk Management Tool

IRISK also denotes a subset of CIKR facilities as critical assets. These facilities are critical to emergency response and continuity of operations or are integral to local economic stability. These critical assets are

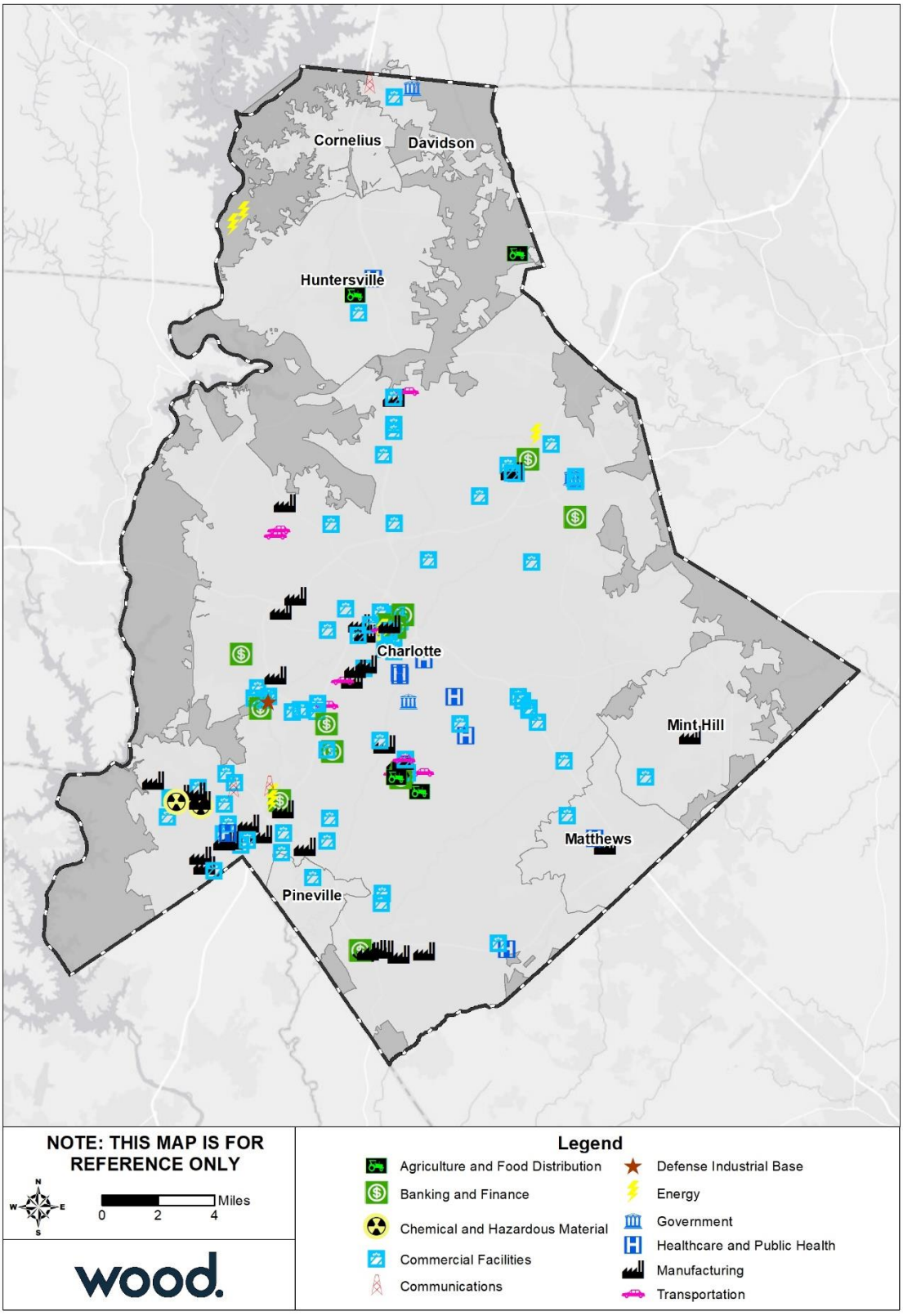
summarized in Table 4.10 and mapped in Figure 4.1. Note that where available, vulnerability of critical facilities is provided for all CIKR buildings, not just this critical asset subset.

Table 4.10 – Critical Assets by Sector

Sector	Number of Buildings at Risk
Agriculture and Food Distribution	4
Banking and Finance	25
Chemical and Hazardous Material	2
Commercial Facilities	84
Communications	3
Manufacturing	38
Defense Industrial Base	2
Energy	11
Government	5
Healthcare and Public Health	11
Transportation	11
Total	**196**

Source: NCEM IRISK Database

Figure 4.1 – Critical Asset Locations



Source: NCEM IRISK Database

4.5 HAZARD PROFILES, ANALYSIS, AND VULNERABILITY

4.5.1 Dam & Levee Failure

Hazard Background

Dam Failure

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 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.

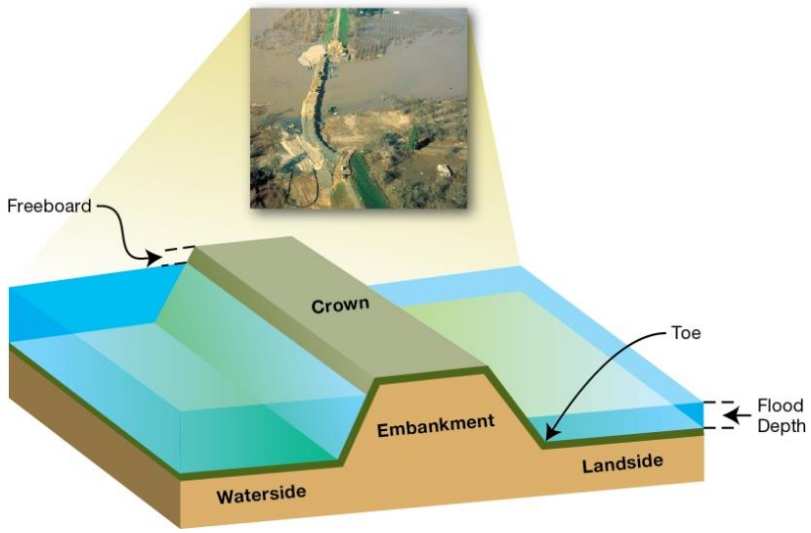
Dam failures are of particular concern because the failure of a large dam has the potential to cause more death and destruction than the failure of any other manmade structure. This is because of the destructive power of the flood wave that would be released by the sudden collapse of a large dam. Dams 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.

Levee Failure

FEMA defines a levee as "a man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water in order to reduce the risk from temporary flooding." Levee systems consist of levees, floodwalls, and associated structures, such as closure and drainage devices, which are constructed and operated in accordance with sound engineering practices. Levees often have "interior drainage" systems that work in conjunction with the levees to take water from the landward side to the water side. An interior drainage system may include culverts, canals, ditches, storm sewers, and/or pumps.

Levees and floodwalls are constructed from the earth, compacted soil or artificial materials, such as concrete or steel. To protect against erosion and scouring, earthen levees can be covered with grass and gravel or hard surfaces like stone, asphalt, or concrete. Levees and floodwalls are typically built parallel to a waterway, most often a river, in order to reduce the risk of flooding to the area behind it. Figure 4.2 shows the components of a typical levee.

Figure 4.2 – Components of a Typical Levee



Source: FEMA, What is a Levee Fact Sheet, August 2011

Levees provide strong flood protection, but they are not failsafe. Levees are designed to protect against a specific flood level and could be overtopped during severe weather events. Levees reduce, not eliminate, the risk to individuals and structures behind them. A levee system failure or overtopping can create severe flooding and high water velocities. It is important to remember that no levee provides protection from events for which it was not designed, and proper operation and maintenance are necessary to reduce the probability of failure.

For both dam and levee failure events, there is generally very little warning time. A failure may result from heavy rains and flash flooding and occur within hours of the first signs of breaching. The duration of the flood will vary but may last as long as a week.

Warning Time: 4 – Less than six hours

Duration: 3 – Less than one week

Location

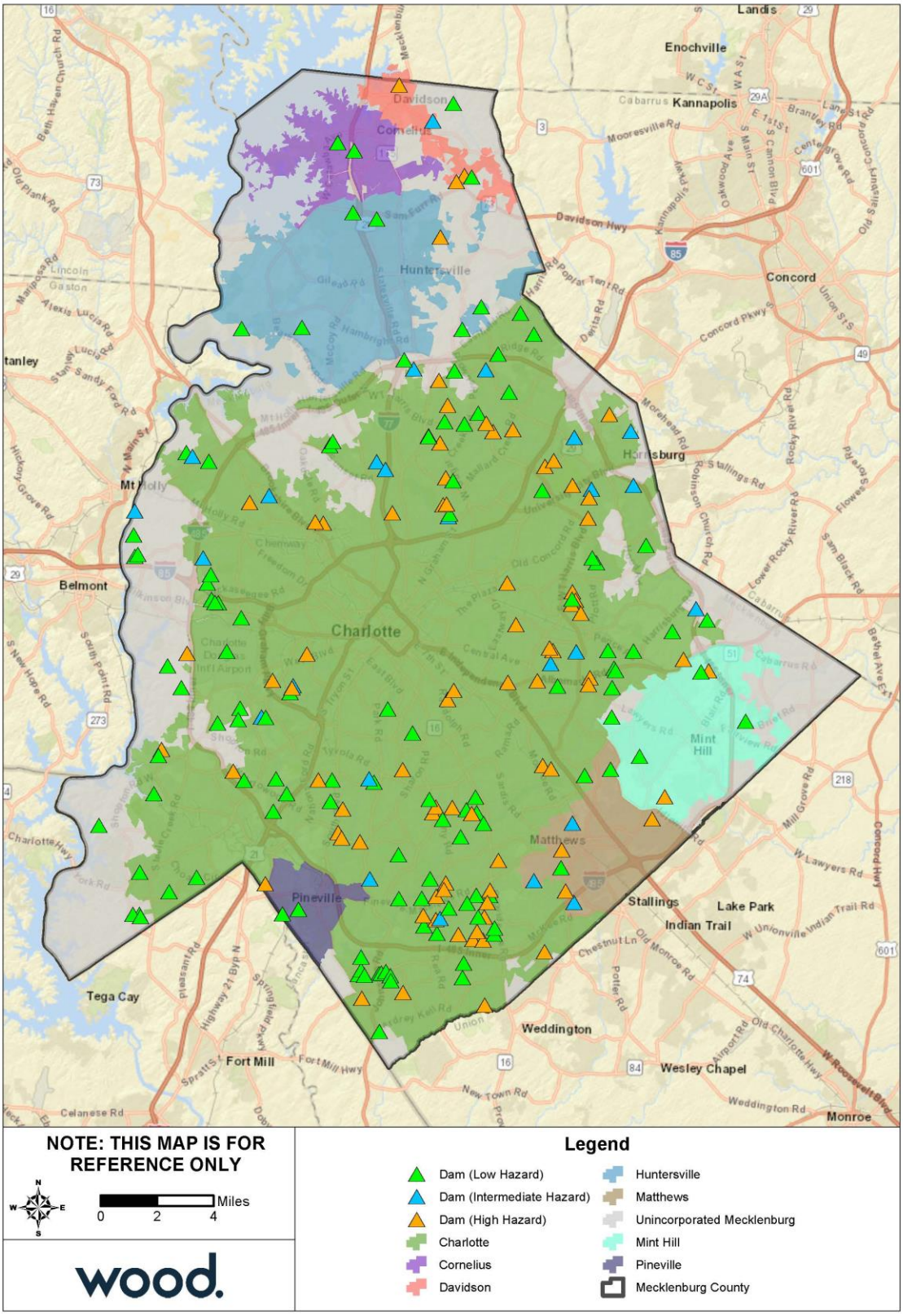
Dam Failure

The North Carolina Dam Inventory, maintained by North Carolina Department of Environmental Quality, provides a detailed inventory of dams in the state. As of July 2018, the NC Dam Inventory contains records of 220 dams in Mecklenburg County, of which 116 are rated low hazard, 25 are rated intermediate hazard, and 79 are rated high hazard. Figure 4.3 shows the location of these dams in Mecklenburg County. Table 4.11 lists all identified dams with high hazard potential in the county.

It should be noted that the NC Dam Inventory is not a comprehensive catalog of all dams in the planning area. HMPC members from the City of Charlotte note that the City has identified hundreds of additional dams through aerial imagery, topographic data, and other GIS resources. While these structures may only be minor impoundments, they nonetheless may pose some additional dam failure risk. Therefore, while the NC Dam Inventory was the best available resource for cataloging dams in the planning area, it underestimates the number of dams and thus also provides an underestimate of the locations potentially at risk to dam failure in the planning area.

Additionally, while the hazard ratings identified by the NC Dam Inventory may be accurate as of the last date of evaluation, the criteria that dictate hazard ratings are subject to change. Development downstream of a dam may increase exposure of property and lives. Therefore, it is possible that some dams that are rated low or moderate hazard may actually fit the criteria for high hazard classification as a result of development since the dam was last evaluated. Again, this delay in reclassification may produce an underestimate of overall risk in the planning area.

Figure 4.3 – Dam Locations in Mecklenburg County



Source: North Carolina Dam Inventory, July 2018

Table 4.11 – High Hazard Dams in Mecklenburg County

Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
Quail Acres Dam	NC00218	Fair	69	Matthews
Cornwell Dam	NC00328	Fair	358	Fairview
Griffith Dam #1	NC03399	Fair	108	Derita
Windermere Dam	NC00401	Not Rated	52	Pineville
Danga Lake Dam	NC00417	Fair	59	Red River Sc
Arrowood Quarry Dam	NC01217	Fair	365	Pineville
Billingsley Dam	NC03400	Fair	10	Charlotte
Forest Lake Dam	NC01691	Fair	60	Charlotte
Delta Lake Dam	NC01692	Fair	68	Charlotte
Moody Pond Dam	NC03402	Fair	38	
Linda Lake Dam	NC03403	Fair	45	Charlotte
Oakwood Lane Dam	NC03410	Fair	46	Charlotte
Ardrey Park Dam	NC03414	Fair	16	
Lock Lane Dam	NC03415	Fair	14	Charlotte
Sharon Lake Upper Dam	NC01696	Fair	29	Charlotte
Lake Plaza Dam	NC03419	Fair	30	Charlotte
Pellynwood Lake Dam	NC03421	Fair	73	Charlotte
Giverney Dam	NC03423	Fair	27	Charlotte
Methodist Home Dam	NC03425	Fair	78	Charlotte
Reddmans Pier Dam	NC03431	Fair	16	Charlotte
Lakeside Drive Dam	NC03432	Fair	52	Charlotte
O'Dillon Lake Dam	NC03434	Fair	76	
Quail Hollow West Dam	NC03443	Fair	23	Charlotte
Sharon Lake Lower Dam	NC03444	Fair	60	Charlotte
Village Lake Dam	NC03445	Fair	43	Charlotte
Lake Providence Dam	NC03447	Fair	40	
Hideaway Bay Dam	NC03448	Poor	42	Charlotte
Ivey's Pond Dam	NC03449	Fair	63	Charlotte
University Place Dam	NC03453	Fair	193	Charlotte
Withrow Dam	NC03455	Fair	48	Charlotte
Baucom Lake Dam	NC03459	Fair	48	Charlotte
Davis Lake Subdivision Dam	NC03460	Fair	173	Charlotte
Clearwater Lake Dam at Runaway Bay	NC03462	Fair	25	Charlotte
Harris Pond Dam	NC03465	Fair	3	
Hidden Landing Dam	NC03467	Fair	36	Charlotte
Raintree Dam #O	NC03468	Fair	31	Charlotte
Raintree Dam #2	NC03469	Fair	43	Charlotte
Raintree Dam #4	NC03470	Fair	11	Charlotte
Raintree Dam #7	NC03471	Fair	72	Charlotte
Radbourne Subdivision Dam	NC03474	Fair	20	Charlotte
Maplecroft Dam	NC03479	Fair	30	
Woodrow Allen Dam	NC03483	Poor	36	Mint Hill
Windrow Dam	NC03484	Fair	17	Matthews
Beverly Crest Dam	NC03486	Fair	460	Charlotte

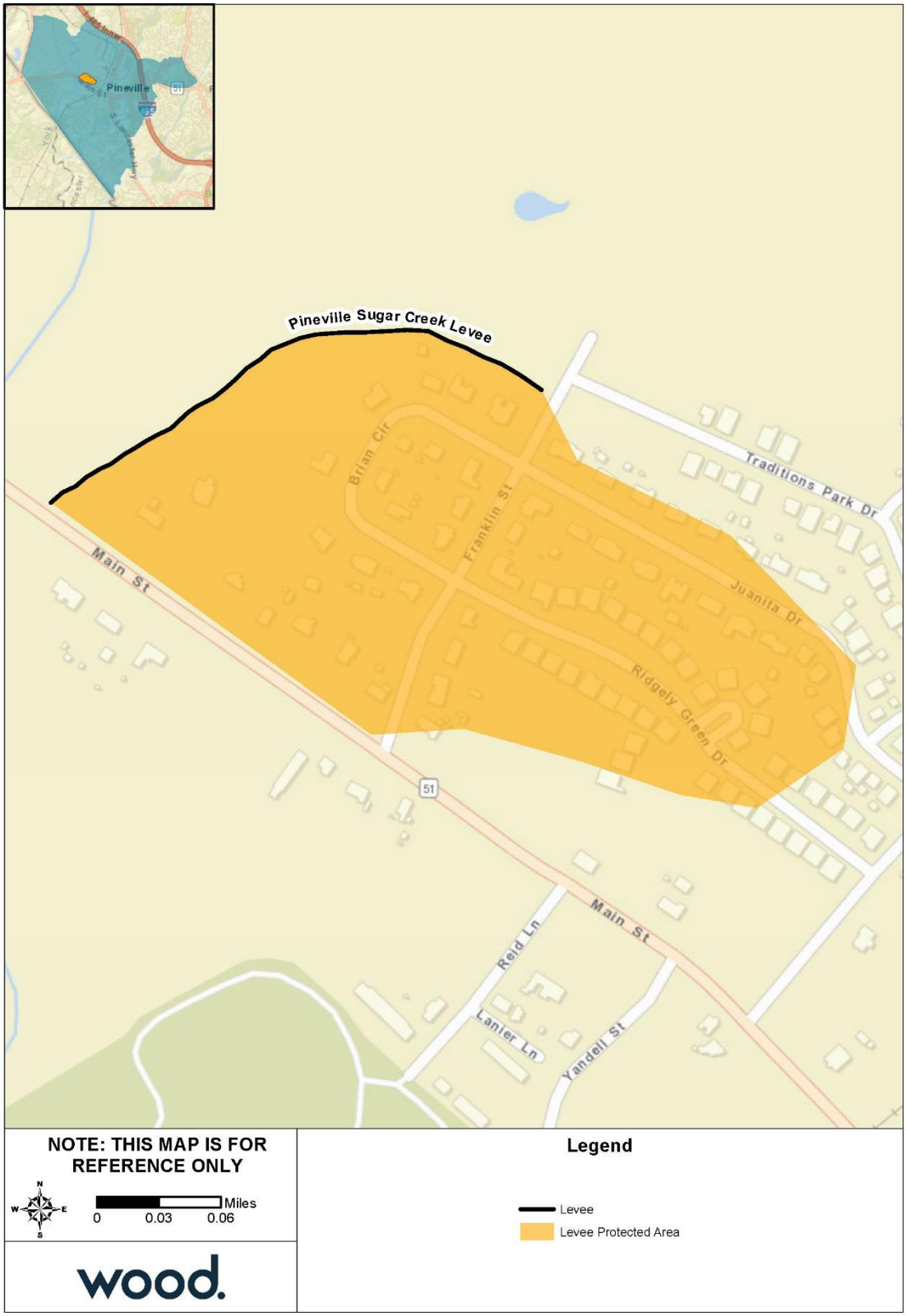
Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
Winterbrooke Dam	NC03488	Fair	20	Matthews
Piper Glen Dam B	NC04814	Fair	36	Charlotte
Franklin Treatment Plant 250 Mg Raw Water Reservoir	NC04816	Fair	777	Charlotte
Fernhill Pond Dam	NC04818	Fair	54	Charlotte
Francis Beatty Park Dam	NC04819	Fair	67	Charlotte
Cobblestone Dam	NC04821	Fair	17	Charlotte
Cottonwood Dam	NC04825	Fair	8	Charlotte
Arnold Palmer Dam	NC04881	Fair	9	Charlotte
Clarks Creek Subdivision Dam	NC05059	Fair	228	Huntersville
Ballantrae At Piper Glen	NC05315	Fair	8	Charlotte
Jordan Dam	NC05317	Fair	16	Charlotte
University Place on The Green Dam	NC05326	Fair	12	Charlotte
Beaty Dam	NC05328	Poor	12	Davidson
Peter's Lake Dam at The Villas	NC05329	Fair	26	Charlotte
Carson Pond Dam	NC05332	Fair	18	Charlotte
Franklin Treatment Plant Raw Water Reservoir	NC05333	Fair	917	Charlotte
Lakeview Dam at Faires Farm	NC05337	Fair	11	Charlotte
Irwin Creek Flood Protection Dike	NC05344	Fair	0	Charlotte
Muddy Pond Dam	NC05346	Not Rated	8	Charlotte
Pierson Pond Dam	NC05348	Fair	9	Charlotte
Lakepointe Corporate Center Dam	NC05349	Fair	10	Charlotte
Page's Pond Dam	NC05351	Fair	26	Davidson
Symphony Park Dam	NC05566	Fair	23	Charlotte
Winery Lane Dam	NC05616	Fair	7	Charlotte
Berewick Farm Pond Dam #2	NC05678	Fair	15	
Carolina Golf and Country Club Irrigation Dam	NC05830	Fair	110	
Resource Square WQ Pond Dam	NC05849	Fair	25	Charlotte
Eastfield Station Dam	NC05851	Fair	17	
Hunter Acres Pond Dam	NC05881	Fair	27	
Hechenbleikner Dam	NC05961	Fair	16	
McDonald Dam	NC05988	Fair	0	Charlotte
Samonds Dam	NC05992	Fair	11	Charlotte
Walden Two Dam	NC06144	Poor	32	
Landtec Pond Dam	NC06177	Fair	5	Matthews
Reformed Theological Seminary Dam	NC0TEMP	Not Rated	0	Charlotte

Source: North Carolina Dam Inventory, July 2018

Levee Failure

According to the US Army Corps of Engineers' (USACE) National Levee Database (NLD), there is one recognized levee in the planning area, located in Pineville. The Pineville Sugar Creek Levee is 0.27 miles long and protects 131 people and 31 structures valued at approximately $13 million. This levee has not been screened to determine a Levee Safety Action Classification. The levee and leveed area are shown in Figure 4.4.

Figure 4.4 – Pineville Sugar Creek Levee, Protected Area



Source: National Levee Database

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 4.12 – Dam Hazard Classifications

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

Source: NCDEQ

Impact: 2 – Limited

Spatial Extent: 1 – Negligible

Historical Occurrences

There are no records of damages, deaths or injuries associated with dam or levee failure in Mecklenburg County. However, as reported in the 2015 plan, torrential rains in September 2004 the from the combined effects of hurricanes Ivan and Frances forced Duke Energy to release flows through the Cowans Ford dam, resulting in the overtopping of the Mountain Island dam further downstream (there is no controlled spillway for the Mountain Island dam). This overtopping caused moderate flooding of areas immediately below the dam, including approximately 50-70 homes near Riverside and Lake Drives.

Probability of Future Occurrence

While there is a significant presence of high hazard dams in Mecklenburg County, the probability of failure of a dam is also contingent upon the condition and ongoing maintenance of the dam. A high hazard dam that is well maintain and in good condition may be very unlikely to fail, whereas a dam with maintenance issues or poor overall condition may be at greater risk of failure. Of the 79 high hazard dams identified by the NC Dam Inventory in Mecklenburg County, 4 (5% of the total) were considered to be in poor condition at the time of their last inspection report.

There are no records of dam failure in the county, which could suggest that dam failure is unlikely. However, historical events alone do not provide an adequate estimate of potential future occurrence. Similarly, though there are no records of levee failure, future failure is possible. With heavy rain events becoming more frequent and intense, conditions conducive to dam or levee failure may occur more frequently as well. Dam or levee failure is considered possible in the planning area.

Probability: 2 – Possible

Climate Change

Several studies have been conducted internationally to investigate the impact of climate change scenarios on dam safety. One PhD study evaluated the safety of dams in the future climate based on an evaluation of changes in design floods and the freeboard available to accommodate an increase in flood levels. The results from this study indicated that the design floods with the corresponding outflow floods and flood water levels will increase in the future, and this increase will adversely affect the safety of the dams in the future, concluding 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 (Chernet, 2013). It is possible that changes would produce similar impacts on levees.

Another study evaluated the impacts of climate change on dam safety and observed that higher average temperatures and longer dry periods may result in longer periods of low reservoir levels, which could expose dams to increased mechanical stresses. Reduced soil moisture may make earthen dams more vulnerable to internal erosion (Fluixá, 2018).

While these studies predict general potential for risk increases for dam safety associated with climate change, data was not available on dam safety impacts at the local or regional level. Impacts on individual dams will vary based on regional temperature variation and hydrological changes at the watershed level.

Vulnerability Assessment

Methodologies and Assumptions

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

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 4.13 summarizes the potential negative consequences of dam and levee failure.

Table 4.13 – Consequence Analysis – Dam & Levee 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 with high hazard dams or a levee within their

boundaries or that are listed as downstream from a high hazard dam were assigned a probability rating of possible and an impact score of limited. Jurisdictions with no high hazard dams or levees were assigned a probability rating of unlikely and an impact rating of limited.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score	Priority
Charlotte	2	2	1	4	3	2.1	M
Cornelius	1	2	1	4	3	1.8	L
Davidson	2	2	1	4	3	2.1	M
Huntersville	2	2	1	4	3	2.1	M
Matthews	2	2	1	4	3	2.1	M
Mint Hill	2	2	1	4	3	2.1	M
Pineville	2	2	1	4	3	2.1	M
Mecklenburg County	2	2	1	4	3	2.1	M

4.5.2 Drought

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 4.14.

Table 4.14 – Types of Drought

Type	Details
Meteorological Drought	Meteorological Drought is based on the degree of dryness (rainfall deficit) and the length of the dry period.
Agricultural Drought	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.
Hydrological Drought	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.
Socioeconomic Drought	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).

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.

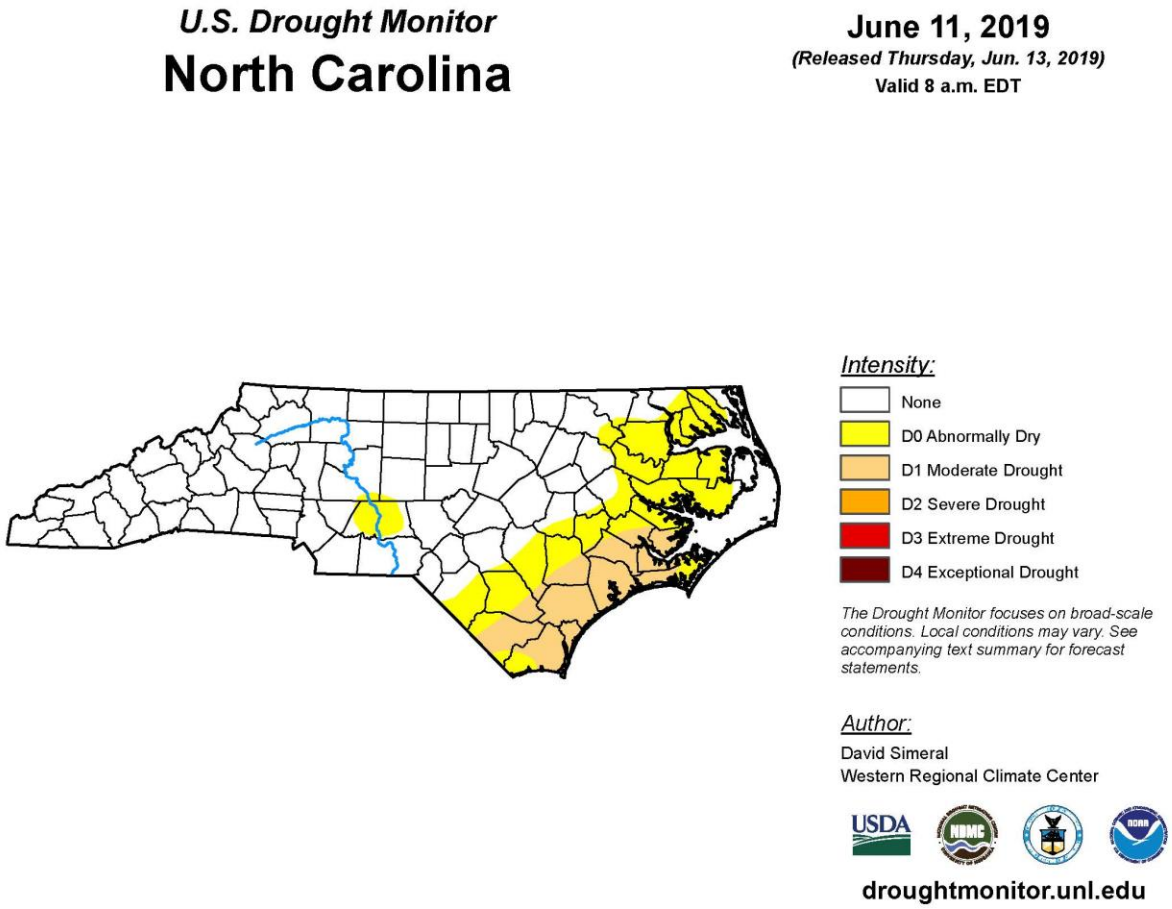
Warning Time: 1 – More than 24 hours

Duration: 4 – More than one week

Location

Drought is a regional hazard that can cover an entire 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 June 11, 2019; as of that date, Mecklenburg County was experiencing no impacts of drought.

Figure 4.5 – US Drought Monitor for Week of June 11, 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 4.6 details the classifications 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 4.6 – US Drought Monitor Classifications

			Ranges				
Category	Description	Possible Impacts	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	Going into drought: ▪ short-term dryness slowing planting, growth of crops or pastures Coming out of drought: ▪ some lingering water deficits ▪ pastures or crops not fully recovered	-1.0 to -1.9	21 to 30	21 to 30	-0.5 to -0.7	21 to 30
D1	Moderate Drought	▪ Some damage to crops, pastures ▪ Streams, reservoirs, or wells low, some water shortages developing or imminent ▪ Voluntary water-use restrictions requested	-2.0 to -2.9	11 to 20	11 to 20	-0.8 to -1.2	11 to 20
D2	Severe Drought	▪ Crop or pasture losses likely ▪ Water shortages common ▪ Water restrictions imposed	-3.0 to -3.9	6 to 10	6 to 10	-1.3 to -1.5	6 to 10
D3	Extreme Drought	▪ Major crop/pasture losses ▪ Widespread water shortages or restrictions	-4.0 to -4.9	3 to 5	3 to 5	-1.6 to -1.9	3 to 5
D4	Exceptional Drought	▪ Exceptional and widespread crop/pasture losses ▪ Shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less	0 to 2	0 to 2	-2.0 or less	0 to 2

Source: US Drought Monitor

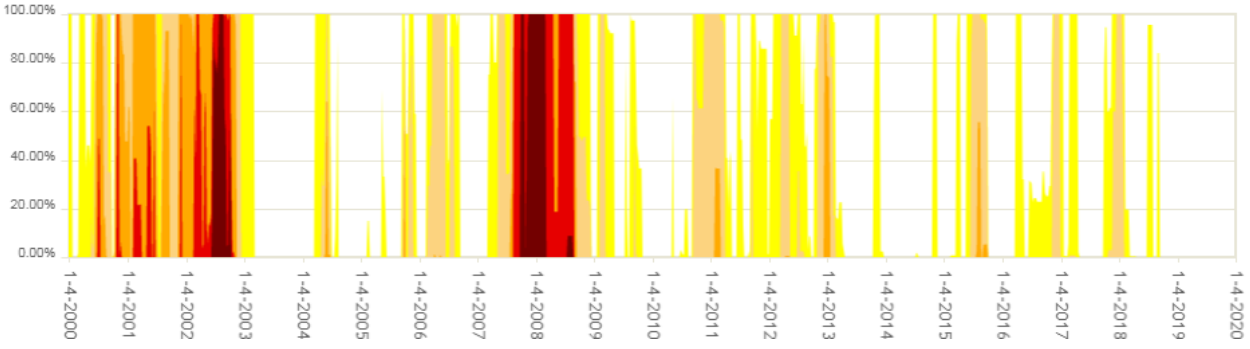
Impact: 1 – Minor

Spatial Extent: 4 – Large

Historical Occurrences

Figure 4.7 shows drought conditions since January 2000 in Mecklenburg County, with drought severity corresponding to the drought classifications in Figure 4.6.

Figure 4.7 – Drought Conditions in Mecklenburg County – 2000-2020



Source: US Drought Monitor

NCEI reports periods of severe drought or worse on a monthly basis. From 1999 through 2018, there were 30 months of drought impacts reported. The longest period of drought lasted nine consecutive months from May 2007 to January 2008.

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 18 were reported to affect Mecklenburg County. Table 4.15 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 4.15 – Drought Impacts Reported for Mecklenburg County, January 2009 - December 2018

Category	Impacts	Years Reported
Agriculture	3	2013, 2015, 2016
Business and Industry	1	2011
Energy	1	2016
Relief, Response & Restrictions	16	2010, 2011, 2012, 2013, 2015, 2016, 2017
Society & Public Health	1	2016
Tourism and Recreation	2	2011, 2016
Water Supply & Quality	14	2010, 2011, 2012, 2015, 2016, 2017

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

Probability of Future Occurrence

Probability: 3 – Likely

Over the 19-year (988 week) period from 2000 through 2018, Mecklenburg County experienced 611 weeks of drought conditions ranging from abnormally dry to exceptional drought. This equates to a 62 percent chance of drought in any given week. Of this time, approximately 194 weeks were categorized as a severe (D2) drought or greater; which equates to an almost 20 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.

Vulnerability Assessment

Methodologies and Assumptions

Vulnerability to drought in Mecklenburg County 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

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 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 Mecklenburg County was $299,970, or an average of roughly $27,270 in losses every year. Table 4.16 summarizes the crop losses due to drought in reported in the RMA system.

Table 4.16 – Crop Losses Resulting from Drought in Mecklenburg County, 2007-2017

Year	Determined Acres	Indemnity Amount
2007	1,448.70	$71,830.00
2008	172.60	$8,166.00
2009	303.60	$13,427.00
2010	134.90	$3,308.00
2014	7.00	$642.60
2015	1,151.67	$168,510.40
2016	976.05	$33,556.00
2017	3.82	$530.20
Total	**4,198.34**	**$299,970.20**

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 4.17 summarizes the potential negative consequences of drought.

Table 4.17 – 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.
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.

Category	Consequences
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; therefore, the magnitude of impacts is typically greater in unincorporated areas. 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	PRI Score	Priority
Charlotte	3	1	4	1	4	2.5	H
Cornelius	3	1	4	1	4	2.5	H
Davidson	3	1	4	1	4	2.5	H
Huntersville	3	1	4	1	4	2.5	H
Matthews	3	1	4	1	4	2.5	H
Mint Hill	3	1	4	1	4	2.5	H
Pineville	3	1	4	1	4	2.5	H
Mecklenburg County	3	2	4	1	4	2.8	H

4.5.3 Earthquake

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.

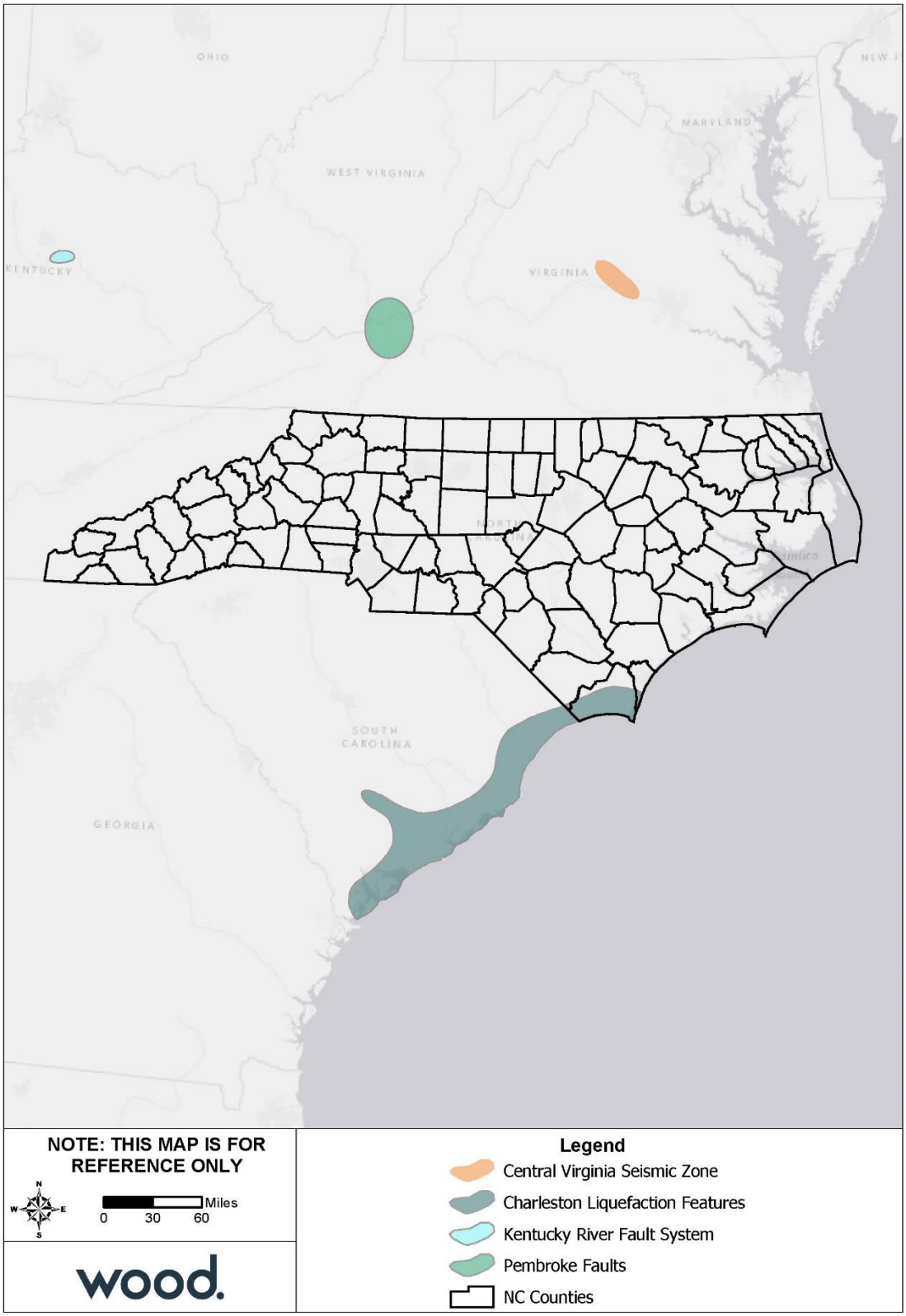
Warning Time: 4 – Less than six hours

Duration: 1 – Less than six hours

Location

Figure 4.8 reflects the Quaternary faults that present an earthquake hazard for the Mecklenburg County planning area based on data from the USGS Earthquake Hazards Program.

Figure 4.8 – US Quaternary Faults



Source: USGS Earthquake Hazards Program

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 4.18. 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 4.19 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 4.18 – 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 4.19 – 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 wakened. 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

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.

The most severe earthquake to impact the Mecklenburg County area was the Charleston earthquake of 1886. It is estimated to have been felt as an 8 on the MMI Scale.

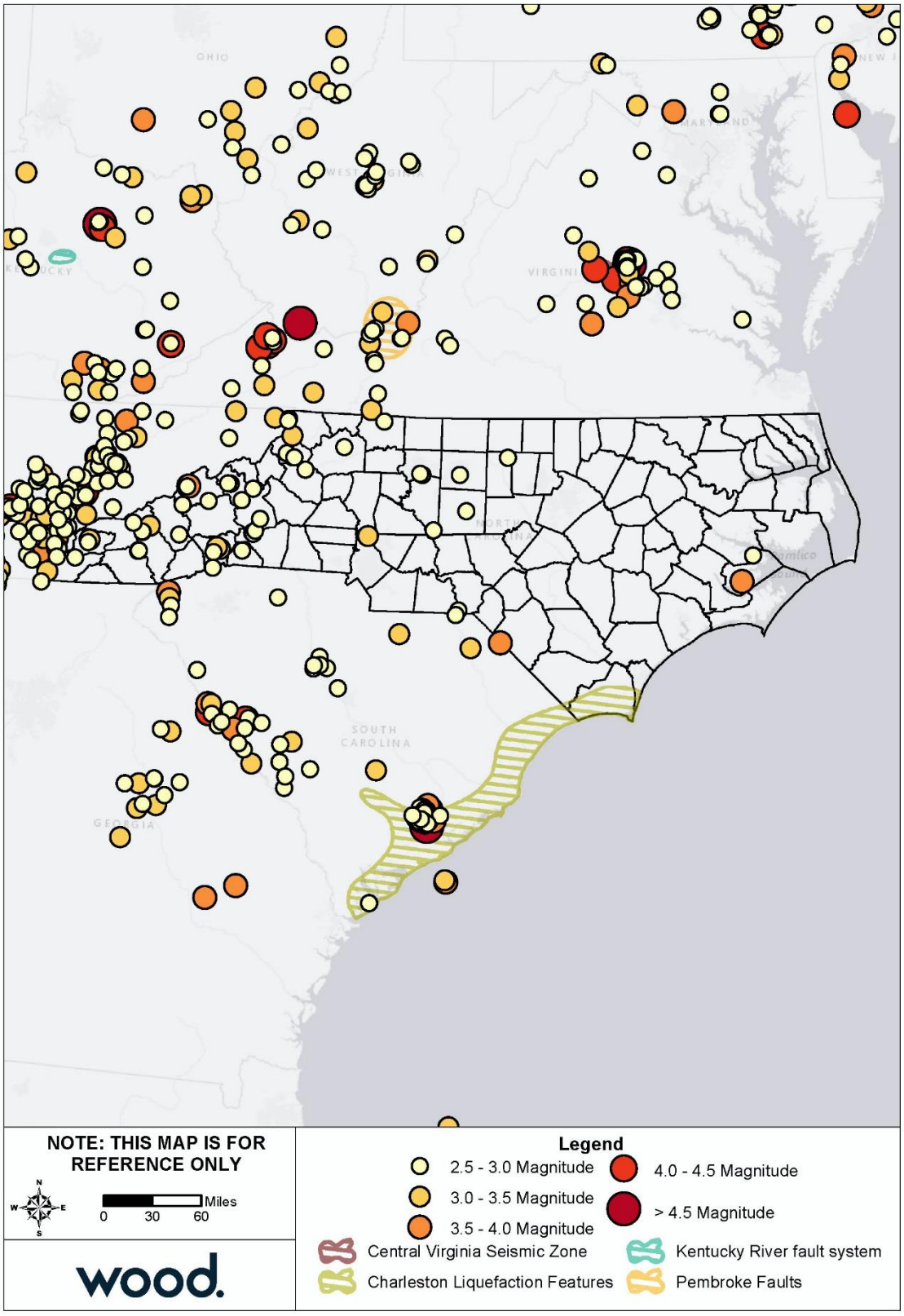
Impact: 1 – Minor

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 4.9 shows historical earthquakes by magnitude in relation to North Carolina and major fault zones identified by USGS. This includes events from 1973 to 2019.

Figure 4.9 – 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 2015 Mecklenburg County Plan lists the following significant seismic events impacting Mecklenburg County from 1638 to 1985.

Table 4.20 – Historical Earthquake Impacts in Mecklenburg County, 1638-1985

Date of Occurrence	Location	MMI (Intensity)	Distance from Epicenter (Miles)
Charlotte	12/13/1879	5	4
Pineville	12/13/1879	5	14
Charlotte	09/01/1886	8	270
Pineville	09/01/1886	4	256
Charlotte	11/25/1898	4	N/A
Charlotte	02/21/1916	5	153
Charlotte	10/20/1924	2	162
Charlotte	11/03/1928	4	180
Charlotte	12/23/1928	3	N/A
Charlotte	07/26/1945	4	101
Charlotte	11/20/1969	5	241
Cornelius	11/20/1969	3	213
Matthews	11/20/1969	3	254
Pineville	11/20/1969	3	257
Davidson	11/22/1974	4	296
Charlotte	09/13/1976	2	152

Source: National Geophysical Data Center; 2015 Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan

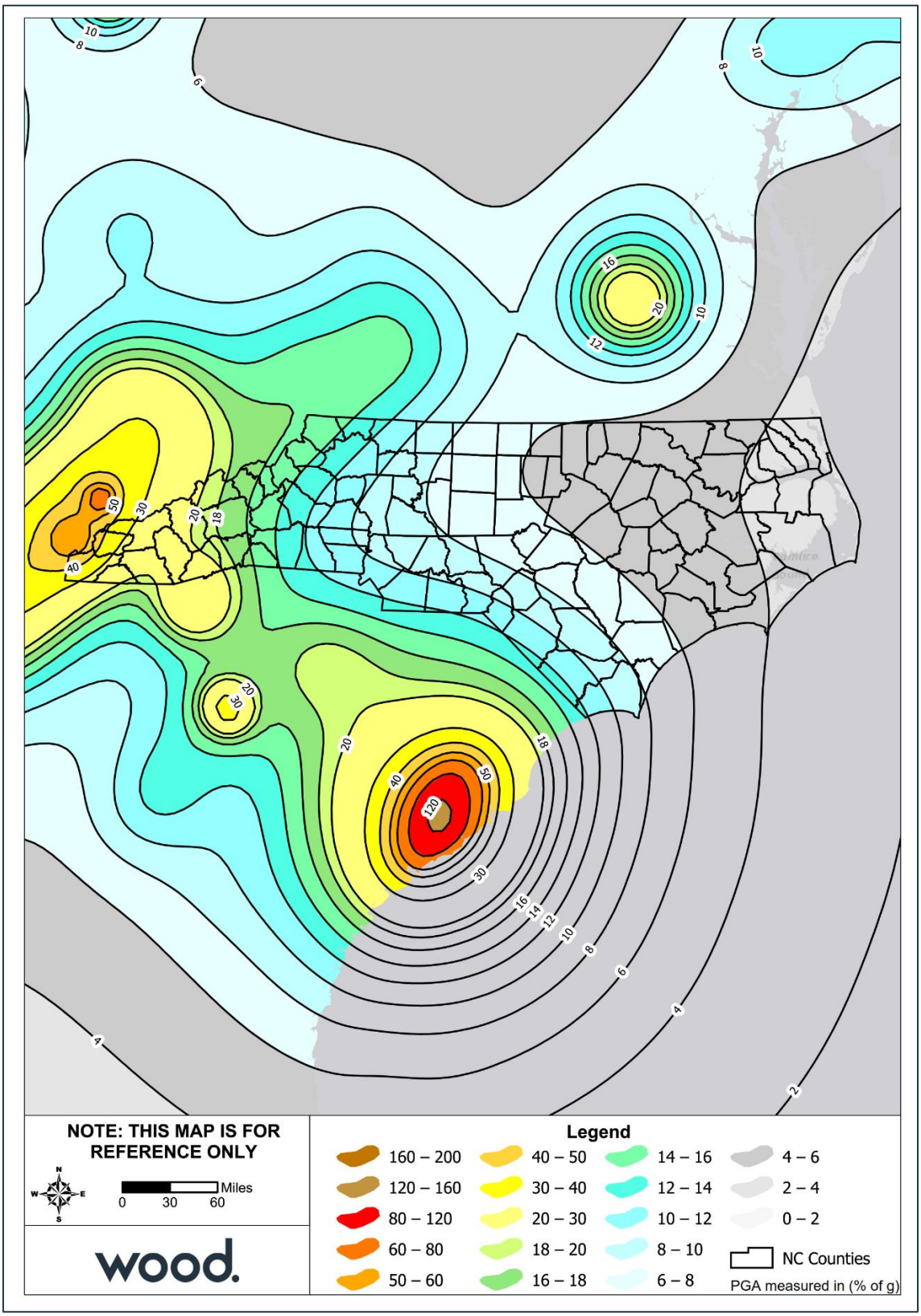
The 2015 plan noted no additional earthquakes between 1985 and 2015. The National Geophysical Data Center (NGDC) Significant Earthquake Database does not report any additional records between 2015 and the 2019 in the Region.

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 4.10 reflects the seismic hazard for Mecklenburg County 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. Mecklenburg County is located within the light blue and medium blue zones representing a low peak acceleration of 0.08 to 0.12 g.

Figure 4.10 – Seismic Hazard Information for North Carolina



Source: USGS Earthquake Hazards Program

Based on this data, it can be reasonably assumed that an earthquake event affecting Mecklenburg County 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

Methodologies and Assumptions

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.

People

Earthquake events in Mecklenburg County 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 4.21 and Table 4.22 detail the population estimated to be at risk from a 250-year earthquake and a 500-year earthquake, respectively, according to the NCEM IRISK database.

Table 4.21 – 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
Unincorporated Mecklenburg County	46,144	46,144	100%	4,070	4,070	100%	3,436	3,436	100%
Charlotte	735,550	735,550	100%	64,886	64,886	100%	54,768	54,768	100%
Cornelius	23,911	23,911	100%	2,109	2,109	100%	1,780	1,780	100%
Davidson	10,481	10,481	100%	935	935	100%	777	777	100%
Huntersville	46,538	46,538	100%	4,105	4,105	100%	3,465	3,465	100%
Matthews	27,087	27,087	100%	2,389	2,389	100%	2,017	2,017	100%
Mint Hill	22,719	22,719	100%	2,005	2,005	100%	1,691	1,691	100%
Pineville	7,420	7,420	100%	654	654	100%	552	552	100%
Total	**919,850**	**919,850**	**100%**	**81,153**	**81,153**	**100%**	**68,486**	**68,486**	**100%**

Source: NCEM Risk Management Tool

Table 4.22 – Estimated Population Impacted by 500-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
Unincorporated Mecklenburg County	46,144	46,144	100%	4,070	4,070	100%	3,436	3,436	100%
Charlotte	735,550	735,550	100%	64,886	64,886	100%	54,768	54,768	100%
Cornelius	23,911	23,911	100%	2,109	2,109	100%	1,780	1,780	100%
Davidson	10,481	10,481	100%	935	935	100%	777	777	100%
Huntersville	46,538	46,538	100%	4,105	4,105	100%	3,465	3,465	100%
Matthews	27,087	27,087	100%	2,389	2,389	100%	2,017	2,017	100%
Mint Hill	22,719	22,719	100%	2,005	2,005	100%	1,691	1,691	100%
Pineville	7,420	7,420	100%	654	654	100%	552	552	100%
Total	**919,850**	**919,850**	**100%**	**81,153**	**81,153**	**100%**	**68,486**	**68,486**	**100%**

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.

Table 4.23 through Table 4.24 detail the estimated buildings impacted from varying magnitudes of earthquake events.

Table 4.23 – 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
Unincorporated Mecklenburg County	24,114	22,506	93.3%	$648,928	1,228	5.1%	$1,017,265	377	1.6%	$185,826	24,111	100%	$1,852,019
Charlotte	246,117	228,383	92.8%	$10,868,935	14,831	6%	$18,032,420	2,897	1.2%	$2,516,935	246,111	100%	$31,418,290
Cornelius	10,558	9,841	93.2%	$520,739	630	6%	$361,792	87	0.8%	$47,784	10,558	100%	$930,316
Davidson	3,871	3,545	91.6%	$186,741	270	7%	$198,887	56	1.4%	$47,225	3,871	100%	$432,854
Huntersville	19,555	18,354	93.9%	$551,507	966	4.9%	$758,161	223	1.1%	$169,825	19,543	99.9%	$1,479,493
Matthews	10,030	9,222	91.9%	$330,011	675	6.7%	$628,080	133	1.3%	$111,751	10,030	100%	$1,069,842
Mint Hill	9,883	9,370	94.8%	$235,076	419	4.2%	$154,599	94	1%	$56,615	9,883	100%	$446,290
Pineville	2,731	2,037	74.6%	$156,632	552	20.2%	$559,141	142	5.2%	$28,943	2,731	100%	$744,716
Total	**326,859**	**303,258**	**92.8%**	**$13,498,569**	**19,571**	**6%**	**$21,710,345**	**4,009**	**1.2%**	**$3,164,904**	**326,838**	**100%**	**$38,373,820**

Source: NCEM Risk Management Tool

Table 4.24 – 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
Unincorporated Mecklenburg County	24,114	22,506	93.3%	$4,940,985	1,228	5.1%	$5,209,861	377	1.6%	$942,487	24,111	100%	$11,093,334
Charlotte	246,117	228,383	92.8%	$78,728,781	14,831	6%	$91,362,055	2,897	1.2%	$13,510,337	246,111	100%	$183,601,173
Cornelius	10,558	9,841	93.2%	$3,209,775	630	6%	$1,587,681	87	0.8%	$262,416	10,558	100%	$5,059,871
Davidson	3,871	3,545	91.6%	$1,183,962	270	7%	$1,036,842	56	1.4%	$219,622	3,871	100%	$2,440,426
Huntersville	19,555	18,354	93.9%	$3,907,225	966	4.9%	$3,663,647	223	1.1%	$884,468	19,543	99.9%	$8,455,341
Matthews	10,030	9,222	91.9%	$2,679,378	675	6.7%	$3,205,602	133	1.3%	$738,680	10,030	100%	$6,623,660
Mint Hill	9,883	9,370	94.8%	$2,049,285	419	4.2%	$861,933	94	1%	$319,754	9,883	100%	$3,230,972
Pineville	2,731	2,037	74.6%	$1,159,254	552	20.2%	$2,949,874	142	5.2%	$173,587	2,731	100%	$4,282,714
Total	**326,859**	**303,258**	**92.8%**	**$97,858,645**	**19,571**	**6%**	**$109,877,495**	**4,009**	**1.2%**	**$17,051,351**	**326,838**	**100%**	**$224,787,491**

Source: NCEM Risk Management Tool

Environment

An earthquake is unlikely to cause substantial impacts to the natural environment in Mecklenburg County. 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 4.25 summarizes the potential negative consequences of earthquake.

Table 4.25 – 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	PRI Score	Priority
Charlotte	1	1	4	4	1	1.9	L
Cornelius	1	1	4	4	1	1.9	L
Davidson	1	1	4	4	1	1.9	L
Huntersville	1	1	4	4	1	1.9	L
Matthews	1	1	4	4	1	1.9	L
Mint Hill	1	1	4	4	1	1.9	L
Pineville	1	1	4	4	1	1.9	L
Mecklenburg County	1	1	4	4	1	1.9	L

4.5.4 Extreme Heat

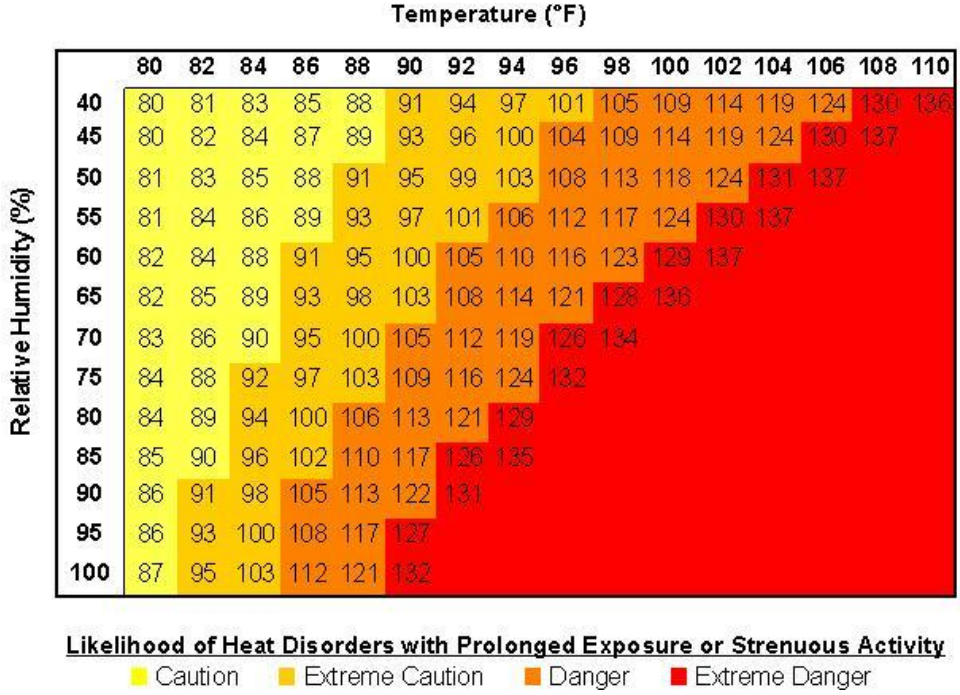
Hazard Background

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 slows 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 4.11 uses both of these factors to produce a guide for the apparent temperature or relative intensity of heat conditions.

Figure 4.11 – Heat Index Chart



Source: National Weather Service (NWS) 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 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 4.26 lists typical symptoms and health impacts of exposure to extreme heat.

Table 4.26 – 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

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 nighttime 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 100ºF to 104ºF 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

Based on data from the "Charlotte WSO Airport" and "Charlotte WB City" weather stations from 1893 through 2012, the highest temperature recorded in Mecklenburg County was 104°F and occurred in both August 2007 and September 1954.

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.

The following heat-related incident was reported by NCEI for Mecklenburg County; this incident caused two fatalities.

June 29, 1998 – A string of several days in the upper 90s to near 100 degrees resulted in the death of an elderly couple when their home's air conditioning failed. The date and time of death was estimated. Severe thunderstorms brought damaging winds to the southern piedmont in the late afternoon and early evening. Numerous trees and power lines were downed across the north and east side of Charlotte, some damaging homes. Power was out for a couple of days in that area. Elsewhere, scattered trees and power lines were blown down with about 7500 people left without power in Mooresville.

Across North Carolina, extreme heat conditions were blamed for 16 fatalities and 17 illnesses between 1996 and 2018.

Heat index records maintained by the North Carolina Climate Office indicate that the Region regularly experiences heat index temperatures above 100°F. Table 4.27 provide counts of heat index values by threshold recorded from 1999-2018 at the Douglas International Airport weather station (KCLT), used as an indicator for county overall. Counts are provided as the number of hours in a given year where the heat index reached or exceeded 100°F.

Table 4.27 – Historical Heat Index Counts, Douglas International Airport Station (KCLT), 1999-2018

Year	Heat Index Value				Total
	100-104°F	105-109°F	110-114°F	≥115°F	
1999	56	31	5	0	92
2000	26	0	0	0	26
2001	26	3	0	0	29
2002	47	1	0	0	48
2003	11	0	0	0	11
2004	0	0	0	0	0
2005	40	6	0	0	46
2006	29	1	0	0	30
2007	44	3	1	0	48
2008	17	0	0	0	17
2009	10	0	0	0	10
2010	111	18	1	0	130
2011	107	26	0	0	133
2012	47	7	1	0	55
2013	5	0	0	0	5
2014	2	0	0	0	2
2015	42	0	0	0	42
2016	76	2	0	0	78
2017	48	5	0	0	53
2018	52	3	0	0	55
Sum	**796**	**106**	**8**	**0**	**910**
Average	**40**	**5**	**0**	**0**	**46**

Source: North Carolina Climate Office, Heat Index Climatology Tool

Probability of Future Occurrence

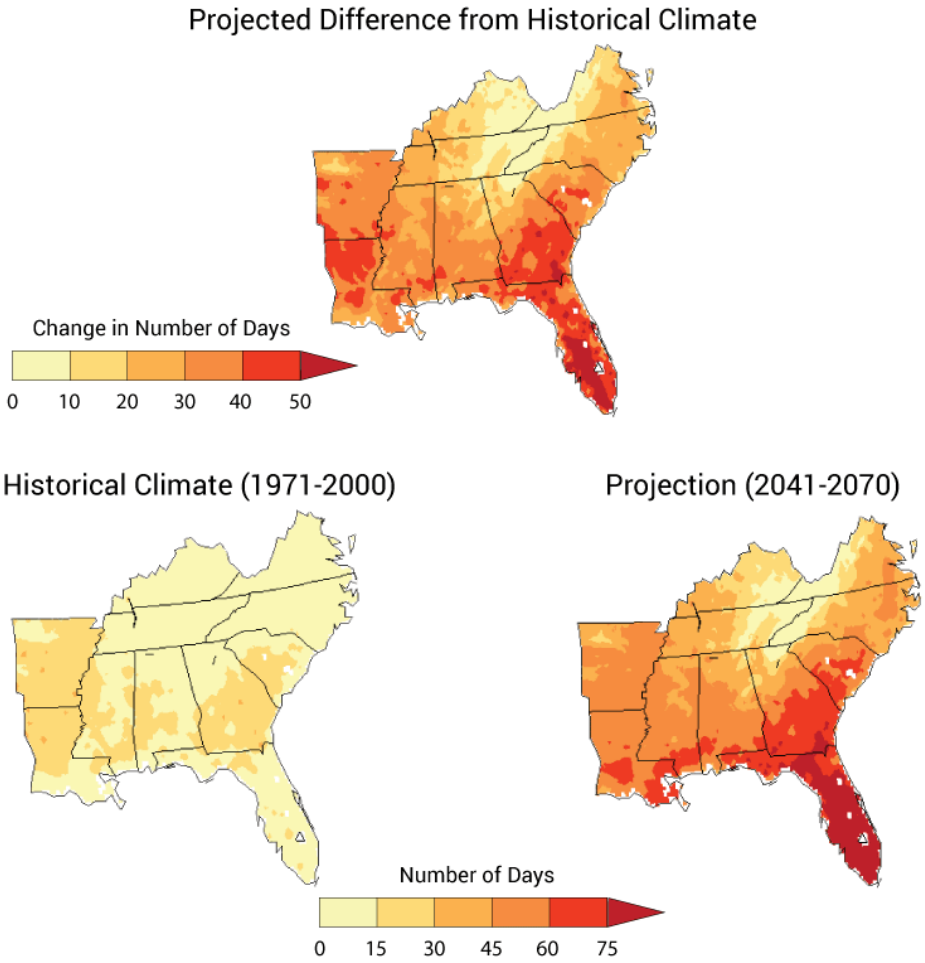
Data was gathered from the North Carolina State Climate Office's Heat Index Climatology Tool using the Douglas International Airport weather station as an approximation for Mecklenburg County. During the 20-year period from 1999 through 2018, Mecklenburg County experienced 910 hours with high temperatures above 100°F, or an average of 46 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 Mecklenburg County 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 4.12. The Triangle Regional Resilience Partnership Resilience Assessment provides climate projections relevant to central North Carolina; the 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 4.12 – 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 quantitatively assess the vulnerability of people or property in the planning area to extreme heat. The following vulnerability assessment provides a qualitative evaluation of potential heat impacts. Agricultural vulnerability was estimated using data from the 2012 Census of Agriculture and a review of past claims related to drought.

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. Fatalities and injuries recorded across the state of North Carolina also note multiple incidents of persons overexerting themselves in the heat. Mecklenburg County has designated 39 cooling stations – 38 in Charlotte and 1 in Huntersville, to ensure residents remain safe and are able to seek relief from the heat.

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 head induced expansion. Power transmission lines may sag from expansion and if contact is made with vegetation the line may short out causing power outages. Additional power demand for cooling also increases power line temperature adding to heat impacts.

Extreme heat can also cause significant agricultural losses, though this fact doesn't have as much of an impact on Mecklenburg County due to its more metropolitan nature. Between 2007-2017, the sum of claims paid for crop damage due to heat in the county was $17,391, or an average of $1,581 in losses every year. Table 4.28 summarizes the crop losses due to drought in reported in the RMA system.

Table 4.28 – Crop Losses Resulting from Heat, 2007-2017

Year	Determined Acres	Indemnity Amount
2010	162.00	$3,970.00
2015	67.29	$11,705.10
2016	15.45	$1,716.00
Total	**244.74**	**$17,391.10**

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 4.29 summarizes the potential negative consequences of extreme heat.

Table 4.29 – 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.

Category	Consequences
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.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score	Priority
Charlotte	4	3	4	1	3	3.3	H
Cornelius	4	3	4	1	3	3.3	H
Davidson	4	3	4	1	3	3.3	H
Huntersville	4	3	4	1	3	3.3	H
Matthews	4	3	4	1	3	3.3	H
Mint Hill	4	3	4	1	3	3.3	H
Pineville	4	3	4	1	3	3.3	H
Mecklenburg County	4	3	4	1	3	3.3	H

4.5.5 Flood

Hazard Background

Flooding is 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 Mecklenburg County can be attributed to two main sources as noted below.

Riverine Flooding: Mecklenburg County has an Effective FIRM dated November 16, 2018 and a Revised Flood Insurance Study (FIS) dated November 16, 2018. The FIS summarizes the principal flood problems in the county as follows:

> "Low-lying areas of Mecklenburg County are subject to periodic flooding caused by excess runoff from various streams and creeks and their tributaries. Flooding also occurs along the Catawba River, mainly along the area just below the Mountain Island Dam. Approximately 10% of the land area in the County is within a mapped floodplain. The most severe flooding has been caused by tropical systems moving up from the Gulf or Atlantic coast. Flooding also occurs in spring or early summer because of heavy rains caused by stationary frontal systems. Thunderstorms occurring also account for some flooding. Damage to structures in the floodplains has occurred during floods in 1916, 1928, 1936, 1942, 1958, 1962, 1973, 1975, 1976, 1995, 1997, 2003, 2004, 2008, 2011, 2013, and 2014."

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 alters natural drainage patterns and increases the amount of surface water generated.

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.

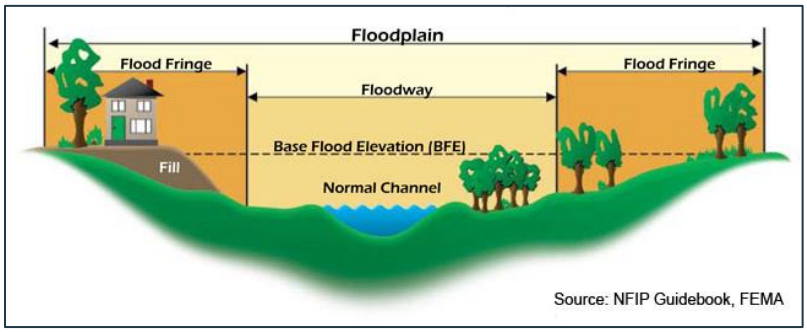
Localized flooding may be caused by the following issues:

- **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 4.13. 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 4.13 – 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 percent chance in any given year of being equaled or exceeded. The 500-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 100-year 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 one week

Location

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 Mecklenburg County using the Effective FIRMs retrieved from NC Flood Risk Information System (FRIS). The current Flood Insurance Study report was revised on November 16, 2018. **Error! Reference source not found.** summarizes the flood insurance zones identified by the Digital FIRM (DFIRM).

Table 4.30 – Mapped Flood Insurance Zones within Mecklenburg County

Zone	Description
AE	Areas subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. Base Flood Elevations (BFEs) are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply.
0.2% Annual Chance (shaded Zone X)	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.)
Zone X (unshaded)	Minimal risk areas outside the 1-percent and 0.2-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.

Nearly nine percent of the county falls within the SFHA. Unincorporated Mecklenburg County, Davidson, and Pineville all have more than 10 percent of their area in the SFHA. **Error! Reference source not found.** below summarizes acreage of the county's total area by flood zone on the effective DFIRM.

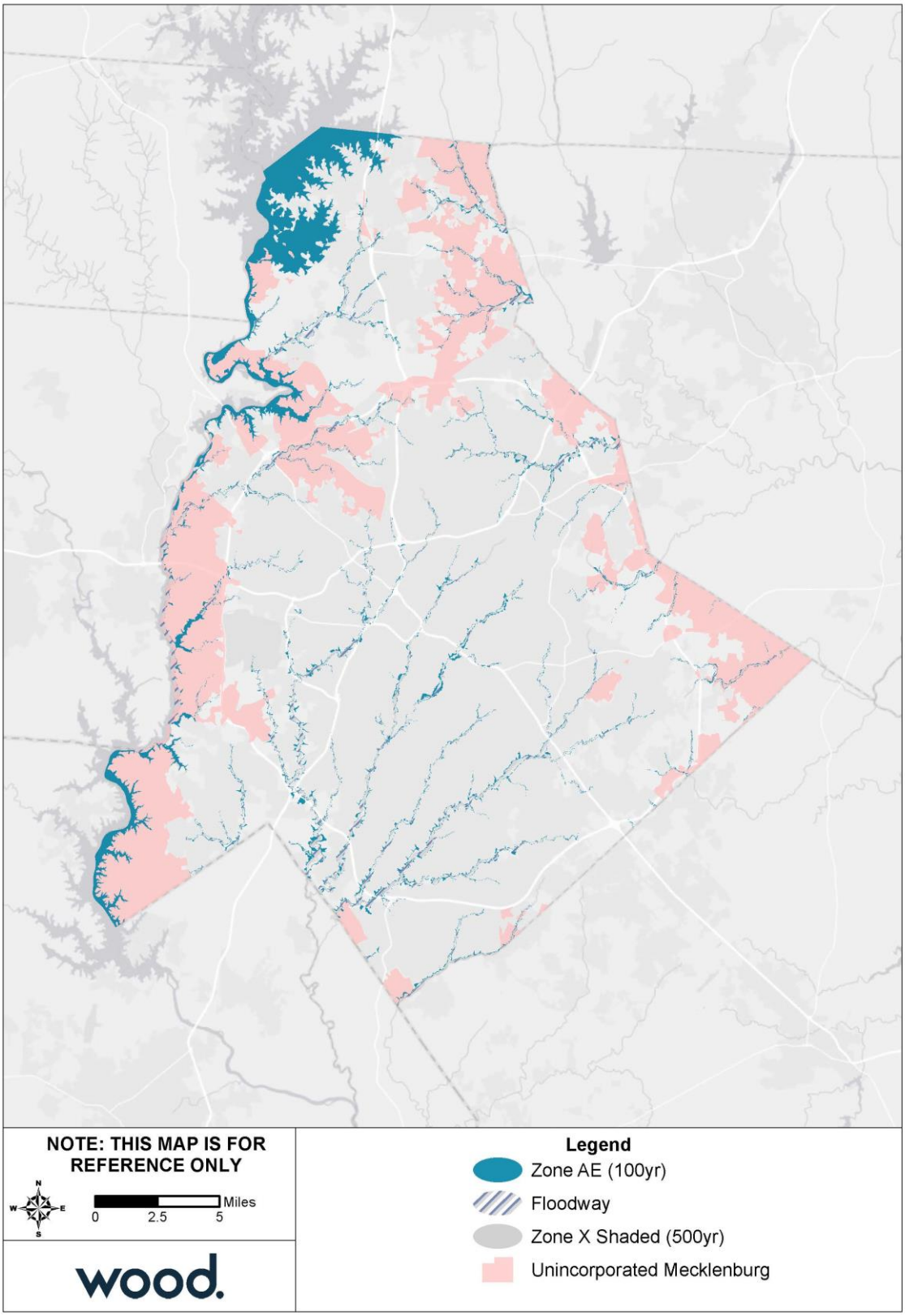
Table 4.31 – Flood Zone Acreage in Mecklenburg County

Flood Zone	Acreage	Percent of Total (%)
Zone AE	30,179.55	8.66%
Zone X (500-year)	141.05	0.04%
Zone X Unshaded	318,124.36	91.30%
Total	**348,444.96**	--

Source: FEMA Effective DFIRM via NC FRIS; Mecklenburg County Open Data

Figure 4.14 reflects the effective mapped flood insurance zones for Mecklenburg County.

Figure 4.14 – FEMA Flood Hazard Areas in Mecklenburg County



Source: FEMA Effective DFIRM via NC FRIS

Flooding can also occur outside the defined SFHA on smaller tributaries that were not studied by FEMA but that nonetheless may be vulnerable to the 1-percent-annual-chance flood. Additionally, localized stormwater flooding can occur anywhere along stormwater system pipes, channels, culverts, and other infrastructure where inadequate capacity, blocked inlets or outfalls, or improper grade prevent sufficient drainage. This type of flooding is more common in the urbanized areas of the county and extends well beyond the limits of the SFHA.

Extent

Flood extent for riverine flooding can be defined by the amount of land in the floodplain and the potential magnitude of flooding as measured by flood depth and velocity. Property damages correlate to the depth of flooding that impacts a property.

Figure 4.15 shows the depth of flooding predicted to result from a 1% annual chance flood.

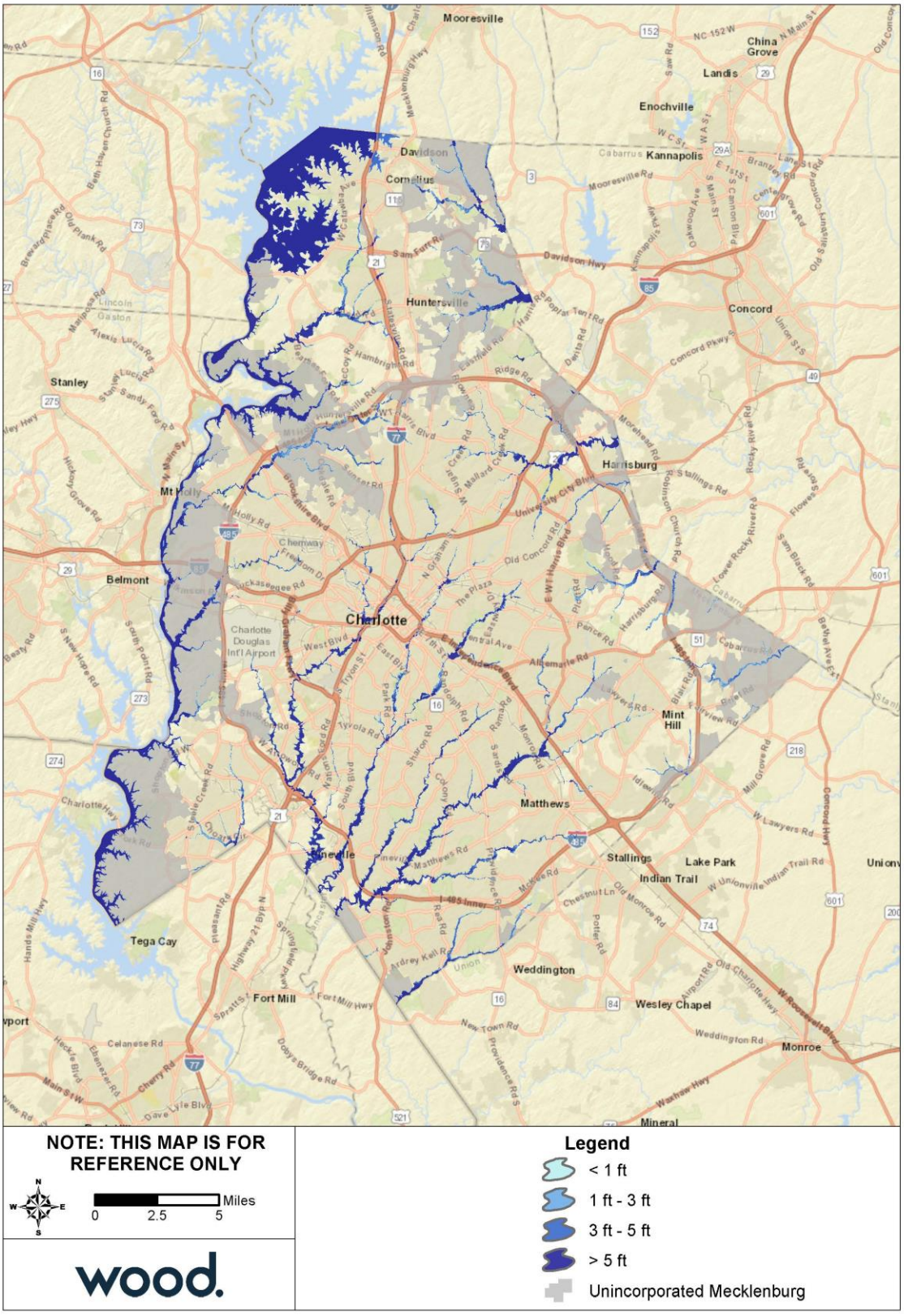
The NFIP utilizes the 100-year flood as a basis for floodplain management. The Flood Insurance Study (FIS) defines the probability of flooding as flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 100-year period (recurrence intervals). Or considered 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.

Data is not available to measure flood depth beyond the SFHA, but it is important to note that damaging floods can and do occur outside the SFHA.

Impact: 3 – Critical

Spatial Extent: 3 – Moderate

Figure 4.15 – Flood Depth, 100-Year Floodplain



Source: FEMA Effective DFIRM via NC FRIS

Historical Occurrences

Flood and flash flood statistics for Mecklenburg County were pulled from the NCEI. 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.

The NCEI records 70 total flash flood incidents occurring in Mecklenburg County between 1999 and 2018. Table 4.32 details the 38 historical occurrences of flash flooding identified from 1999 through 2018 by the NCEI Storm Events database with at least some level of impact (fatalities, injuries, property or crop damage). The incidents resulted in three recorded fatalities, over $12 million in property damage and $10,000 in recorded crop damage.

Table 4.32 – NCEI Records of Flash Flooding, 1999-2018 with Reported Impacts

Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Charlotte	1/23/1999	1	0	$0	$0
Charlotte	6/7/2003	0	0	$1,000,000	$0
Matthews	6/16/2003	0	0	$50,000	$0
Charlotte	7/17/2004	0	0	$25,000	$0
Charlotte	5/10/2005	0	0	$10,000	$0
Charlotte	5/12/2005	0	0	$4,000	$0
Charlotte	6/7/2005	0	0	$10,000	$0
Charlotte	7/22/2006	0	0	$100,000	$0
Charlotte	8/15/2006	0	0	$100,000	$0
Charlotte	7/9/2007	0	0	$10,000	$0
North Charlotte	8/27/2008	0	0	$8,500,000	$0
North Charlotte	9/10/2008	0	0	$100,000	$0
Charlotte	5/5/2009	0	0	$50,000	$0
Charlotte	8/16/2009	0	0	$50,000	$0
Pineville	1/25/2010	0	0	$40,000	$0
Oakhurst	7/12/2010	0	0	$0	$10,000
Haskings Mills	8/6/2010	0	0	$20,000	$0
Thomasboro	8/19/2010	0	0	$50,000	$0
Thrift	8/5/2011	0	0	$1,500,000	$0
Matthews	8/5/2011	2	0	$0	$0
Stonehaven	7/20/2012	0	0	$40,000	$0
Thomasboro	8/7/2012	0	0	$20,000	$0
Matthews	6/2/2013	0	0	$5,000	$0
Hahn	6/3/2013	0	0	$10,000	$0
Smithville	6/28/2013	0	0	$250,000	$0
Chadwick	7/11/2013	0	0	$20,000	$0
Rama	7/21/2013	0	0	$90,000	$0
Douglas Muni Arpt	7/3/2014	0	0	$10,000	$0
Matthews	7/15/2014	0	0	$100,000	$0
Hahn	4/19/2015	0	0	$1,000	$0
Stonehaven	4/19/2015	0	0	$10,000	$0
Hahn	10/3/2015	0	0	$1,000	$0
Stonehaven	12/22/2015	0	0	$500	$0
Huntersville	12/30/2015	0	0	$10,000	$0
Charlotte	9/26/2016	0	0	$1,000	$0

Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Stonehaven	6/13/2017	0	0	$1,000	$0
Smithville	9/1/2017	0	0	$1,000	$0
Hahn	9/16/2018	0	0	$10,000	$0
	Total	**3**	**1**	**$12,199,500**	**$10,000**

Source: NCEI

NCEI reports 19 recorded flood events in the planning area from 1999 through 2018. Table 4.33 details these occurrences, which caused three injuries and over $2 million in property damage.

Table 4.33 – NCEI Records of Flooding, 1999-2018

Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Charlotte	6/10/1999	0	0	$0	$0
Charlotte	7/12/2000	0	3	$0	$0
Charlotte	8/18/2000	0	0	$0	$0
County	9/4/2000	0	0	$0	$0
Charlotte	5/30/2002	0	0	$0	$0
Charlotte	7/14/2002	0	0	$0	$0
County	3/20/2003	0	0	$2,000,000	$0
County	4/10/2003	0	0	$0	$0
County	5/22/2003	0	0	$0	$0
County	9/7/2004	0	0	$0	$0
County	9/8/2004	0	0	$75,000	$0
Charlotte	5/5/2009	0	0	$0	$0
Pineville	1/26/2010	0	0	$0	$0
Newell	11/2/2015	0	0	$500	$0
Shopton	11/2/2015	0	0	$500	$0
Huntersville	12/30/2015	0	0	$500	$0
Hahn	4/24/2017	0	0	$500	$0
Hahn	9/16/2018	0	0	$1,000	$0
Hahn	11/15/2018	0	0	$500	$0
	Total	**0**	**3**	**$2,078,500**	**$0**

Source: NCEI

Table 4.34 provides a summary of this historical information by participating jurisdiction. It is important to note that many of the events attributed to the county are countywide or cover large portions of the county. The individual counts by jurisdiction are for those events that are only attributed to that one jurisdiction.

Table 4.34 – Summary of Historical Flood Occurrences by Participating Jurisdiction, 1999-2018

Jurisdiction	Event Count	Deaths	Injuries	Property Damage	Crop Damage
Charlotte	49	1	4	$1,390,000	$0
Cornelius	1	0	0	$0	$0
Davidson	0	0	0	$0	$0
Huntersville	2	0	0	$10,500	$0
Matthews	5	2	0	$155,000	$0
Mint Hill	1	0	0	$0	$0

Jurisdiction	Event Count	Deaths	Injuries	Property Damage	Crop Damage
Pineville	4	0	0	$40,000	$0
Unincorporated Mecklenburg County	49	0	0	$13,821,000	$10,000
Total	**111**	**3**	**4**	**$15,416,500**	**$10,000**

Source: NCEI

The following historical flood events reported in the 2018 Revised FIS for Mecklenburg County, the NCEI database, and other sources illustrate the potential for flooding throughout the county:

September 2004 – Hurricane Frances had rainfall totals of 18 inches with 5 million dollars in damage in Mecklenburg County.

August 2011 – A thunderstorm stalled over central Mecklenburg County on August 5th dropping nearly seven inches of rain in less than four hours. More than 150 homes and businesses flooded - mostly northwest and west of uptown Charlotte. Emergency responders assisted nearly 90 people caught in flooded vehicles and flooded buildings. Damage was more than $2 million, mostly in the Irwin, Stewart and "big" Sugar Creek Watersheds. Two people drowned in Irvins Creek in southeast Charlotte.

2013 – Heavy rain in the mountains caused flooding May 7 and 8 along the Catawba River and its reservoirs, including Mountain Island Lake. Nearly 100 homes in the County were affected. On June 28, northern portions of the County got close to six inches of rain in four hours. With the ground already saturated, several houses flooded near McDowell Creek and Gilead Road. Intense rain on July 11 flooded parts of west Charlotte. About four inches of rain fell in less than three hours. Many streets were flooded along with six homes and several apartments.

June 2014 – In June of 2014 a cluster of slow-moving thunderstorms produced 3.5 to 5 inches of rain in less than two hours near the Mecklenburg/ Union County line. Severe urban flooding occurred in the Matthews area, with water up to the windows of some vehicles. Stream flooding included a tributary of McAlpine Creek which flooded a part of Sam Newell Road. Multiple roads were closed throughout the Town. In a separate event, 2 – 3 inches of rain fell in a couple hours near the airport, resulting in closure of multiple roads including Freedom Drive.

June 2019 – During the development of this plan update, northwestern Mecklenburg County experienced heavy rains and substantial flooding along the Catawba River and Mountain Island Lake, with the Catawba River reaching nearly seven feet above full pond. The County estimated as many as 100 homes sustained damages. The event was the worst flooding to hit Mountain Island Lake since at least 2004, when the Catawba River went four feet over full pond.

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, much of the planning area is subject to urban stormwater flooding and smaller flash flood events. While potentially less severe than the 1%-annual-chance flood,

these events can still cause significant damage. Taken as a whole, the probability of flooding is considered likely (greater than 10% 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

The following section provides an assessment of vulnerability to flooding by jurisdiction and flood return period.

Methodologies and Assumptions

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 4.35 below provides the NFIP entry date for each participating jurisdiction, which was used to determine which buildings were constructed pre-FIRM. Pre-FIRM structures were built prior to the adoption of flood protection building standards and are therefore assumed to be at greater risk to the flood hazard.

Table 4.35 – NFIP Entry Dates

Jurisdiction	NFIP Entry Date
City of Charlotte	08/15/78
Town of Cornelius	06/01/81
Town of Davidson	06/01/81
Town of Huntersville	02/04/04
Town of Matthews	02/04/04
Town of Mint Hill	02/04/04
Town of Pineville	03/18/87
Mecklenburg County (Unincorporated Area)	06/01/81

Source: Federal Emergency Management Agency Community Status Book Report: Communities Participating in the National Flood Program, August 2013

If the NFIP entry date for a given community is between January and June, buildings constructed the same year as the entry date are considered to be post-FIRM (e.g., if the NFIP entry date is 02/01/1991, buildings constructed in 1990 and before are pre-FIRM. Buildings constructed from 1991 to the present are post-FIRM.). If the NFIP entry date is between July and December, then the following year applies for the year built cut-off (e.g., if the NFIP entry date is 12/18/2007, buildings constructed in the year 2007 and before are pre-FIRM, 2008 and newer are post-FIRM).

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

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 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 the City 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 injuries and fatalities. Individuals face particularly high risk when driving through flooded streets, or from being washed away by floodwaters on foot. NCEI reports three deaths and three injuries in Mecklenburg County caused by flood events, including:

- A woman in Charlotte was injured after her automobile was swept up by floodwaters
- A man in Charlotte swept into a creek and drowned
- Three boys in Charlotte injured while playing in a swollen creek which swept them downstream
- A mother and daughter in Charlotte drowned while trying to wade through a swollen river

Table 4.36 details the estimated 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 analysis for the IRISK dataset was performed. Therefore, actual population at risk is likely higher.

Table 4.36 – 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	Percent		Number	Percent		Number	Percent
Charlotte	735,550	3,418	0.5%	64,886	302	0.5%	54,768	255	0.5%
Unincorporated Mecklenburg County	46,144	230	0.5%	4,070	20	0.5%	3,436	17	0.5%
Cornelius	23,911	56	0.2%	2,109	5	0.2%	1,780	4	0.2%
Davidson	10,481	0	0%	935	0	0%	777	0	0%
Huntersville	46,538	30	0.1%	4,105	3	0.1%	3,465	2	0.1%
Matthews	27,087	26	0.1%	2,389	2	0.1%	2,017	2	0.1%
Mint Hill	22,719	39	0.2%	2,005	3	0.1%	1,691	3	0.2%
Pineville	7,420	90	1.2%	654	8	1.2%	552	7	1.3%
Total	**919,850**	**3,889**	**0.4%**	**81,153**	**343**	**0.4%**	**68,486**	**290**	**0.4%**

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 4.37 provides an estimate of the number of pre-FIRM buildings in each jurisdiction. This analysis was prepared using building footprint and parcel data from Mecklenburg County Open Data GIS and comparing the year built for each structure to the date of the corresponding community's initial Flood Insurance Rate Map (FIRM). Only year-built information was available for building data, therefore these pre-FIRM estimates include all buildings constructed during the year of the initial FIRM and prior.

Table 4.37 – Pre-FIRM Buildings by Jurisdiction

Jurisdiction	Pre-FIRM Building Count	% Pre-FIRM	Date of Initial FIRM
Unincorporated Mecklenburg County	6,859	29%	6/1/1981
Charlotte	95,890	39%	8/15/1978
Cornelius	1,569	15%	6/8/1981
Davidson	886	23%	6/8/1981
Huntersville	14,282	73%	2/4/2004
Matthews	8,846	88%	2/4/2004
Mint Hill	8,115	81%	2/4/2004
Pineville	1,094	40%	3/18/1987
Total	**137,541**	**42%**	--

Source: NCEM IRISK Database; GIS analysis performed by Wood

Note: These estimates do not account for any historical changes in jurisdictional boundaries. Buildings were classified based on the Initial FIRM date for the current jurisdictional boundaries.

Table 4.38 through Table 4.42 detail the estimated property at risk from the 10 percent annual chance flood event through the 0.2 percent 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 analysis for the IRISK dataset was performed. Additionally, the IRISK analysis does not account for property at risk outside of the FEMA mapped floodplains; however,

there is additional property at risk along the County's smaller unstudied tributaries and in urbanized areas vulnerable to stormwater flooding that could experience losses.

The damage estimates for the 1% annual chance flood event total $52,124,056, 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 4.43 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings across all jurisdictions by sector. Vulnerability of CIKR, where applicable, can be found by jurisdiction in each community's annex to this plan.

Table 4.38 – Buildings Impacted by the 10-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
Unincorporated Mecklenburg County	24,114	9	0%	10	0%	$31,394	0	0%	$0	0	0%	$0	10	0%	$31,394
Charlotte	246,117	277	0.1%	320	0.1%	$2,705,580	45	0%	$2,938,493	2	0%	$71,013	367	0.1%	$5,715,086
Cornelius	10,558	0	0%	0	0%	$0	0	0%	$0	0	0%	$0	0	0%	$0
Davidson	3,871	0	0%	0	0%	$0	0	0%	$0	0	0%	$0	0	0%	$0
Huntersville	19,555	4	0%	4	0%	$5,115	0	0%	$0	0	0%	$0	4	0%	$5,115
Matthews	10,030	0	0%	0	0%	$0	0	0%	$0	0	0%	$0	0	0%	$0
Mint Hill	9,883	2	0%	2	0%	$14,352	0	0%	$0	0	0%	$0	2	0%	$14,352
Pineville	2,731	18	0.7%	12	0.4%	$237,576	11	0.4%	$409,697	0	0%	$0	23	0.8%	$647,273
Total	**326,859**	**310**	**0.1%**	**348**	**0.1%**	**$2,994,017**	**56**	**0%**	**$3,348,190**	**2**	**0%**	**$71,013**	**406**	**0.1%**	**$6,413,220**

Source: NCEM IRISK Database

Table 4.39 – Buildings Impacted by the 25-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
Unincorporated Mecklenburg County	24,114	10	0%	12	0%	$104,017	0	0%	$0	0	0%	$0	12	0%	$104,017
Charlotte	246,117	504	0.2%	571	0.2%	$6,180,204	88	0%	$6,420,285	4	0%	$180,700	663	0.3%	$12,781,189
Cornelius	10,558	0	0%	0	0%	$0	0	0%	$0	0	0%	$0	0	0%	$0
Davidson	3,871	0	0%	0	0%	$0	0	0%	$0	0	0%	$0	0	0%	$0
Huntersville	19,555	6	0%	6	0%	$15,661	0	0%	$0	0	0%	$0	6	0%	$15,661
Matthews	10,030	2	0%	2	0%	$783	0	0%	$0	0	0%	$0	2	0%	$783
Mint Hill	9,883	7	0.1%	7	0.1%	$42,689	0	0%	$0	0	0%	$0	7	0.1%	$42,689
Pineville	2,731	21	0.8%	14	0.5%	$549,050	14	0.5%	$559,940	0	0%	$0	28	1%	$1,108,989
Total	**326,859**	**550**	**0.2%**	**612**	**0.2%**	**$6,892,404**	**102**	**0%**	**$6,980,225**	**4**	**0%**	**$180,700**	**718**	**0.2%**	**$14,053,328**

Source: NCEM IRISK Database

Table 4.40 – Buildings Impacted by the 50-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
Unincorporated Mecklenburg County	24,114	11	0%	13	0.1%	$175,303	0	0%	$0	0	0%	$0	13	0.1%	$175,303
Charlotte	246,117	705	0.3%	794	0.3%	$14,456,420	130	0.1%	$8,823,898	6	0%	$320,123	930	0.4%	$23,600,441
Cornelius	10,558	0	0%	0	0%	$0	0	0%	$0	0	0%	$0	0	0%	$0
Davidson	3,871	0	0%	0	0%	$0	0	0%	$0	0	0%	$0	0	0%	$0
Huntersville	19,555	6	0%	6	0%	$26,235	0	0%	$0	0	0%	$0	6	0%	$26,235
Matthews	10,030	5	0%	5	0%	$3,173	0	0%	$0	0	0%	$0	5	0%	$3,173
Mint Hill	9,883	10	0.1%	10	0.1%	$65,311	0	0%	$0	0	0%	$0	10	0.1%	$65,311
Pineville	2,731	42	1.5%	22	0.8%	$820,532	29	1.1%	$1,019,777	0	0%	$0	51	1.9%	$1,840,309
Total	**326,859**	**779**	**0.2%**	**850**	**0.3%**	**$15,546,974**	**159**	**0%**	**$9,843,675**	**6**	**0%**	**$320,123**	**1,015**	**0.3%**	**$25,710,772**

Source: NCEM IRISK Database

Table 4.41 – 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
Unincorporated Mecklenburg County	24,114	59	0.2%	111	0.5%	$1,250,372	23	0.1%	$563,493	3	0%	$88,485	137	0.6%	$1,902,350
Charlotte	246,117	904	0.4%	1,062	0.4%	$33,648,304	190	0.1%	$13,239,633	11	0%	$550,207	1,263	0.5%	$47,438,145
Cornelius	10,558	5	0%	23	0.2%	$59,886	0	0%	$0	0	0%	$0	23	0.2%	$59,886
Davidson	3,871	0	0%	0	0%	$0	0	0%	$0	0	0%	$0	0	0%	$0
Huntersville	19,555	12	0.1%	12	0.1%	$76,629	0	0%	$0	0	0%	$0	12	0.1%	$76,629
Matthews	10,030	9	0.1%	9	0.1%	$40,709	0	0%	$0	0	0%	$0	9	0.1%	$40,709
Mint Hill	9,883	16	0.2%	16	0.2%	$106,661	0	0%	$0	0	0%	$0	16	0.2%	$106,661
Pineville	2,731	46	1.7%	25	0.9%	$962,114	34	1.2%	$1,537,562	0	0%	$0	59	2.2%	$2,499,676
Total	**326,859**	**1,051**	**0.3%**	**1,258**	**0.4%**	**$36,144,675**	**247**	**0.1%**	**$15,340,688**	**14**	**0%**	**$638,692**	**1,519**	**0.5%**	**$52,124,056**

Source: NCEM IRISK Database

Table 4.42 – Buildings Impacted by the 500-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
Unincorporated Mecklenburg County	24,114	25	0.1%	40	0.2%	$355,649	2	0%	$86,501	0	0%	$0	42	0.2%	$442,150
Charlotte	246,117	1,402	0.6%	2,140	0.9%	$104,457,277	305	0.1%	$35,279,106	27	0%	$1,901,795	2,472	1%	$141,638,178
Cornelius	10,558	0	0%	2	0%	$44,421	0	0%	$0	0	0%	$0	2	0%	$44,421
Davidson	3,871	0	0%	6	0.2%	$29,447	0	0%	$0	0	0%	$0	6	0.2%	$29,447
Huntersville	19,555	61	0.3%	61	0.3%	$499,179	1	0%	$1,119	0	0%	$0	62	0.3%	$500,298
Matthews	10,030	23	0.2%	24	0.2%	$216,187	0	0%	$0	0	0%	$0	24	0.2%	$216,187
Mint Hill	9,883	29	0.3%	29	0.3%	$297,707	0	0%	$0	0	0%	$0	29	0.3%	$297,707
Pineville	2,731	59	2.2%	51	1.9%	$1,748,271	47	1.7%	$4,040,859	2	0.1%	$6,877	100	3.7%	$5,796,007
Total	**326,859**	**1,599**	**0.5%**	**2,353**	**0.7%**	**$107,648,138**	**355**	**0.1%**	**$39,407,585**	**29**	**0%**	**$1,908,672**	**2,737**	**0.8%**	**$148,964,395**

Source: NCEM IRISK Database

Table 4.43 – Critical Infrastructure and Key Resources at Risk to Flood by Event and Sector

Sector	Number of Buildings at Risk	Estimated Damages
100-year		
Commercial Facilities	91	$4,230,678
Critical Manufacturing	117	$5,505,423
Government Facilities	9	$479,464
Healthcare and Public Health	3	$193,594
Transportation Systems	41	$5,570,224
Total	**261**	**$15,979,383**
500-year		
Banking and Finance	1	$65,634
Commercial Facilities	135	$11,558,012
Critical Manufacturing	173	$14,926,730
Government Facilities	24	$1,621,133
Healthcare and Public Health	5	$260,683
Transportation Systems	46	$12,884,065
Total	**384**	**$41,316,257**

Source: NCEM IRISK Database

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 NFIP records provided in the FEMA Community Information System as of June 2020, there are a total of 679 repetitive loss properties within Mecklenburg County, of which only 7.2 percent are insured. There are 30 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.

Occupancy data was not available from FEMA for repetitive loss properties; however, the previous plan reports 332 repetitive loss properties of which 94% were residential and 6% were non-residential. Based on this past data; current policy data, including occupancy of insured buildings; and knowledge of repetitive loss properties across North Carolina, it is estimated that at least 90% of the identified repetitive loss properties are residential.

Table 4.44 summarizes repetitive loss properties by jurisdiction as identified by FEMA through the NFIP.

Table 4.44 – Repetitive Loss Properties by Jurisdiction

Jurisdiction	Total Number of RL Properties	Insured RL Properties	Total Number of Losses	Total Amount of Claims Payments	Severe Repetitive Loss Properties
Mecklenburg County	41	5	66	$1,896,190.05	4
Charlotte	637	44	1,134	$27,245,296.29	26
Cornelius	0	--	--	--	--
Davidson	0	--	--	--	--
Huntersville	0	--	--	--	--
Matthews	1	0	2	$26,994.77	0
Mint Hill	0	--	--	--	--

Jurisdiction	Total Number of RL Properties	Insured RL Properties	Total Number of Losses	Total Amount of Claims Payments	Severe Repetitive Loss Properties
Pineville	0	--	--	--	--
Total	**679**	**49**	**1,202**	**$29,168,481.11**	**30**

Source: FEMA

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 4.45 summarizes the potential detrimental consequences of flood.

Table 4.45 – 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.
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. Communities without historical flood events in the last 20 years were assigned a probability rating of 2; those with between 1 and 20 flood events were assigned a probability rating of 3, and those with more than 20 past occurrences in the past 20 years were assigned a probability rating of 4. Communities with 10% or more of their land area in the SFHA were assigned a spatial extent of 3; those with less than 10% land area in the SFHA were given a spatial extent rating of 2. All other factors do not vary by jurisdiction.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score	Priority
Charlotte	4	3	3	3	3	3.3	H
Cornelius	3	3	2	3	3	2.8	H
Davidson	2	3	3	3	3	2.7	H
Huntersville	3	3	2	3	3	2.8	H
Matthews	3	3	2	3	3	2.8	H
Mint Hill	3	3	2	3	3	2.8	H
Pineville	3	3	3	3	3	3.0	H
Mecklenburg County	4	3	3	3	3	3.3	H

4.5.6 Hurricane and Tropical Storm

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 Mecklenburg County planning area. While coastal areas are most vulnerable to hurricanes, their wind and rain impacts can be felt hundreds of miles inland.

Extent

Hurricane intensity is classified by the Saffir-Simpson Scale, shown in Table 4.46, which rates hurricane intensity on a scale of 1 to 5, with 5 being the most intense.

Table 4.46 – 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 4.47 describes the damage that could be expected for each category of hurricane. Damage during hurricanes may also result from spawned tornadoes and inland flooding associated with heavy rainfall that usually accompanies these storms.

Table 4.47 – Hurricane Damage Classifications

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

Source: National Hurricane Center; Federal Emergency Management Agency

Based on past occurrences, Mecklenburg County is unlikely to experience a Category 4 or Category 5 storm, but a Category 3 storm is possible and could cause limited damages.

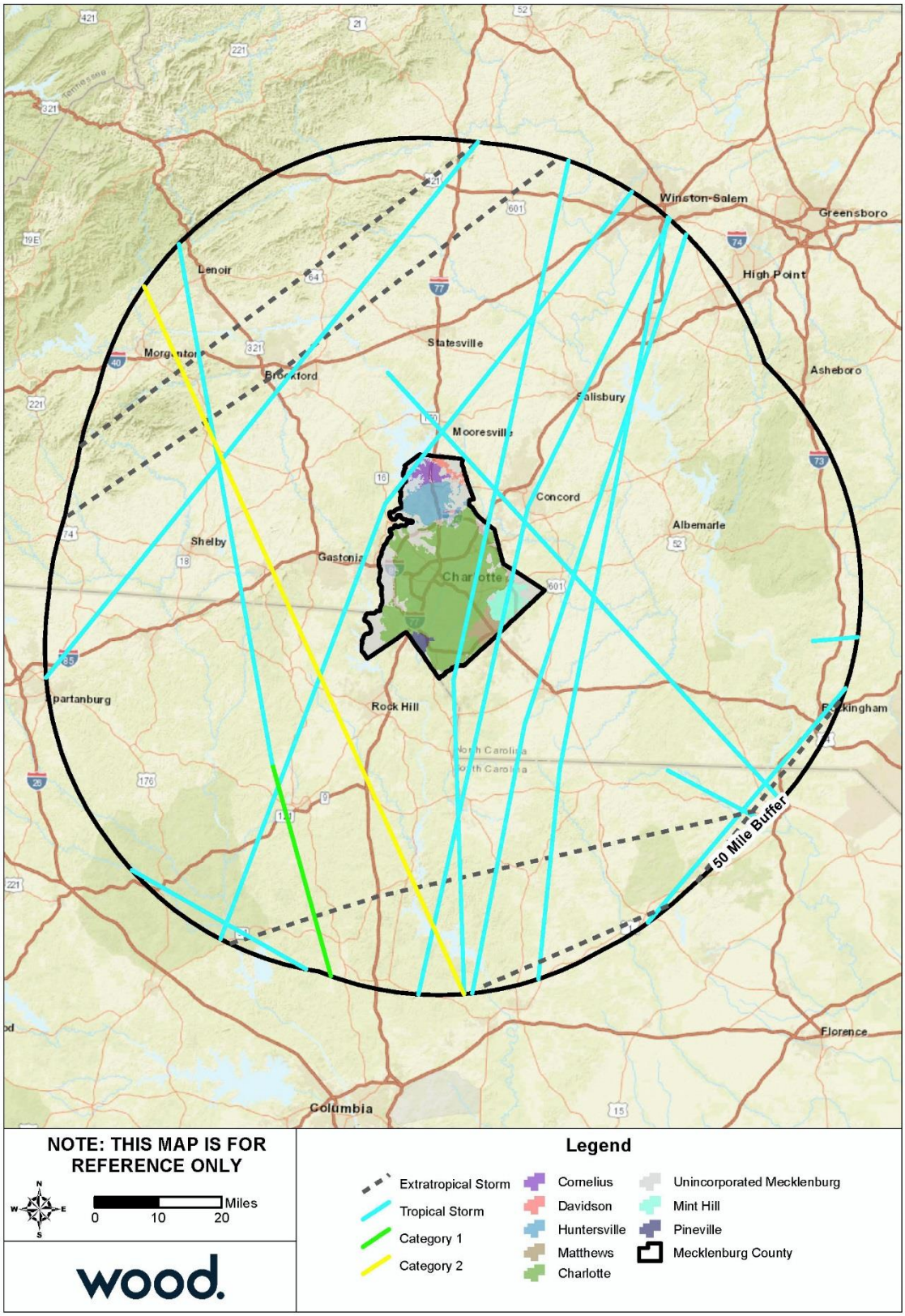
Impact: 2 – Limited

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, 18 hurricanes and tropical storms passed within 50 miles of Mecklenburg County from 1900-2016. These storms tracks are shown in Figure 4.16. The date, storm name, storm category, and maximum wind speed of each event are detailed in Table 4.48.

Figure 4.16 – Hurricane and Tropical Storm Tracks within 50 miles of Mecklenburg County, 1900-2016



Source: NOAA Office of Coastal Management

Table 4.48 – Hurricane and Tropical Storm Tracks within 50 Miles of Mecklenburg County, 1900-2016

Date	Storm Name	Max Storm Category*	Max Wind Speed (mph)
7/13/1901	Unnamed	Tropical Storm	40
6/16/1902	Unnamed	Tropical Storm	40
10/11/1902	Unnamed	Extratropical Storm	40
9/23/1907	Unnamed	Extratropical Storm	40
6/14/1912	Unnamed	Extratropical Storm	40
9/3/1913	Unnamed	Tropical Storm	46
8/3/1915	Unnamed	Tropical Storm	40
7/15/1916	Unnamed	Tropical Storm	58
10/3/1927	Unnamed	Tropical Storm	46
10/2/1929	Unnamed	Extratropical Storm	58
8/28/1949	Unnamed	Tropical Storm	58
8/31/1952	Able	Tropical Storm	52
8/28/1952	Unnamed	Tropical Storm	46
9/30/1959	Gracie	Category 1	75
9/5/1979	David	Tropical Storm	63
7/25/1985	Bob	Tropical Storm	63
9/22/1989	Hugo	Category 2	98
6/14/2006	Alberto	Extratropical Storm	40

*Reports the most intense category that occurred within 50 miles of Mecklenburg County, not for the storm event overall.
Source: Office of Coastal Management, 2019. https://marinecadastre.gov/data/

From 1999 through 2018, only one storm with hurricane or tropical storm force winds, Tropical cyclone Michael, was recorded in NCEI with impacts in Mecklenburg County, as detailed below:

October 11, 2018 – Tropical cyclone Michael gradually weakened as it tracked from the South Carolina Midlands through portions of the South Carolina and North Carolina Piedmont throughout the 11th. Gusty winds increased during the daylight hours on the east side of the storm track, with numerous trees blown, especially across the Piedmont. There were $5,000 in reported property damages.

The most significant storm to impact Mecklenburg County was Hurricane Hugo in September 1989. Mecklenburg County was included in the Presidential Disaster Declaration for Hurricane Hugo in 1989 and is known to have sustained a significant portion of the estimated statewide total of $1 billion in property damages caused by the storm. The following excerpt from *North Carolina's Hurricane History* by Jay Barnes was provided in the previous plan:

> "As the center of the storm rolled past Charlotte, wind gusts of over 85 mph buffeted the region. Trees crashed into homes, cars, and power lines and utility poles snapped. Charlotte lost more than eighty thousand trees to the storm, many of which were more than seventy years old. Ninety eight percent of the city's residents lost power, and for some, repairs were not made for more than two weeks. Power outages caused large amounts of raw sewage to bypass treatment plants and flow into streams throughout Mecklenburg County. North Carolina's largest metropolitan area was brought to its knees by the storm...
>
> …The people of Mecklenburg County thought they were immune to hurricanes prior to this storm's arrival. Most had believed that tropical cyclones were strictly a coastal phenomenon, but Hugo proved to be an exception." (Barnes, 1998)

Probability of Future Occurrence

Probability: 2 – Possible

Per NCEI records, in the 20-year period from 1999 through 2018, one tropical storm impacted the Mecklenburg County area. It should be noted that secondary impacts of hurricanes and tropical storms (i.e. flooding or flash flooding) may be recorded by the NCEI as separate events. Nonetheless, the probability of a hurricane or tropical storm impacting Mecklenburg County is possible.

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.

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 the handicapped are especially vulnerable to harm from hurricanes. For those who are unable to evacuate for medical reasons, there should be provision to take care of 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 medical care. There is a need to provide ongoing treatment for these vulnerable citizens, either on the coast or by air evacuation to upland hospitals. The stress from disasters such as a hurricane can result in immediate and long-term physical and emotional health problems among victims.

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 winds are often the deadly and most destructive results of hurricanes. Agriculture damages are also common impacts, though the USDA RMA reports no agricultural damages in Mecklenburg County due to hurricane.

The damage estimates for the 100-year hurricane wind event total $151,225,063, 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 county would likely experience a higher overall loss ratio from the 100-year hurricane event and face difficulty recovering from such an event.

Table 4.49 through Table 4.53 detail the estimated building damages from varying magnitudes of hurricane events.

Table 4.49 – 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
Unincorporated Mecklenburg County	24,114	22,151	91.9%	$1,630,575	1,227	5.1%	$542,194	377	1.6%	$78,918	23,755	98.5%	$2,251,688
Charlotte	246,117	225,421	91.6%	$21,864,923	14,782	6%	$6,767,153	2,897	1.2%	$1,217,015	243,100	98.8%	$29,849,091
Cornelius	10,558	9,797	92.8%	$1,535,568	630	6%	$141,061	87	0.8%	$21,099	10,514	99.6%	$1,697,728
Davidson	3,871	3,506	90.6%	$449,724	270	7%	$56,392	56	1.4%	$18,512	3,832	99%	$524,627
Huntersville	19,555	18,220	93.2%	$1,805,086	966	4.9%	$265,964	223	1.1%	$198,862	19,409	99.3%	$2,269,911
Matthews	10,030	9,144	91.2%	$875,650	675	6.7%	$109,768	133	1.3%	$79,052	9,952	99.2%	$1,064,470
Mint Hill	9,883	9,257	93.7%	$737,731	419	4.2%	$50,265	94	1%	$14,581	9,770	98.9%	$802,577
Pineville	2,731	2,018	73.9%	$133,142	552	20.2%	$79,842	142	5.2%	$6,340	2,712	99.3%	$219,323
Total	**326,859**	**299,514**	**91.6%**	**$29,032,399**	**19,521**	**6%**	**$8,012,639**	**4,009**	**1.2%**	**$1,634,379**	**323,044**	**98.8%**	**$38,679,415**

Source: NCEM Risk Management Tool

Table 4.50 – 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
Charlotte	246,117	225,421	91.6%	$21,864,923	14,782	6%	$6,767,153	2,897	1.2%	$1,217,015	243,100	98.8%	$29,849,091
Unincorporated Mecklenburg County	24,114	22,151	91.9%	$1,630,575	1,227	5.1%	$542,194	377	1.6%	$78,918	23,755	98.5%	$2,251,688
Cornelius	10,558	9,797	92.8%	$1,535,568	630	6%	$141,061	87	0.8%	$21,099	10,514	99.6%	$1,697,728
Davidson	3,871	3,506	90.6%	$449,724	270	7%	$58,180	56	1.4%	$18,512	3,832	99%	$526,416
Huntersville	19,555	18,220	93.2%	$1,805,086	966	4.9%	$265,964	223	1.1%	$198,862	19,409	99.3%	$2,269,911
Matthews	10,030	9,144	91.2%	$875,650	675	6.7%	$109,768	133	1.3%	$79,052	9,952	99.2%	$1,064,470
Mint Hill	9,883	9,257	93.7%	$737,731	419	4.2%	$50,265	94	1%	$14,581	9,770	98.9%	$802,577
Pineville	2,731	2,018	73.9%	$133,142	552	20.2%	$79,842	142	5.2%	$6,340	2,712	99.3%	$219,323
Total	**326,859**	**299,514**	**91.6%**	**$29,032,399**	**19,521**	**6%**	**$8,014,427**	**4,009**	**1.2%**	**$1,634,379**	**323,044**	**98.8%**	**$38,681,204**

Source: NCEM Risk Management Tool

Table 4.51 – 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
Unincorporated Mecklenburg County	24,114	22,419	93%	$6,480,251	1,227	5.1%	$2,571,183	377	1.6%	$345,582	24,023	99.6%	$9,397,016
Charlotte	246,117	228,249	92.7%	$84,244,024	14,782	6%	$27,712,878	2,897	1.2%	$4,678,824	245,928	99.9%	$116,635,726
Cornelius	10,558	9,841	93.2%	$5,566,212	630	6%	$634,746	87	0.8%	$103,243	10,558	100%	$6,304,201
Davidson	3,871	3,545	91.6%	$1,798,420	270	7%	$211,951	56	1.4%	$83,429	3,871	100%	$2,093,800
Huntersville	19,555	18,354	93.9%	$6,932,738	966	4.9%	$1,010,379	223	1.1%	$620,262	19,543	99.9%	$8,563,378
Matthews	10,030	9,222	91.9%	$3,303,745	675	6.7%	$391,784	133	1.3%	$378,085	10,030	100%	$4,073,614
Mint Hill	9,883	9,370	94.8%	$2,930,855	419	4.2%	$224,196	94	1%	$56,508	9,883	100%	$3,211,559
Pineville	2,731	2,037	74.6%	$603,767	552	20.2%	$318,820	142	5.2%	$23,182	2,731	100%	$945,769
Total	**310,482**	**303,037**	**92.7%**	**$111,860,012**	**19,521**	**6%**	**$33,075,937**	**4,009**	**1.2%**	**$6,289,115**	**326,567**	**99.9%**	**$151,225,063**

Source: NCEM Risk Management Tool

Table 4.52 – 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
Unincorporated Mecklenburg County	24,114	22,419	93%	$38,648,799	1,227	5.1%	$20,811,682	377	1.6%	$3,019,012	24,023	99.6%	$62,479,492
Charlotte	246,117	228,249	92.7%	$578,181,591	14,782	6%	$242,374,351	2,897	1.2%	$41,630,571	245,928	99.9%	$862,186,513
Cornelius	10,558	9,841	93.2%	$46,264,250	630	6%	$6,433,509	87	0.8%	$1,273,428	10,558	100%	$53,971,186
Davidson	3,871	3,545	91.6%	$11,783,873	270	7%	$2,603,768	56	1.4%	$1,105,714	3,871	100%	$15,493,355
Huntersville	19,555	18,354	93.9%	$47,895,765	966	4.9%	$10,686,839	223	1.1%	$4,885,841	19,543	99.9%	$63,468,445
Matthews	10,030	9,222	91.9%	$21,529,138	675	6.7%	$4,606,168	133	1.3%	$3,575,055	10,030	100%	$29,710,360
Mint Hill	9,883	9,370	94.8%	$16,829,484	419	4.2%	$2,192,156	94	1%	$555,094	9,883	100%	$19,576,734
Pineville	2,731	2,037	74.6%	$5,525,416	552	20.2%	$4,612,656	142	5.2%	$307,532	2,731	100%	$10,445,605
Total	**326,859**	**303,037**	**92.7%**	**$766,658,316**	**19,521**	**6%**	**$294,321,129**	**4,009**	**1.2%**	**$56,352,247**	**326,567**	**99.9%**	**$1,117,331,690**

Source: NCEM Risk Management Tool

Table 4.53 – 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
Unincorporated Mecklenburg County	24,114	22,419	93%	$113,447,504	1,227	5.1%	$41,952,246	377	1.6%	$7,076,104	24,023	99.6%	$162,475,855
Charlotte	246,117	228,249	92.7%	$1,708,893,733	14,782	6%	$607,088,780	2,897	1.2%	$111,598,034	245,928	99.9%	$2,427,580,546
Cornelius	10,558	9,841	93.2%	$145,931,559	630	6%	$17,138,498	87	0.8%	$3,508,330	10,558	100%	$166,578,387
Davidson	3,871	3,545	91.6%	$36,158,453	270	7%	$8,007,111	56	1.4%	$3,531,024	3,871	100%	$47,696,589
Huntersville	19,555	18,354	93.9%	$159,647,450	966	4.9%	$31,161,469	223	1.1%	$11,303,979	19,543	99.9%	$202,112,898
Matthews	10,030	9,222	91.9%	$68,428,054	675	6.7%	$13,444,958	133	1.3%	$7,283,850	10,030	100%	$89,156,863
Mint Hill	9,883	9,370	94.8%	$48,255,073	419	4.2%	$5,066,222	94	1%	$1,430,361	9,883	100%	$54,751,656
Pineville	2,731	2,037	74.6%	$16,143,307	552	20.2%	$14,999,121	142	5.2%	$969,441	2,731	100%	$32,111,868
Total	**326,859**	**303,037**	**92.7%**	**$2,296,905,133**	**19,521**	**6%**	**$738,858,405**	**4,009**	**1.2%**	**$146,701,123**	**326,567**	**99.9%**	**$3,182,464,662**

Source: NCEM Risk Management Tool

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 4.54 summarizes the potential negative consequences of hurricanes and tropical storms.

Table 4.54 – 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. Potential impacts to response capabilities due to storm impacts
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 foliation 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. While mobile home units do not comprise a significant proportion of any jurisdictions housing mix, Mecklenburg County and Charlotte each have over 4,000 mobile home units in their jurisdiction and therefore may face more severe impacts from wind.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score	Priority
Charlotte	2	3	4	1	2	2.6	H
Cornelius	2	2	4	1	2	2.3	M
Davidson	2	2	4	1	2	2.3	M
Huntersville	2	2	4	1	2	2.3	M
Matthews	2	2	4	1	2	2.3	M
Mint Hill	2	2	4	1	2	2.3	M
Pineville	2	2	4	1	2	2.3	M
Mecklenburg County	2	3	4	1	2	2.6	H

4.5.7 Landslide

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 accompanies these events. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides. Some landslides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly.

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

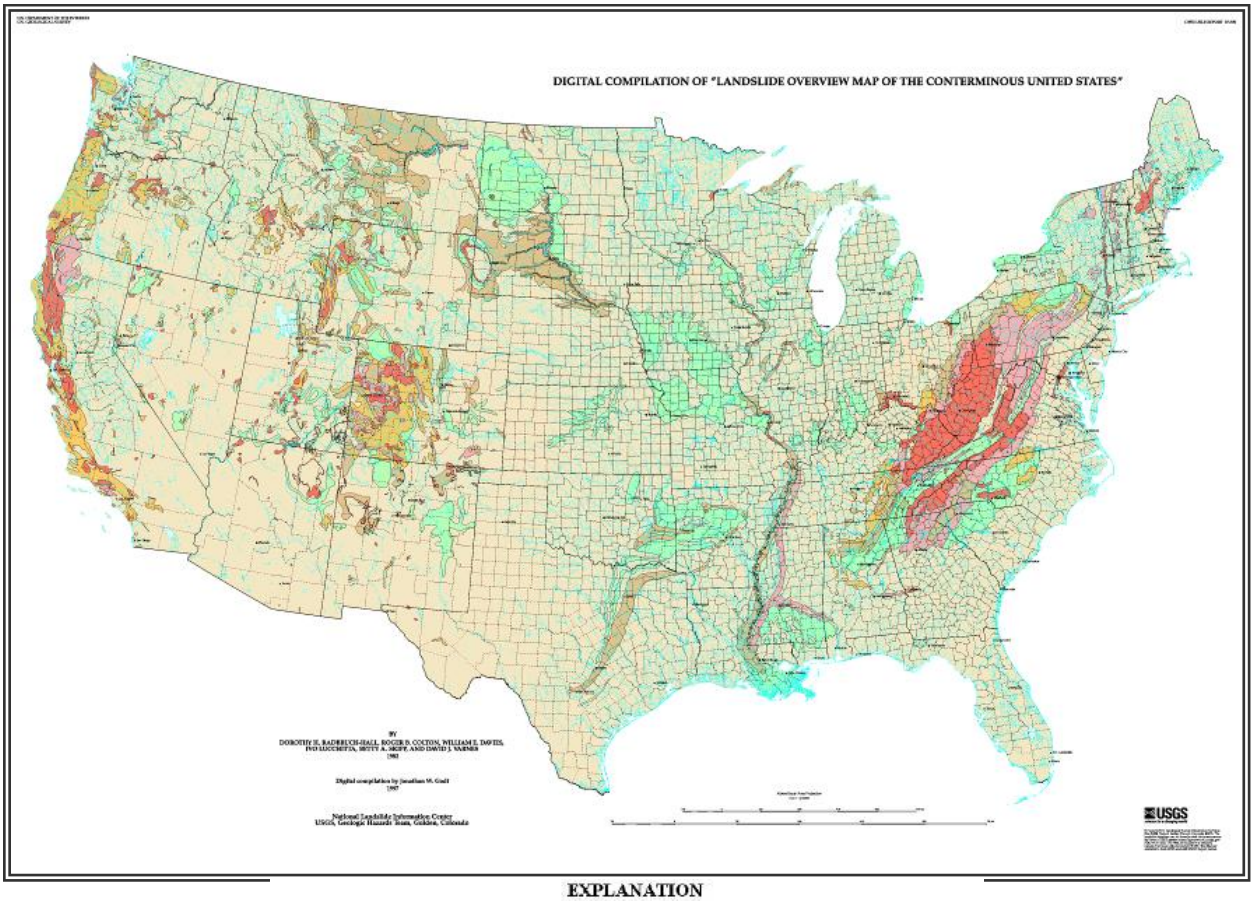
Warning Time: 4 – 6 to 12 hours

Duration: 1 – Less than six hours

Location

The U.S. Geological Survey (USGS) has produced landslide susceptibility and incidence mapping of the U.S., as shown in Figure 4.17. 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 Mecklenburg County faces low susceptibility and incidence of landslide. However, areas along the north central areas of county are at a significantly elevated risk of this hazard occurring, although there are no historical incidents to cite.

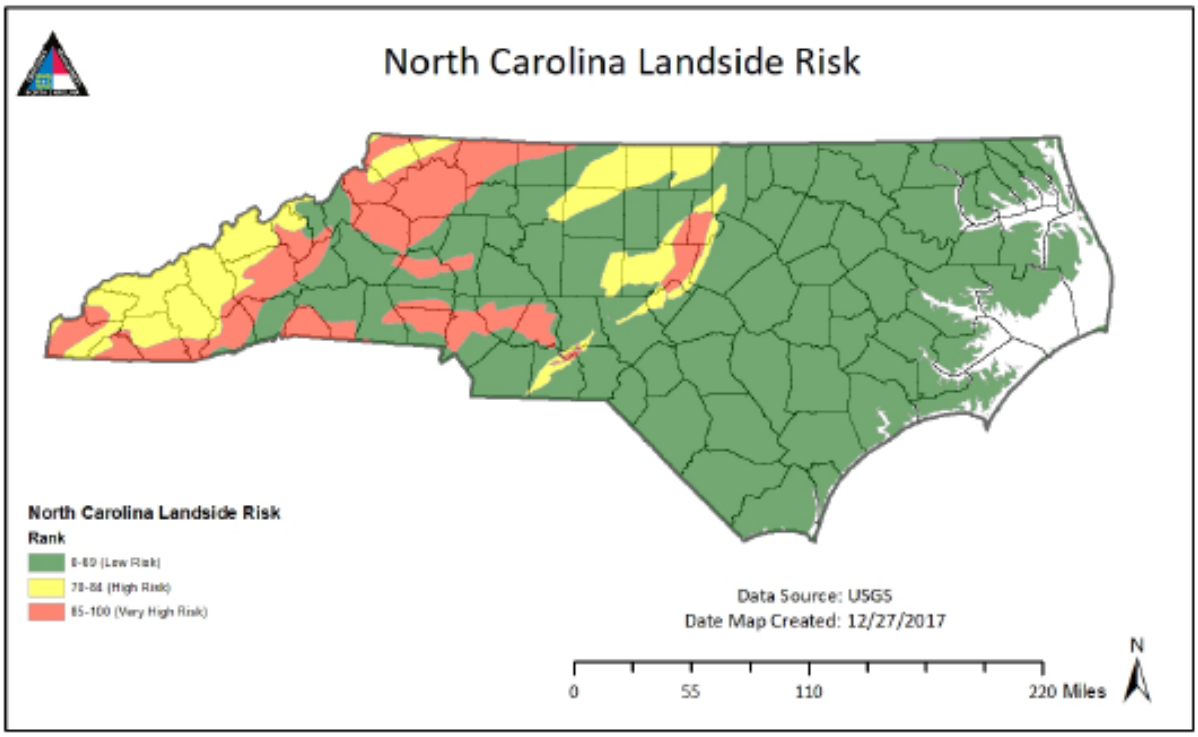
Figure 4.17 – Landslide Incidence and Susceptibility



Source: USGS

The 2018 North Carolina Hazard Mitigation Plan assesses landslide risk across the State. Per the state plan, areas through the central portion of the county are at very high risk from landslides; the rest of the county has low risk. Figure 4.18 shows areas of very high, high and low risk across the county and state.

Figure 4.18 – North Carolina Landslide Risk



Source: 2018 North Carolina Hazard Mitigation Plan

Extent

Landslide extent can be defined by susceptibility and incidence, which are defined and depicted in Figure 4.17 and Figure 4.18. Event magnitude is also dependent on topography; landslide risk is higher in areas with steeper slopes.

There are no historical records of landslides in the county to extrapolate an extent of damages, nor has much specific analysis been done on potential impacts. Landslides would have impacts on infrastructure above and below the slide area.

Impact: 1 – Minor

Spatial Extent: 1 – Negligible

Historical Occurrences

According to the North Carolina Department of Environmental Quality (NC DEQ), the 2015 Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan and the North Carolina Hazard Mitigation Plan, no recent landslides of record have occurred anywhere in Mecklenburg County.

Probability of Future Occurrence

Due to the lack of recorded landslide incidents in the county, probability of occurrence in the future can be extrapolated to be unlikely. However, areas of elevated landslide risk exist in the county, so there is still a low likelihood in these areas that a landslide incident may occur in the future.

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

Methodologies and Assumptions

This assessment of vulnerability to landslide in Mecklenburg County is based solely on a hypothetical incident scenario due to no recorded instances. Data on susceptibility is limited for the planning area and only available in an area-wide aggregate.

People

People are unlikely to sustain serious physical harm as a result of landslides in Mecklenburg County. 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

Landslides are infrequent in Mecklenburg County and are most likely to 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. A potential 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

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.

Consequence Analysis

Table 4.55 summarizes the potential negative consequences of landslide.

Table 4.55 – 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 in Mecklenburg County.
Property, Facilities and Infrastructure	Buildings and infrastructure may incur minor damages as a result of landslide; however, vulnerability in Mecklenburg County is low.

Category	Consequences
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 Mecklenburg County 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. Probability was determined to be slightly higher for jurisdictions in the central portions of Mecklenburg County where USGS mapping indicates very high risk. It should be noted that this probability rating reflects a low-consequence event and that the probability of a significant landslide is unlikely across the entire county. All other factors do not vary across jurisdictions.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score	Priority
Charlotte	2	1	1	4	1	1.6	L
Cornelius	1	1	1	4	1	1.3	L
Davidson	1	1	1	4	1	1.3	L
Huntersville	2	1	1	4	1	1.6	L
Matthews	1	1	1	4	1	1.3	L
Mint Hill	1	1	1	4	1	1.3	L
Pineville	1	1	1	4	1	1.3	L
Mecklenburg County	2	1	1	4	1	1.6	L

4.5.8 Severe Weather (Thunderstorm Winds, Lightning & Hail)

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.

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, 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

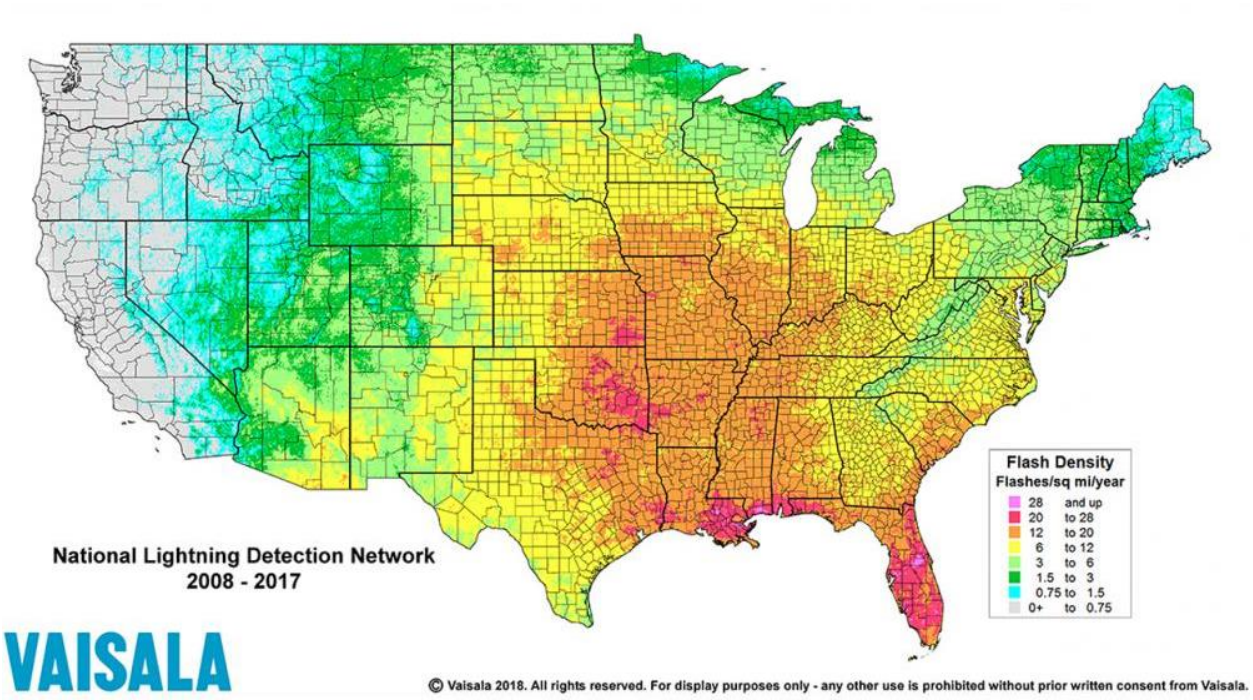
Duration: 1 – Less than six hours

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 Mecklenburg County shares equal risk to the threat of severe weather.

According to the Vaisala flash density map, shown in Figure 4.19, the majority of Mecklenburg County is located in an area that experiences 6 to 12 lightning flashes per square mile per year. It should be noted that future lightning occurrences may exceed these figures.

Figure 4.19 – Lightning Flash Density (2008-2017)



Source: Vaisala

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 county occurred on July 23, 1962 with a measured gust of 92 mph, though the NCEI recorded no location or impact data.

Impact: 2 – Limited

Spatial Extent: 3 – Moderate

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 4.56 – 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 county 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 Mecklenburg County 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 4.57 indicates the hailstone measurements utilized by the National Weather Service.

Table 4.57 – 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
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 4.58 describes typical intensity and damage impacts of the various sizes of hail.

Table 4.58 – 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 1998 and 2017 in Mecklenburg County was a little under 1" in diameter; the largest hailstone recorded was 2.5", recorded on May 24, 1996 in Charlotte. This storm resulted in a recorded $1 million in property damage per NCEI.

Impact: 1 – Minor

Hailstorms frequently accompany thunderstorms, so their locations and spatial extents coincide. Mecklenburg County 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, 1998 and December 31, 2017, the NCEI recorded 242 separate incidents of thunderstorm winds, occurring on 198 separate days. These events caused $1.45 million in recorded property damage, 6 injuries and no fatalities. The recorded gusts averaged 59.1 mph, with the highest gusts recorded at 86.3 mph in Charlotte during a storm on August 18, 2000. Wind gusts with property damage recorded averaged almost $29,000 in damage, with five gusts accounting for $850,000 property damage alone. All 52 incidents with recorded damages are detailed in Table 4.59:

Table 4.59 – Thunderstorm Winds with Property Damages in Mecklenburg County, 1999-2018

Location	Date	Time	Wind Speed (mph)	Fatalities	Injuries	Property Damage
Charlotte	8/18/2000	1630	86.3	0	0	$250,000
Cornelius	5/13/2002	1635	63.3	0	0	$3,000
Charlotte	5/13/2002	1705	69.0	0	0	$50,000
Matthews	5/13/2002	1720	59.8	0	0	$50,000
Pineville	7/1/2002	1749	57.5	0	0	$1,000
Paw Creek	7/2/2002	1710	69.0	0	0	$3,000
Charlotte	7/3/2002	1656	57.5	0	0	$7,500
Charlotte	7/3/2002	1707	57.5	0	0	$20,000
Charlotte	7/3/2002	1815	63.3	0	0	$3,000
Charlotte	8/16/2002	1900	57.5	0	0	$1,000
Cornelius	8/24/2002	1730	63.3	0	0	$3,000
Charlotte	5/2/2003	1619	74.8	0	2	$100,000
Huntersville	5/2/2003	1630	69.0	0	3	$25,000
Charlotte	7/9/2003	1550	57.5	0	0	$1,000
Huntersville	7/11/2003	1605	57.5	0	0	$1,000
Huntersville	7/12/2003	2235	57.5	0	0	$5,000
Charlotte	8/5/2003	1628	57.5	0	0	$5,000
Charlotte	8/22/2003	1659	62.1	0	0	$1,000
Huntersville	11/19/2003	750	57.5	0	0	$1,000
Charlotte	11/19/2003	800	57.5	0	0	$1,000
Charlotte	5/31/2004	700	57.5	0	0	$1,000
Charlotte	1/14/2005	30	57.5	0	0	$4,000
Charlotte	1/14/2005	51	57.5	0	0	$5,000
Charlotte	3/8/2005	726	69.0	0	0	$50,000
Pineville	3/8/2005	737	69.0	0	0	$20,000
Davidson	7/28/2005	1731	63.3	0	0	$10,000
Charlotte	2/4/2006	1330	57.5	0	0	$10,000
Charlotte	6/11/2006	1700	69.0	0	0	$100,000
Charlotte	8/26/2007	1658	69.0	0	0	$50,000
North Charlotte	4/19/2013	1500	46.0	0	0	$5,000
Shopton	6/10/2013	1358	57.5	0	0	$10,000
Charlotte	6/26/2015	2054	57.5	0	0	$2,000
Charlotte	7/8/2015	1640	57.5	0	0	$10,000
Derita	8/11/2015	1454	46.0	0	0	$100,000
Griffith	8/19/2015	1515	46.0	0	0	$20,000
Davidson	9/10/2015	1630	57.5	0	0	$5,000
Clt Wilgrove Arpk Ar	9/10/2015	1805	46.0	0	0	$20,000
Douglas Muni Arpt	2/24/2016	1227	57.5	0	0	$25,000
Chadwick	7/8/2016	1931	57.5	0	0	$20,000
Charlotte	7/21/2016	1353	57.5	0	0	$50,000
Charlotte	8/17/2016	1638	57.5	0	0	$40,000
Shopton	3/1/2017	1916	57.5	0	0	$5,000

Location	Date	Time	Wind Speed (mph)	Fatalities	Injuries	Property Damage
Charlotte	3/1/2017	1928	57.5	0	0	$10,000
North Charlotte	5/5/2017	10	46.0	0	0	$1,000
Clt Brockenbrough Ar	6/4/2017	1520	46.0	0	1	$5,000
Huntersville	7/6/2017	1608	63.3	0	0	$2,000
Croft	7/8/2017	1710	46.0	0	0	$1,000
Charlotte	7/18/2017	1938	57.5	0	0	$200,000
Homestead	7/28/2017	1546	57.5	0	0	$25,000
Charlotte	8/7/2017	2142	57.5	0	0	$100,000
(Clt)Charlotte/Dougl	4/15/2018	1413	69.0	0	0	$5,000
Griffith	7/24/2018	1830	46.0	0	0	$10,000
			Total	**0**	**6**	**$1,452,500**

Source: NCEI

In addition to recorded thunderstorm wind events, NCEI reports 16 high wind and strong wind events during this same period that caused $716,250 in property damage. Of all wind events recorded by NCEI, 8 directly caused deaths or injuries. Those incidents are recorded below:

Table 4.60 – Recorded Wind Events with Injuries and/or Fatalities, 1999-2018

Location	Event Type	Date	Wind Speed (mph)	Fatalities	Injuries	Property Damage
Huntersville	Thunderstorm Wind	5/2/2003	69	0	3	$25,000
Charlotte	Thunderstorm Wind	5/2/2003	74.8	0	2	$100,000
Mecklenburg County	High Wind	3/7/2004	74.8	1	2	$75,000
Mecklenburg County	High Wind	3/28/2000	57.5	0	1	$0
Brockenbrough Airport	Thunderstorm Wind	6/4/2017	46	0	1	$5,000
Mecklenburg County	High Wind	4/17/2001	57.5	1	0	$0
Mecklenburg County	Strong Wind	3/9/2008	51.8	1	0	$0
Clt Brockenbrough Ar	Thunderstorm Wind	6/4/2017	46.0	0	1	$5,000
			Total	**3**	**9**	**$205,000**

Source: NCEI

Lightning

According to NCEI data, there were 43 lightning strikes reported between 1999 and 2018. Of these, 31 events recorded property damage totaling over $2.395 million. These events directly caused 11 injuries and 3 fatalities. Event narratives indicate in some cases that property damage occurred but was not estimated; therefore, actual property damage amounts are higher. No 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 Mecklenburg County. Table 4.61 details NCEI-recorded lightning strikes from 1999 through 2018.

Table 4.61 – Recorded Lightning Strikes in Mecklenburg County, 1999-2018

Location	Date	Time	Fatalities	Injuries	Property Damage
Charlotte	7/31/1999	100	0	0	$0
Charlotte	6/14/2000	1330	0	1	$0
Charlotte	7/7/2000	230	0	0	$100,000
Charlotte	7/3/2002	1707	0	0	$20,000

Location	Date	Time	Fatalities	Injuries	Property Damage
Charlotte	7/3/2002	1725	0	0	$10,000
Charlotte	7/4/2002	1400	0	0	$260,000
Huntersville	5/2/2003	1630	0	1	$0
Charlotte	6/16/2003	1820	0	0	$250,000
Charlotte	7/19/2003	1800	0	0	$30,000
Charlotte	7/21/2003	1859	0	1	$0
Matthews	7/29/2003	1536	3	1	$30,000
Charlotte	7/29/2003	1730	0	1	$0
Charlotte	8/14/2003	1745	0	0	$0
Charlotte	5/23/2004	1600	0	0	$250,000
South Portion	6/8/2004	1800	0	0	$5,000
Charlotte	7/5/2004	1940	0	0	$20,000
Charlotte	5/10/2005	1830	0	0	$50,000
Charlotte	6/7/2005	1700	0	0	$25,000
Charlotte	7/1/2005	2030	0	0	$60,000
Matthews	7/18/2005	1900	0	0	$0
Huntersville	7/28/2005	1800	0	0	$20,000
Douglas Airport	4/3/2006	1800	0	0	$15,000
Charlotte	6/23/2006	1430	0	1	$0
Charlotte	7/22/2006	2100	0	0	$150,000
Huntersville	6/24/2007	1900	0	0	$20,000
Charlotte	7/7/2007	1515	0	0	$20,000
Charlotte	7/22/2008	1940	0	0	$50,000
Derita	5/2/2009	1630	0	0	$0
Pineville	6/13/2010	1620	0	0	$50,000
Alexanders Store	6/13/2010	1645	0	0	$150,000
Matthews	7/13/2010	1600	0	0	$100,000
Oakhurst	7/27/2010	1800	0	0	$100,000
Matthews	7/27/2010	1800	0	0	$100,000
Pineville	6/21/2011	2130	0	0	$200,000
Pineville	8/7/2011	1900	0	0	$150,000
Smithville	3/20/2012	2130	0	0	$50,000
Griffith	5/22/2012	2130	0	0	$50,000
Croft	7/1/2012	1730	0	0	$25,000
Griffith	7/16/2012	1630	0	0	$5,000
Charlotte	6/25/2014	1500	0	1	$0
Huntersville	8/19/2015	1700	0	1	$30,000
Yorkmont Park	9/10/2015	1825	0	2	$0
Thomasboro	6/15/2017	1930	0	1	$0
Total			**3**	**11**	**$2,395,000**

Source: NCEI

The following are a selection of narrative descriptions recorded in NCEI for lightning events that occurred in Mecklenburg County:

June 14, 2000 - Thunderstorms developed in the foothills and piedmont during the early afternoon. One became severe and produced dime size hail in the Greenlee community, outside of Marion. Another severe thunderstorm produced several small microbursts in the Sturdivants area. A brick well house was

destroyed, several trees were downed, some fell on houses, tin was torn off of barns, and one barn had additional light structural damage. A woman hanging clothes out to dry was shocked and injured by lightning which struck nearby her Charlotte home.

July 7, 2002 – At least 3 major fires were ignited by lightning in Charlotte, some at apartments and houses.

June 16, 2003 – Lightning stuck the roof a condominium in Charlotte, resulting in a fire which caused significant damage.

July 29, 2003 - Three people were killed and another injured when lightning struck a large oak tree in Matthews, which then fell on and crushed the vehicle they were sitting in. Two other vehicles were damaged by the fallen tree, causing $30,000 in property damage.

June 25, 2014 - A small area of showers intensified slightly, producing occasional lightning strikes as it moved over the Charlotte metro area during late afternoon. One of these strikes hit a 9-year-old boy near Johnson C. Smith University, causing serious injuries.

Hail

NCEI records 134 separate hail incidents across 88 days between January 1, 1999 and December 31, 2018 in Mecklenburg County. The largest diameter hail recorded in the County during this period was two inches, recorded two separate times; the average hail size in all storms was a little under one inch in diameter. No injuries, fatalities, property damage or crop damages were recorded by NCEI for these incidents, though it should be noted that as insured loss, hail damage numbers are not reliably reported and are usually orders of magnitude higher than available reports. Event narratives in the NCEI record many instances of non-quantified damages.

Probability of Future Occurrence

Based on historical occurrences recorded by NCEI for the 20-year period from 1999 through 2018, Mecklenburg County averages 9.9 days with thunderstorm wind events per year. Over this same period, 39 lightning events were reported as having caused death, injury, or property damage, which equates to an average of 1.95 damaging lightning strikes per year.

Over the 20-year period from 1999 through 2018, Mecklenburg County experienced 134 reported hail incidents; this averages to almost seven reported incidents per year somewhere in the planning area.

Based on these historical occurrences, there is a 100% chance that the County 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 all of the 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

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

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. Residents living in mobile homes are 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), 5,555 housing units (1.6%) in Mecklenburg County are classified as "mobile homes." Based on an estimated average of 2.57 persons per household from the 2017 ACS, there are approximately 14,276 people in Mecklenburg County living in mobile homes. Individuals who work outdoors may also face increased risk.

Between 1999 and 2018, the NCEI record three fatalities and 11 injuries attributed to lightning in Mecklenburg County. NCEI records zero fatalities and six injuries attributed to wind events in Mecklenburg County. There are no injuries or fatalities attributed to hail.

Property

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 lightning strikes in Mecklenburg County, the vast majority of recorded property damage was due to structure fires.

NCEI records lightning impacts over 20 years (1999-2018), with $2,395,000 in property damage recorded. Historically, this has resulted in $119,750 in property impacts annually in Mecklenburg County. The average impact from lightning per incident in Mecklenburg County is almost $56,000.

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 Mecklenburg County, NCEI reported no property or crop damages due to hail.

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 Mecklenburg County, 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 4.62 through Table 4.65.

Severe weather can also cause significant agricultural losses. While severe weather is a threat to the county, no crop losses due to wind or hail were reported in the USDA Risk Management Agency (RMA) system.

Table 4.62 – 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
Unincorporated Mecklenburg County	24,114	22,419	93%	$6,480,251	1,227	5.1%	$2,571,183	377	1.6%	$345,582	24,023	99.6%	$9,397,016
Charlotte	246,117	228,249	92.7%	$84,244,024	14,782	6%	$27,712,878	2,897	1.2%	$4,678,824	245,928	99.9%	$116,635,726
Cornelius	10,558	9,841	93.2%	$5,566,212	630	6%	$634,746	87	0.8%	$103,243	10,558	100%	$6,304,201
Davidson	3,871	3,545	91.6%	$1,798,420	270	7%	$213,282	56	1.4%	$83,429	3,871	100%	$2,095,131
Huntersville	19,555	18,354	93.9%	$6,932,738	966	4.9%	$1,010,379	223	1.1%	$620,262	19,543	99.9%	$8,563,378
Matthews	10,030	9,222	91.9%	$3,303,745	675	6.7%	$391,784	133	1.3%	$378,085	10,030	100%	$4,073,614
Mint Hill	9,883	9,370	94.8%	$2,930,855	419	4.2%	$224,196	94	1%	$56,508	9,883	100%	$3,211,559
Pineville	2,731	2,037	74.6%	$603,767	552	20.2%	$318,820	142	5.2%	$23,182	2,731	100%	$945,769
Total	**326,859**	**303,037**	**92.7%**	**$111,860,012**	**19,521**	**6%**	**$33,077,268**	**4,009**	**1.2%**	**$6,289,115**	**326,567**	**99.9%**	**$151,226,394**

Source: NCEM Risk Management Tool

Table 4.63 – 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
Unincorporated Mecklenburg County	24,114	22,419	93%	$10,598,206	1,227	5.1%	$4,989,316	377	1.6%	$670,553	24,023	99.6%	$16,258,076
Charlotte	246,117	228,249	92.7%	$140,652,746	14,782	6%	$52,525,236	2,897	1.2%	$8,712,369	245,928	99.9%	$201,890,350
Cornelius	10,558	9,841	93.2%	$9,268,846	630	6%	$1,259,184	87	0.8%	$216,595	10,558	100%	$10,744,625
Davidson	3,871	3,545	91.6%	$2,963,072	270	7%	$422,325	56	1.4%	$169,627	3,871	100%	$3,555,024
Huntersville	19,555	18,354	93.9%	$11,226,404	966	4.9%	$1,944,887	223	1.1%	$1,105,324	19,543	99.9%	$14,276,615
Matthews	10,030	9,222	91.9%	$5,371,996	675	6.7%	$764,203	133	1.3%	$782,325	10,030	100%	$6,918,524
Mint Hill	9,883	9,370	94.8%	$4,795,361	419	4.2%	$449,864	94	1%	$110,115	9,883	100%	$5,355,341
Pineville	2,731	2,037	74.6%	$1,096,072	552	20.2%	$658,145	142	5.2%	$45,630	2,731	100%	$1,799,847
Total	**326,859**	**303,037**	**92.7%**	**$185,972,703**	**19,521**	**6%**	**$63,013,160**	**4,009**	**1.2%**	**$11,812,538**	**326,567**	**99.9%**	**$260,798,402**

Source: NCEM Risk Management Tool

Table 4.64 – 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
Unincorporated Mecklenburg County	24,114	22,419	93%	$24,607,788	1,227	5.1%	$14,083,201	377	1.6%	$1,963,587	24,023	99.6%	$40,654,576
Charlotte	246,117	228,249	92.7%	$355,687,881	14,782	6%	$153,828,903	2,897	1.2%	$25,787,135	245,928	99.9%	$535,303,920
Cornelius	10,558	9,841	93.2%	$26,275,857	630	6%	$3,960,868	87	0.8%	$754,385	10,558	100%	$30,991,110
Davidson	3,871	3,545	91.6%	$7,233,552	270	7%	$1,491,337	56	1.4%	$610,676	3,871	100%	$9,335,565
Huntersville	19,555	18,354	93.9%	$28,069,045	966	4.9%	$6,316,253	223	1.1%	$3,135,463	19,543	99.9%	$37,520,760
Matthews	10,030	9,222	91.9%	$13,059,805	675	6.7%	$2,647,422	133	1.3%	$2,377,242	10,030	100%	$18,084,469
Mint Hill	9,883	9,370	94.8%	$10,919,496	419	4.2%	$1,397,505	94	1%	$344,117	9,883	100%	$12,661,118
Pineville	2,731	2,037	74.6%	$3,253,976	552	20.2%	$2,533,436	142	5.2%	$168,278	2,731	100%	$5,955,690
Total	**326,859**	**303,037**	**92.7%**	**$469,107,400**	**19,521**	**6%**	**$186,258,925**	**4,009**	**1.2%**	**$35,140,883**	**326,567**	**99.9%**	**$690,507,208**

Source: NCEM Risk Management Tool

Table 4.65 – 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
Unincorporated Mecklenburg County	24,114	22,419	93%	$38,648,799	1,227	5.1%	$20,811,682	377	1.6%	$3,019,012	24,023	99.6%	$62,479,492
Charlotte	246,117	228,249	92.7%	$578,181,591	14,782	6%	$242,374,351	2,897	1.2%	$41,630,571	245,928	99.9%	$862,186,513
Cornelius	10,558	9,841	93.2%	$46,264,250	630	6%	$6,433,509	87	0.8%	$1,273,428	10,558	100%	$53,971,186
Davidson	3,871	3,545	91.6%	$11,783,873	270	7%	$2,603,736	56	1.4%	$1,105,714	3,871	100%	$15,493,323
Huntersville	19,555	18,354	93.9%	$47,895,765	966	4.9%	$10,686,839	223	1.1%	$4,885,841	19,543	99.9%	$63,468,445
Matthews	10,030	9,222	91.9%	$21,529,138	675	6.7%	$4,606,168	133	1.3%	$3,575,055	10,030	100%	$29,710,360
Mint Hill	9,883	9,370	94.8%	$16,829,484	419	4.2%	$2,192,156	94	1%	$555,094	9,883	100%	$19,576,734
Pineville	2,731	2,037	74.6%	$5,525,416	552	20.2%	$4,612,656	142	5.2%	$307,532	2,731	100%	$10,445,605
Total	**326,859**	**303,037**	**92.7%**	**$766,658,316**	**19,521**	**6%**	**$294,321,097**	**4,009**	**1.2%**	**$56,352,247**	**326,567**	**99.9%**	**$1,117,331,658**

Source: NCEM Risk Management Tool

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 4.66 summarizes the potential negative consequences of severe weather.

Table 4.66 – 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
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. While mobile home units do not comprise a significant proportion of any jurisdictions housing mix, Mecklenburg County and Charlotte each have over 4,000 mobile home units in their jurisdiction and therefore 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	PRI Score	Priority
Charlotte	4	2	3	4	1	2.9	H
Cornelius	4	1	3	4	1	2.6	H
Davidson	4	1	3	4	1	2.6	H
Huntersville	4	1	3	4	1	2.6	H
Matthews	4	1	3	4	1	2.6	H
Mint Hill	4	1	3	4	1	2.6	H
Pineville	4	1	3	4	1	2.6	H
Mecklenburg County	4	2	3	4	1	2.9	H

4.5.9 Severe Winter Storm

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 of more inches in 12 hours or less. A blizzard is the most severe form of winter storm. It combines low temperatures, heavy snow, and winds of 35 miles per hour or more, which reduces visibility to a quarter mile or less for at least 3 hours. Winter storms are often accompanied by sleet, freezing rain, or an ice storm. Such freeze events are particularly hazardous as they create treacherous surfaces.

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

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 one week

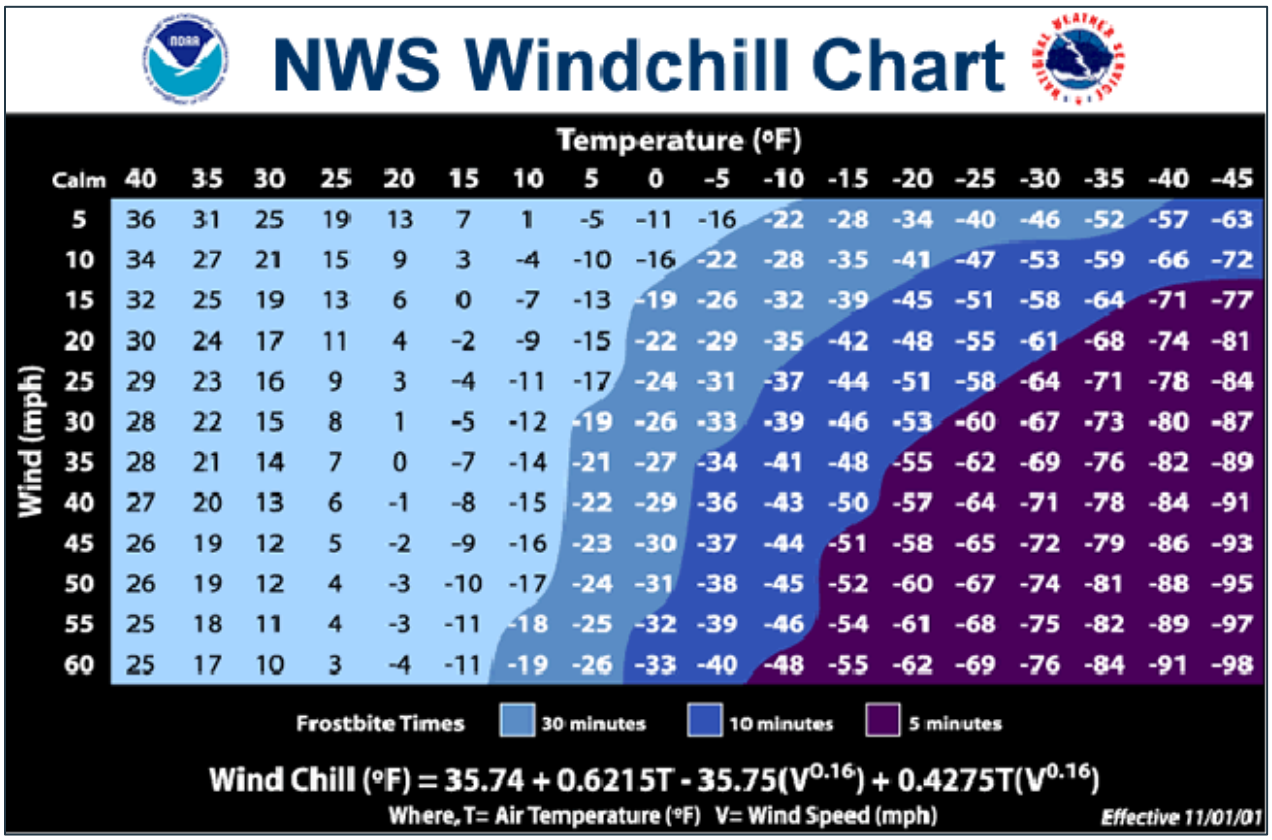
Location

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 county.

Extent

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 4.20, provides a formula for calculating the dangers of winter winds and freezing temperatures.

Figure 4.20 – NWS Wind Chill Temperature Index



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

The greatest snowfall amount recorded in the Mecklenburg County planning area was 19.3 inches, recorded on March 3, 1952 at the Charlotte Airport weather station.

Impact: 2 – Limited

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. Mecklenburg County 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 County 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) 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.

Summarized impacts from data collected for the years 1998 through 2017 are included in Table 4.67. Cumulatively, severe winter storms caused $42.6 million in property damage, $1 million in crop damage, and one fatality. In this timeframe, the County experienced no injuries from the impacts of severe winter storm, though these types of impacts are possible in future events. No blizzard events were recorded.

Table 4.67 – Total Severe Winter Storm Events in Mecklenburg County, 1999-2018

Event Type	Number of Recorded Incidents	Total Fatalities	Total Injuries	Total Property Damage	Total Crop Damage
Cold/Wind Chill	4	1	0	$0	$0
Extreme Cold/Wind Chill	1	0	0	$0	$0
Frost/Freeze	3	0	0	$0	$1,000,000
Heavy Snow	11	0	0	$2,500,000	$0
Ice Storm	3	0	0	$40,100,000	$0
Sleet	2	0	0	$0	$0
Winter Storm	9	0	0	$0	$0
Winter Weather	26	0	0	$0	$0
Total	**59**	**1**	**0**	**$42,600,000**	**$1,000,000**

Source: NCEI

Specific events with recorded injuries, property damage, or crap damage in Mecklenburg County are detailed in Table 4.68.

Table 4.68 – Events with Recorded Severe Winter Storm Impacts in Mecklenburg County, 1999-2018

Date	Event Type	Fatalities	Injuries	Property Damage	Crop Damage
12/4/2002	Ice Storm	0	0	$40,000,000	0
2/26/2004	Heavy Snow	0	0	$2,500,000	0
12/15/2005	Ice Storm	0	0	$100,000	0
4/8/2007	Frost/Freeze	0	0	0	$1,000,000
1/20/2008	Cold/Wind Chill	1	0	0	0
Total		**1**	**0**	**$42,600,000**	**$1,000,000**

Source: NCEI

Several storm impacts from NCEI are summarized below:

December 4, 2002 – Freezing rain began over the extreme southern mountains of North Carolina during the early afternoon on the 4th and had spread into the southwest piedmont by mid-afternoon. Resultant damage due to ice accumulation began during the mid-to-late afternoon. The intensity of the freezing rain increased after midnight, and by sunrise on the 5th, devastating ice accumulations of 1/2 to 1 1/2 inches were observed. The hardest hit area was Charlotte metro. Hundreds of thousands lost power, and the outages lasted for as long as 2 weeks in some areas. Altogether, the storm caused almost $100 million in property damage across the region.

February 26, 2004 – Heavy snow began to fall across the foothills, piedmont, and northern mountains of North Carolina during the late morning. Although snowfall intensity decreased dramatically during the early-to-middle portion of the afternoon, heavy snow redeveloped during the late afternoon, and continued into the evening and overnight hours. Scattered thunderstorms contributed to intense snowfall rates of 2 to 3 inches per hour from time to time, especially in the piedmont, where total snowfall of 12-22 inches occurred. The heaviest amounts occurred in the southwest piedmont, particularly in southern portions of Charlotte metro. Thousands of people were stranded on I-77 during the early afternoon, and some required rescue. The weight of the snowfall caused damage to numerous roofs, while some roofs completely collapsed. Across the foothills and northern mountains, accumulations were considerably lighter, generally in the 4-8 inch range, although amounts of 10-16 inches fell along the Blue Ridge north of I-40. The storm caused $2.5 million in property damage in Mecklenburg County.

April 8, 2007 – An early spring hard freeze saw temperatures fall to the upper teens and lower 20s across much of the western Carolinas and northeast Georgia on the morning of the 8th. This resulted in massive agricultural losses across the region. It was estimated that 90 percent of the apple and peach crop across the area was destroyed. As much as 50 percent of the berry crop was lost, while more than 50 percent of the grape crop across western North Carolina was damaged. NCDC recorded $1,000,000 crop damage to the Mecklenburg County region.

January 20, 2008 – Cold weather was blamed for the death of a homeless man in northwest Charlotte. The low temperature on the 20th was 23 degrees, while the high the previous day was only 36.

Mecklenburg County received one emergency management declaration and three 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 4.69 – Emergency & Disaster Declarations in Mecklenburg County due to Severe Winter Storms

Number	Date	Disaster Type	Incident Start	Incident End
EM 3033	3/2/1977	Drought and Freezing	3/2/1977	3/2/1977
DR 1087	1/13/1996	Blizzard	1/6/1996	1/12/1996

Number	Date	Disaster Type	Incident Start	Incident End
DR 1312	1/31/2000	Severe Winter Storm	1/24/2000	2/1/2000
DR 1448	12/12/2002	Severe Ice Storm	12/4/2002	12/6/2002

Source: FEMA, December 20, 2018

Probability of Future Occurrence

NCEI records 59 severe winter storm related events during the 20-year period from 1998 through 2017, which equates to an average of almost 3 events per year, or more than 100 percent likelihood of an occurrence 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. Those without shelter are also especially vulnerability to the impacts of winter weather; extreme cold took the life of one homeless person in 2008.

Property

According to reported data of storm impacts recorded by the NCEI, between 1999 and 2018 Mecklenburg County experienced $42.6 million in property damage related to the impacts of severe winter storm, and $1 million in crop damage. Of these impacts, $40 million in property damages occurred during one storm, and all $1 million in crop damage occurred in a single storm as well.

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 4.70 summarizes the potential negative consequences of severe winter storm.

Table 4.70 – 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	PRI Score	Priority
Charlotte	4	2	4	1	3	3.0	H
Cornelius	4	2	4	1	3	3.0	H
Davidson	4	2	4	1	3	3.0	H
Huntersville	4	2	4	1	3	3.0	H
Matthews	4	2	4	1	3	3.0	H
Mint Hill	4	2	4	1	3	3.0	H
Pineville	4	2	4	1	3	3.0	H
Mecklenburg County	4	2	4	1	3	3.0	H

4.5.10 Sinkhole

Hazard Background

A sinkhole is a cavity formed in an area of ground with no natural external surface drainage. Sinkholes are a natural and common geologic feature in areas with underlying limestone and other rock types that are soluble in natural water. Most limestone is porous, allowing the acidic water of rain to percolate through their strata, dissolving some limestone and carrying it away in solution. Over time, this persistent erosional process can create extensive underground voids and drainage systems in much of the carbonate rocks. Collapse of overlying sediments into the underground cavities produces sinkholes. Sinkholes can also form as a result of infrastructure failures, where leaks in the stormwater system result in the creation of these underground voids that may result in ground collapse.

The three general types of sinkholes are: subsidence, solution, and collapse. Collapse sinkholes are most common in areas where the overburden (the sediments and water contained in the unsaturated zone, surficial aquifer system, and the confining layer above an aquifer) is thick, but the confining layer is breached or absent. Collapse sinkholes can form with little warning and leave behind a deep, steep sided hole. Subsidence sinkholes form gradually where the overburden is thin and only a veneer of sediments is overlying the limestone. Solution sinkholes form where no overburden is present and the limestone is exposed at land surface.

Sinkholes occur in many shapes, from steep-walled holes to bowl or cone shaped depressions. Sinkholes are dramatic because the land generally stays intact for a while until the underground spaces get too big. If there is not enough support for the land above the spaces, then a sudden collapse of the land surface can occur. Under natural conditions, sinkholes form slowly and expand gradually. However, human activities such as dredging, constructing reservoirs, diverting surface water, and pumping groundwater can accelerate the rate of sinkhole expansions, resulting in the abrupt formation of collapse sinkholes. In the case of sinkholes caused by stormwater infrastructure failure, they can form and grow rapidly once a failure occurs.

Although a sinkhole can form without warning, specific signs can signal potential development:

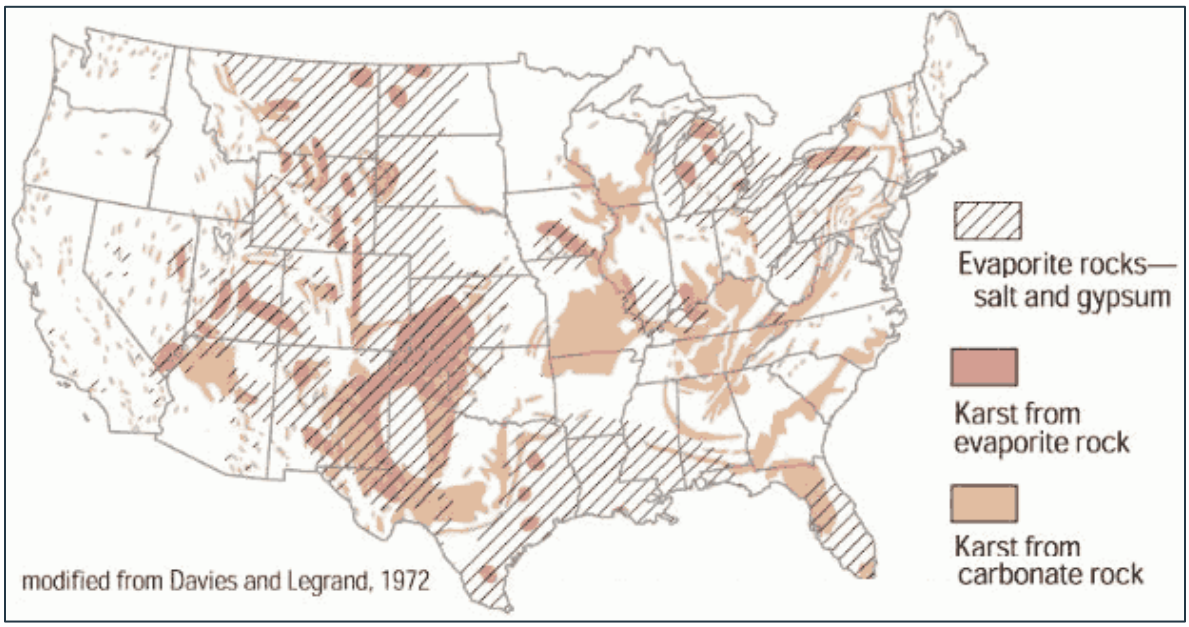
- Slumping or falling fenceposts, trees, or foundations;
- Sudden formation of small ponds;
- Wilting vegetation;
- Discolored well water; and/or
- Structural cracks in walls, floors.

Sinkhole formation is aggravated and accelerated by urbanization. Development increases water usage, alters drainage pathways, overloads the ground surface, and redistributes soil. According to FEMA, the number of human-induced sinkholes has doubled since 1930, insurance claims for damages as a result of sinkholes has increased 1,200 percent from 1987 to 1991, costing nearly $100 million.

Warning Time: 4 – Less than six hours

Duration: 1 – Less than six hours

Figure 4.21 – Rock Formations in the United States



Location

Existing soil types in Mecklenburg County are not conducive to the formation of natural sinkholes. Instead, sinkhole risk is tied to stormwater system failures. There is a higher potential for soil piping and/or erosion caused by leakage from drainage pipes, collapsed water mains or sewer lines, failed culverts and the effects of other human infrastructure activity. In Mecklenburg County, sinkholes typically occur in roadways or yards along infrastructure lines; occasionally these events impact buildings.

Extent

Sinkholes are relatively unpredictable, causing greater impacts when they do occur. The extent of sinkhole activity is measured in terms of the dimensions of the sinkhole. They can range dramatically in size, from a few feet wide to hundreds of acres wide and from less than 1 foot to more than 100 feet deep. The largest known sinkhole in the region was 45 feet deep recorded in Catawba County in 2002. This sinkhole was caused by a drainpipe failure. Sinkholes can also vary in shape. Some are shaped like shallow bowls or saucers while others have vertical walls. In North Carolina, sinkholes sometimes hold water and form natural ponds. There is no formal scale for measuring the extent of sinkholes.

Sinkholes can have dramatic effects if they occur in urban settings, particularly when infrastructure, such as roads, or buildings are on top of the cavity, causing catastrophic damage. They can also contaminate water resources and have been known to swallow up vehicles, swimming pools, parts of roadways, and even buildings.

In some cases in North Carolina, sinkholes have measured up to 20 to 25 feet in depth with similar widths.

Impact: 2 – Limited

Spatial Extent: 1 – Negligible

Historical Occurrences

Mecklenburg County has experienced minor sinkhole activity in the past; however, while minor sinkholes are a regular occurrence, significant events causing any reported property damages are uncommon. In June 2003, several large sinkholes accompanied a flash flood in Charlotte, per NCEI records. Per the 2015 Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan, the most recent significant incident was reported in June 2009 when heavy rain formed a sinkhole around an existing drainage pipe underneath Sam Drenan Road. The corrugated metal pipe was originally installed in 1961 which corroded and the entire road was washed out. The failure caused Sam Drenan Road to be closed to vehicular and pedestrian access for several months. No private property damages occurred, but this event resulted in approximately $800,000 in repair costs to replace the roadway crossing. According to the county engineer, sinkholes of that magnitude are very uncommon. However, many pipes underneath the ground could form cracks due to age and over time leaks could erode the dirt and soil around it.

Probability of Future Occurrence

Sinkholes relating to stormwater infrastructure failure remain a possible occurrence in localized areas of Mecklenburg County. This is particularly the case in areas of the county with older water and sewer lines that are prone to possible leakage or collapse. Probability of sinkhole occurrence is linked to infrastructure age and maintenance. Charlotte-Mecklenburg Utility crews continuously examine underground pipes for problems and spend approximately $15 million each year to maintain and repair water and sewer lines. Impacts from such events would likely cause minimal localized damage, though potentially significant service interruptions caused by infrastructure damage and road closures.

Probability: 1 – Unlikely

Climate Change

Direct effects from global warming and climate change such as an increase in droughts, floods and hurricanes could contribute to an increase in sinkholes. Climate change raises the likelihood of extreme weather, meaning the torrential rain and flooding conditions that often lead to the exposure of sinkholes are likely to become increasingly common. Certain events such as a hurricane following a period of drought can trigger a sinkhole due to low levels of groundwater combined with a heavy influx of rain. As discussed in Sections 4.5.2 Drought, 4.5.5 Flood, and 4.5.6 Hurricane, potential increases in these contributing events are possible. Therefore, an increase in the occurrence of sinkholes in the future is possible.

Vulnerability Assessment

People

A person's vulnerability is directly related to the speed in which the sinkhole opens and the person being above the sinkhole. Records exist for deaths associated with sinkholes opening beneath homes while occupants were present or from motor vehicle deaths when drivers could not avoid driving into the sinkhole before protective barriers were in place.

Property

Similar to people, property's vulnerability to a sinkhole is dependent on a variety of factors including the speed at which the sinkhole develops. Property above a large sinkhole that suddenly collapses can suffer catastrophic damages ranging from cracked foundations to damaged roadways and totaled vehicles.

Environment

Sinkholes are unlikely to cause substantial impacts to the natural environment. Natural areas that are damaged will recover quickly.

Consequence Analysis

Table 4.71 summarizes the potential negative consequences of sinkhole.

Table 4.71 - Consequence Analysis – Sinkhole

Category	Consequences
Public	Impacts are expected to be minimal to the larger population. Impacts for those effected could cause anxiety or depression about economic and property losses and personal injury.
Responders	First responders will be impacted similarly to other events that have advance warning.
Continuity of Operations (including Continued Delivery of Services)	Continuity of operations is generally not disrupted by sinkholes.
Property, Facilities and Infrastructure	Although sinkhole extents are localized, buildings located on or adjacent to a sinkhole are susceptible to foundation damage or building collapse. If the building is located close enough to the sinkhole it can be completely destroyed or in worst cases, completely collapse into the sinkhole. Remediation costs can be high due to costly foundation shoring or cost of stabilization of the sinkhole itself.
Environment	Sinkholes are natural occurring process and local plants and animals adjust quickly. Many naturally occurring sinkholes fill with rainwater creating new aquatic habitat.
Economic Condition of the Jurisdiction	Sinkholes located in open areas or that impact only small numbers of buildings, while having a high impact to the local property owner, do not have substantial impacts to the economy. Sinkholes that open up in major traffic thoroughfares can include significant impact to daily work traffic and flow of goods.
Public Confidence in the Jurisdiction's Governance	Sinkholes are relatively unpredictable, however if a sinkhole occurs after a recent inspection and causes harm to people or property, the public may lose confidence in the jurisdiction's ability to manage a future sinkhole event.

Hazard Summary by Jurisdiction

The following table summarizes sinkhole hazard risk by jurisdiction. Sinkhole hazard risk does not vary substantially by jurisdiction.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score	Priority
Charlotte	2	1	1	4	1	1.6	L
Cornelius	2	1	1	4	1	1.6	L
Davidson	2	1	1	4	1	1.6	L
Huntersville	2	1	1	4	1	1.6	L
Matthews	2	1	1	4	1	1.6	L
Mint Hill	2	1	1	4	1	1.6	L
Pineville	2	1	1	4	1	1.6	L
Mecklenburg County	2	1	1	4	1	1.6	L

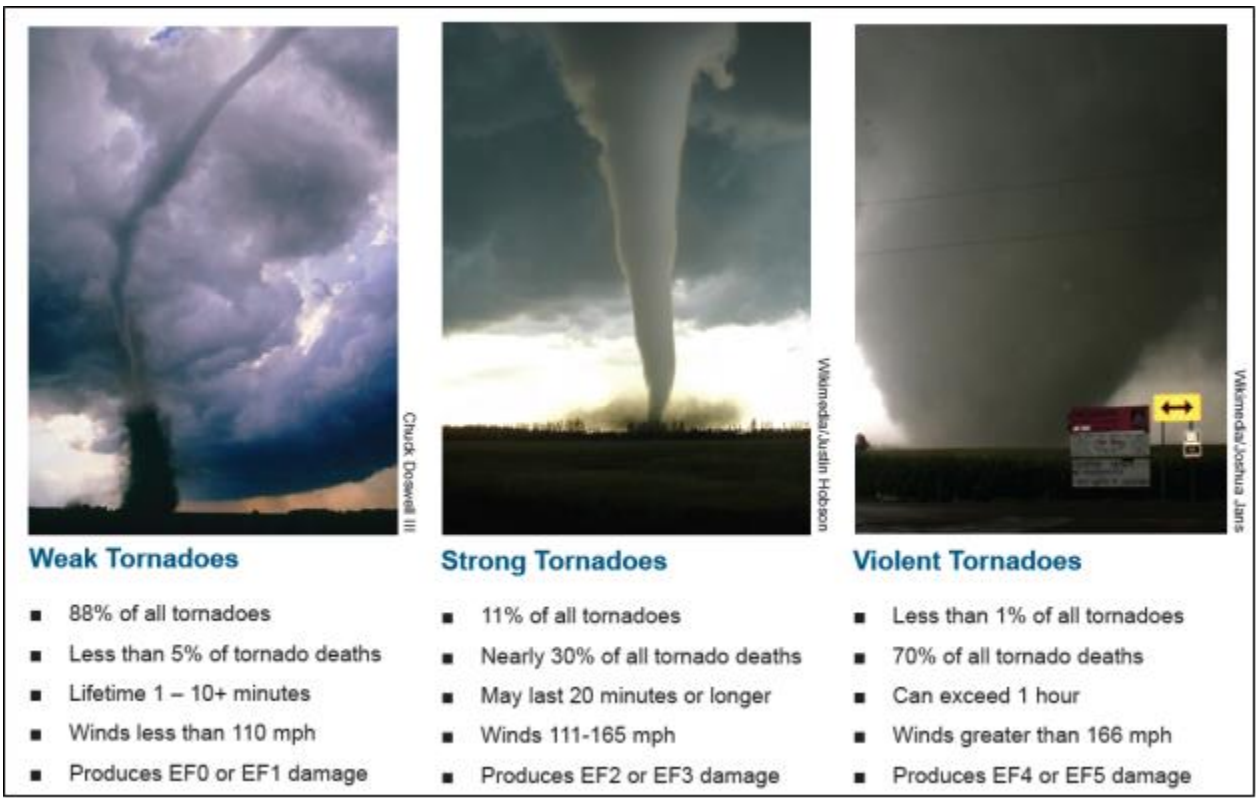
4.5.11 Tornado

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.



Source: NOAA National Weather Service

Warning Time: 4 – less than six hours

Duration: 1 – less than six hours

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 4.22 – Tornado Activity in the U.S.

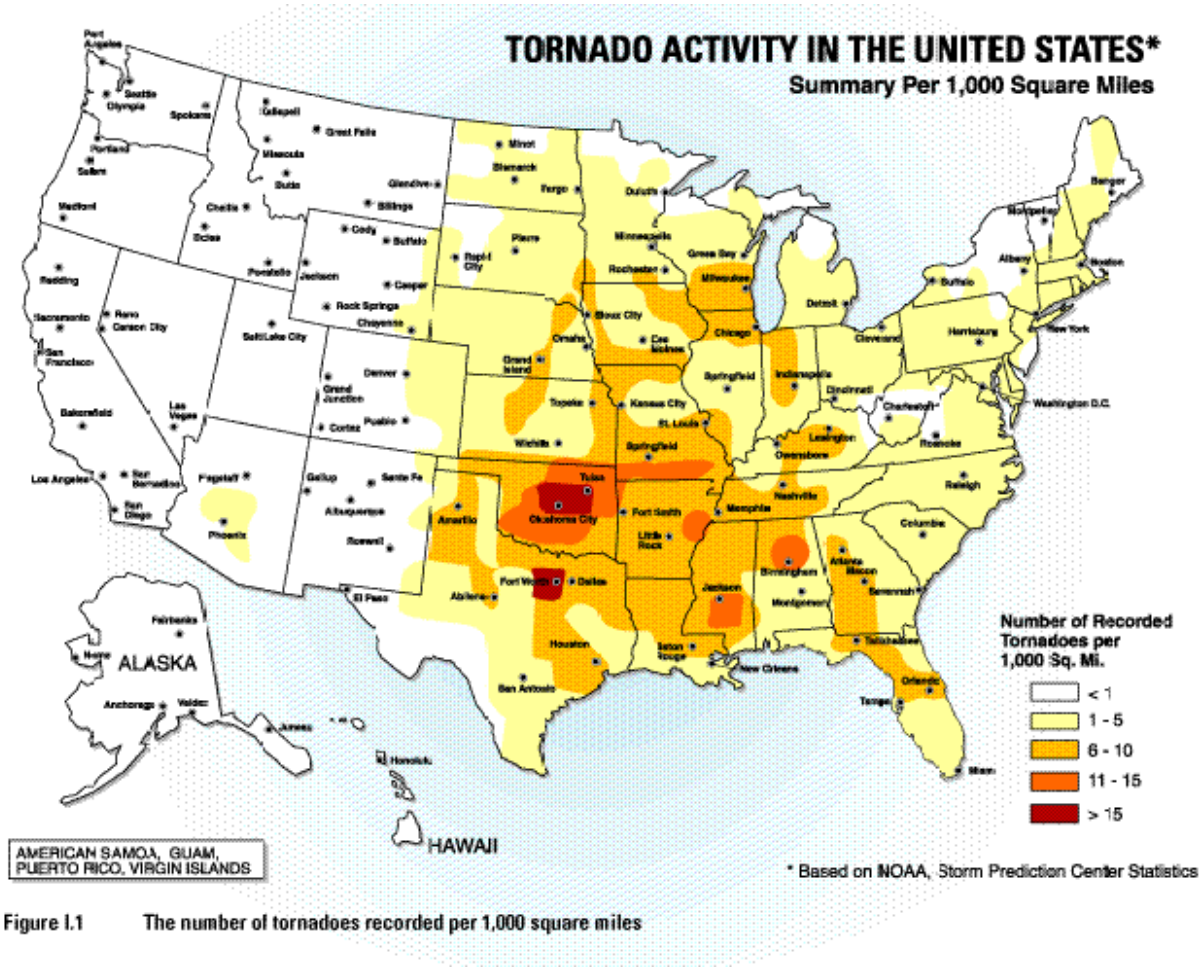


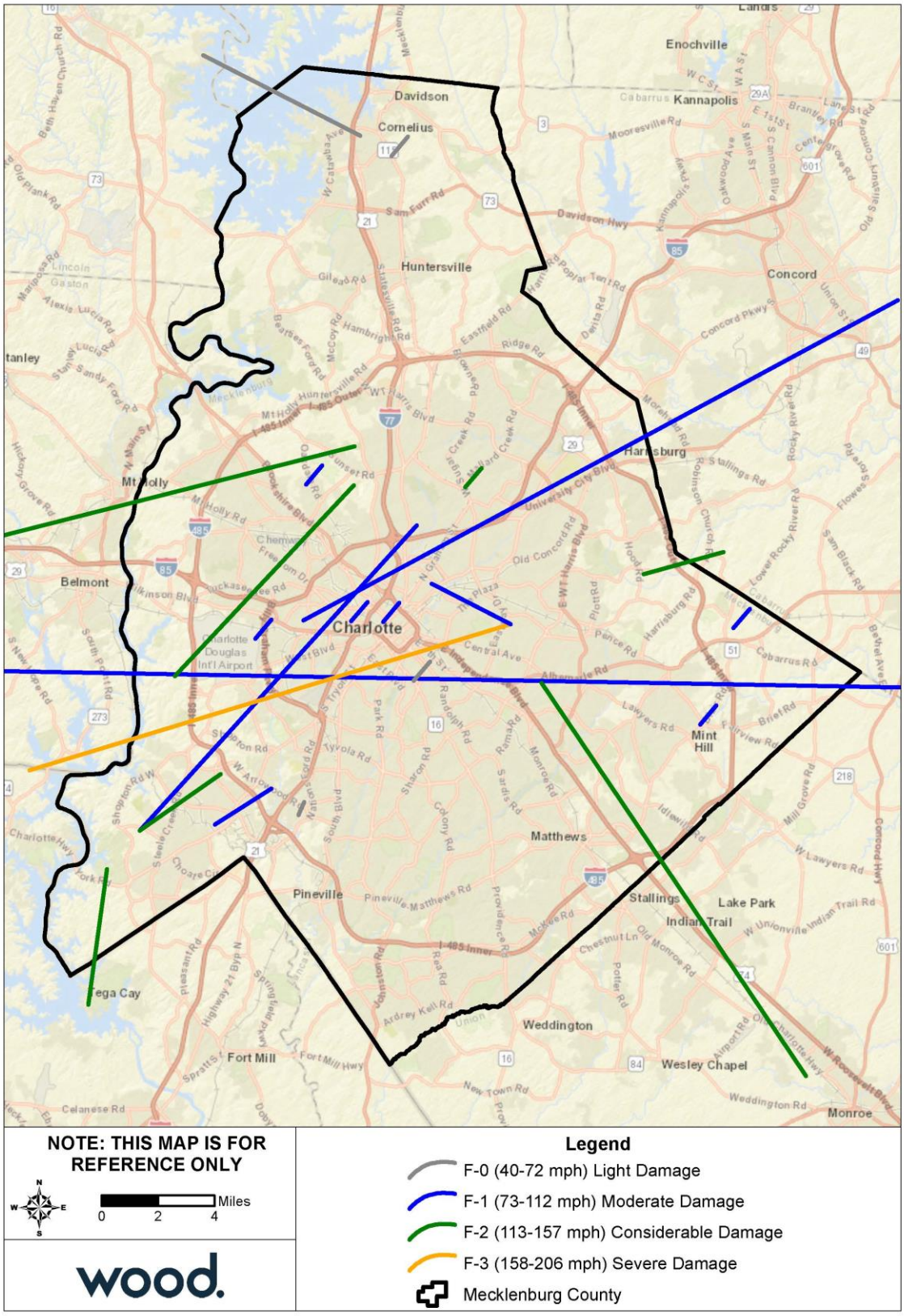
Figure I.1 The number of tornadoes recorded per 1,000 square miles

Source: American Society of Civil Engineers

Location

Figure 4.23 reflects the tracks of past tornados that passed through Mecklenburg County from 1950 through 2017 according to data from the NOAA/National Weather Service Storm Prediction Center.

Figure 4.23 – Tornado Paths Through Mecklenburg County, 1950-2017



Source: NOAA/NWS Storm Prediction Center

Tornados can occur anywhere in the County. 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 Mecklenburg County 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 4.72 shows the wind speeds associated with the enhanced Fujita scale ratings and the damage that could result at different levels of intensity.

Table 4.72 – Enhanced Fujita Scale

EF Number	3 Second Gust (mph)	Damage
0	65-85	**Light damage.** Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
1	96-110	**Moderate damage.** Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
2	111-135	**Considerable damage.** 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	**Severe damage.** 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	**Devastating damage.** Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
5	Over 200	**Incredible damage.** 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.

Historically, the highest rated tornadoes to pass through Mecklenburg County were rated F2; F2 tornadoes were recorded in 1965, 1968, 1973, 1992 and 2004, causing a combined $2.95 million in property damage; an F2 tornado in March 1992 caused 18 injuries and $2.5 million in property damage.

Impact: 3 – Critical

Spatial Extent: 2 – Small

Historical Occurrences

NCEI storm reports were reviewed from 1989 through 2018 to assess whether recent trends varied from the longer historical record. According to NCEI, Mecklenburg County experienced 11 tornado incidents between 1989 and 2018, causing no fatalities, 22 injuries, almost $4.4 million in property damage and no crop damage. Table 4.72 shows historical tornadoes in Mecklenburg County during this time period.

Table 4.73 – Recorded Tornadoes in Mecklenburg County, 1989-2018

Location	Date	Time	Magnitude	Deaths	Injuries	Property Damage
Mecklenburg County	11/28/1990	1940	F1	0	0	$25,000
Mecklenburg County	3/10/1992	2107	F2	0	18	$2,500,000
Mint Hill	3/20/1998	1442	F0	0	0	$0
Cornelius	5/7/1998	1845	F0	0	0	$50,000
Pineville	8/1/1999	1935	F0	0	0	$0
Charlotte	9/7/2004	1045	F2	0	0	$150,000
Charlotte	3/8/2005	740	F1	0	0	$50,000
Paw Creek	5/9/2008	123	EF1	0	0	$0
Wilgrove	3/3/2012	235	EF2	0	4	$1,500,000
Charlotte	5/15/2014	546	EF0	0	0	$10,000
Shopton	11/30/2016	1826	EF1	0	0	$100,000
Total				**0**	**22**	**$4,385,000**

Source: NCEI

Specific incidents with some level of impact include:

March 10, 1992 – A tornado touched down in the waters of the Steele Creek subdivision about 12 miles southwest of downtown Charlotte. It moved east-northeast on the ground for almost 3.5 miles, damaging or destroying approximately 40 houses. A 65-year-old man in one of the damaged houses died of a heart attack shortly after the storm, and another 18 people were injured. Damage estimates totaled over $2 million.

March 3, 2012 – A NWS Storm Survey found the path of a strong tornado that developed rapidly over eastern portions of the Charlotte metro area during the early morning hours of March 3rd. The tornado touched down near the intersection of Dulin Creek Rd and Little Whiteoak Rd, moving just south of Plaza Rd extension. The tornado affected two subdivisions in Mecklenburg County. Four homes slid off their foundations and were completely destroyed. Twenty-nine homes were rendered uninhabitable from collapsed exterior walls. A total of 162 homes were damaged in the county. Four people were injured in this area. The tornado crossed I-485, just south of Plaza Rd Extension before moving into Cabarrus County. The total path length in Mecklenburg County was a little over 1.5 miles, while the maximum width was 200 yards. $1.5 million in property damages were recorded for this storm.

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 thirty-year span between 1988 and 2017, Mecklenburg County experienced 11 separate tornado incidents. This correlates to a 36.67 percent annual probability that the county will experience a tornado somewhere in its boundaries in any given year.

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

People and populations exposed to the elements are most vulnerable to tornadoes. 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), 5,555 housing units (1.6%) in Mecklenburg County are classified as "mobile homes." Based on an estimated average of 2.57 persons per household from the 2017 ACS, there are approximately 14,276 people in Mecklenburg County living in mobile homes.

Since 1950, the NCEI records no fatalities and 23 injuries attributed to tornadoes in Mecklenburg County; these fatalities and injuries were the result of tornadoes rated as low as F1, illustrating the destructive power of tornadoes and the dangers they pose to exposed populations without proper shelter.

Property

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 over $5.5 million worth of damage to property, and no reported damage to crops, according to NCEI data.

Table 4.74 through Table 4.78 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 county.

Table 4.74 – 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
Unincorporated Mecklenburg County	24,114	22,506	93.3%	$212,201,981	1,228	5.1%	$103,361,676	377	1.6%	$12,572,139	24,111	100%	$328,135,795
Charlotte	246,117	228,383	92.8%	$2,422,828,753	14,831	6%	$1,401,402,786	2,897	1.2%	$174,748,827	246,111	100%	$3,998,980,366
Cornelius	10,558	9,841	93.2%	$137,876,648	630	6%	$30,745,991	87	0.8%	$5,385,539	10,558	100%	$174,008,178
Davidson	3,871	3,545	91.6%	$56,435,292	270	7%	$20,968,032	56	1.4%	$3,914,663	3,871	100%	$81,317,987
Huntersville	19,555	18,354	93.9%	$203,737,713	966	4.9%	$63,880,290	223	1.1%	$15,115,967	19,543	99.9%	$282,733,970
Matthews	10,030	9,222	91.9%	$98,884,035	675	6.7%	$43,711,164	133	1.3%	$11,353,964	10,030	100%	$153,949,163
Mint Hill	9,883	9,370	94.8%	$94,112,318	419	4.2%	$14,709,059	94	1%	$4,827,170	9,883	100%	$113,648,547
Pineville	2,731	2,037	74.6%	$23,246,191	552	20.2%	$37,849,384	142	5.2%	$1,594,248	2,731	100%	$62,689,822
Total	**326,859**	**303,258**	**92.8%**	**$3,249,322,931**	**19,571**	**6%**	**$1,716,628,382**	**4,009**	**1.2%**	**$229,512,517**	**326,838**	**100%**	**$5,195,463,828**

Source: NCEM Risk Management Tool

Table 4.75 – 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
Unincorporated Mecklenburg County	24,114	22,506	93.3%	$1,548,928,741	1,228	5.1%	$672,539,498	377	1.6%	$70,821,147	24,111	100%	$2,292,289,386
Charlotte	246,117	228,383	92.8%	$17,232,610,194	14,831	6%	$9,081,402,080	2,897	1.2%	$999,092,216	246,111	100%	$27,313,104,490
Cornelius	10,558	9,841	93.2%	$991,662,021	630	6%	$195,876,903	87	0.8%	$29,667,229	10,558	100%	$1,217,206,154
Davidson	3,871	3,545	91.6%	$408,131,536	270	7%	$126,216,683	56	1.4%	$23,092,295	3,871	100%	$557,440,514
Huntersville	19,555	18,354	93.9%	$1,489,353,152	966	4.9%	$425,699,782	223	1.1%	$81,895,613	19,543	99.9%	$1,996,948,547
Matthews	10,030	9,222	91.9%	$719,602,309	675	6.7%	$272,054,083	133	1.3%	$59,240,548	10,030	100%	$1,050,896,940
Mint Hill	9,883	9,370	94.8%	$690,971,165	419	4.2%	$93,458,537	94	1%	$24,445,968	9,883	100%	$808,875,670
Pineville	2,731	2,037	74.6%	$158,181,364	552	20.2%	$240,939,791	142	5.2%	$11,085,695	2,731	100%	$410,206,850
Total	**326,859**	**303,258**	**92.8%**	**$23,239,440,482**	**19,571**	**6%**	**$11,108,187,357**	**4,009**	**1.2%**	**$1,299,340,711**	**326,838**	**100%**	**$35,646,968,551**

Source: NCEM Risk Management Tool

Table 4.76 – 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
Unincorporated Mecklenburg County	24,114	22,506	93.3%	$2,953,696,565	1,228	5.1%	$1,421,353,325	377	1.6%	$224,748,646	24,111	100%	$4,599,798,536
Charlotte	246,117	228,383	92.8%	$35,304,276,280	14,831	6%	$20,866,908,890	2,897	1.2%	$3,192,314,139	246,111	100%	$59,363,499,309
Cornelius	10,558	9,841	93.2%	$1,988,214,902	630	6%	$461,011,993	87	0.8%	$93,156,388	10,558	100%	$2,542,383,284
Davidson	3,871	3,545	91.6%	$807,844,283	270	7%	$277,663,584	56	1.4%	$74,820,576	3,871	100%	$1,160,328,443
Huntersville	19,555	18,354	93.9%	$2,872,839,560	966	4.9%	$984,012,877	223	1.1%	$255,079,139	19,543	99.9%	$4,111,931,576
Matthews	10,030	9,222	91.9%	$1,407,815,471	675	6.7%	$670,093,261	133	1.3%	$181,021,070	10,030	100%	$2,258,929,802
Mint Hill	9,883	9,370	94.8%	$1,323,310,948	419	4.2%	$216,993,124	94	1%	$73,517,646	9,883	100%	$1,613,821,719
Pineville	2,731	2,037	74.6%	$353,903,518	552	20.2%	$608,206,400	142	5.2%	$38,292,363	2,731	100%	$1,000,402,282
Total	**326,859**	**303,258**	**92.8%**	**$47,011,901,527**	**19,571**	**6%**	**$25,506,243,454**	**4,009**	**1.2%**	**$4,132,949,967**	**326,838**	**100%**	**$76,651,094,951**

Source: NCEM Risk Management Tool

Table 4.77 – 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
Unincorporated Mecklenburg County	24,114	22,506	93.3%	$3,564,669,379	1,228	5.1%	$1,753,911,140	377	1.6%	$350,439,352	24,111	100%	$5,669,019,870
Charlotte	246,117	228,383	92.8%	$47,887,910,260	14,831	6%	$26,746,362,205	2,897	1.2%	$4,983,169,992	246,111	100%	$79,617,442,457
Cornelius	10,558	9,841	93.2%	$2,593,875,424	630	6%	$588,308,855	87	0.8%	$145,000,777	10,558	100%	$3,327,185,055
Davidson	3,871	3,545	91.6%	$1,030,819,096	270	7%	$381,557,436	56	1.4%	$117,057,027	3,871	100%	$1,529,433,560
Huntersville	19,555	18,354	93.9%	$3,497,988,503	966	4.9%	$1,261,579,500	223	1.1%	$396,502,208	19,543	99.9%	$5,156,070,210
Matthews	10,030	9,222	91.9%	$1,754,694,207	675	6.7%	$878,633,139	133	1.3%	$280,474,405	10,030	100%	$2,913,801,751
Mint Hill	9,883	9,370	94.8%	$1,584,874,300	419	4.2%	$281,151,912	94	1%	$113,594,763	9,883	100%	$1,979,620,975
Pineville	2,731	2,037	74.6%	$548,873,678	552	20.2%	$787,632,884	142	5.2%	$60,502,682	2,731	100%	$1,397,009,243
Total	**326,859**	**303,258**	**92.8%**	**$62,463,704,847**	**19,571**	**6%**	**$32,679,137,071**	**4,009**	**1.2%**	**$6,446,741,206**	**326,838**	**100%**	**$101,589,583,121**

Source: NCEM Risk Management Tool

Table 4.78 – 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
Unincorporated Mecklenburg County	24,114	22,506	93.3%	$3,593,536,886	1,228	5.1%	$1,807,185,575	377	1.6%	$375,862,133	24,111	100%	$5,776,584,594
Charlotte	246,117	228,383	92.8%	$49,446,883,139	14,831	6%	$27,604,071,524	2,897	1.2%	$5,334,370,281	246,111	100%	$82,385,324,944
Cornelius	10,558	9,841	93.2%	$2,657,408,752	630	6%	$613,043,536	87	0.8%	$155,990,229	10,558	100%	$3,426,442,518
Davidson	3,871	3,545	91.6%	$1,051,258,192	270	7%	$395,985,006	56	1.4%	$124,819,518	3,871	100%	$1,572,062,716
Huntersville	19,555	18,354	93.9%	$3,531,683,117	966	4.9%	$1,307,351,108	223	1.1%	$427,549,873	19,543	99.9%	$5,266,584,099
Matthews	10,030	9,222	91.9%	$1,780,458,912	675	6.7%	$915,693,311	133	1.3%	$304,130,701	10,030	100%	$3,000,282,923
Mint Hill	9,883	9,370	94.8%	$1,594,101,079	419	4.2%	$291,557,689	94	1%	$123,761,617	9,883	100%	$2,009,420,385
Pineville	2,731	2,037	74.6%	$580,650,008	552	20.2%	$822,007,680	142	5.2%	$63,415,696	2,731	100%	$1,466,073,385
Total	**326,859**	**303,258**	**92.8%**	**$64,235,980,085**	**19,571**	**6%**	**$33,756,895,429**	**4,009**	**1.2%**	**$6,909,900,048**	**326,838**	**100%**	**$104,902,775,564**

Source: NCEM Risk Management Tool

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 4.79 summarizes the potential negative consequences of tornado.

Table 4.79 – 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	PRI Score	Priority
Charlotte	3	3	2	4	1	2.7	H
Cornelius	3	3	2	4	1	2.7	H
Davidson	3	3	2	4	1	2.7	H
Huntersville	3	3	2	4	1	2.7	H
Matthews	3	3	2	4	1	2.7	H
Mint Hill	3	3	2	4	1	2.7	H
Pineville	3	3	2	4	1	2.7	H
Mecklenburg County	3	3	2	4	1	2.7	H

4.5.12 Wildfire

Hazard Background

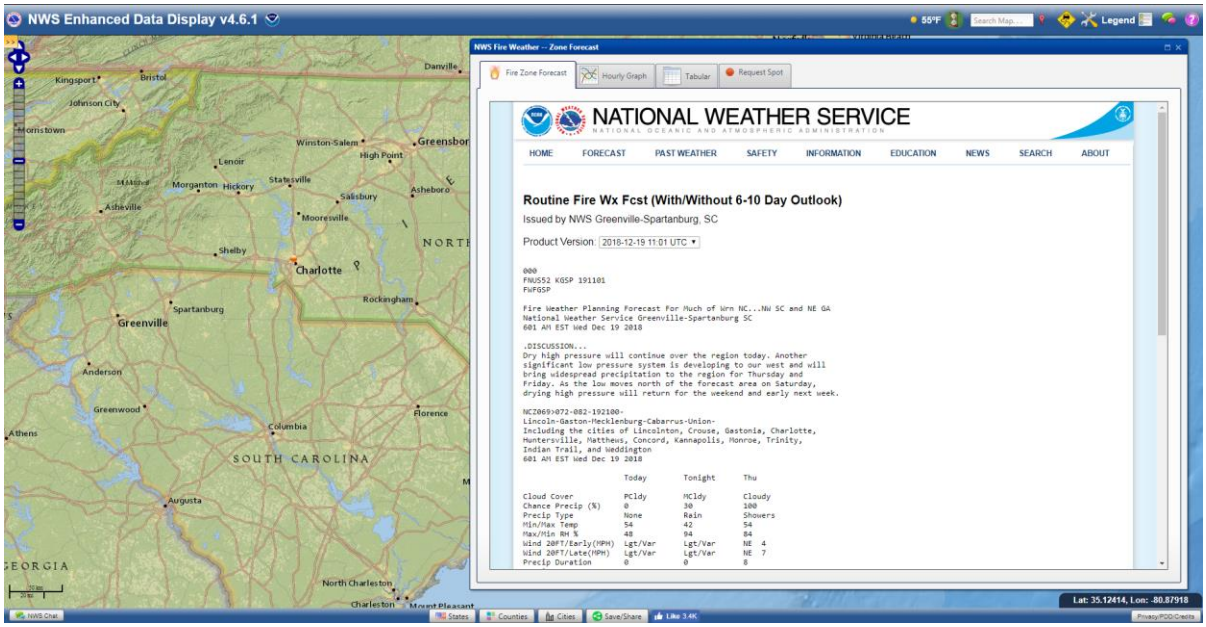
A wildfire is an uncontained fire that spreads through the environment. Wildfires have the ability to consume large areas, including infrastructure, property, and resources. When massive fires, or conflagrations, develop near populated areas, evacuations possibly ensue. Not only do the flames impact 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 4.24, the National Weather Service Greenville-Spartanburg Forecast Office provides year-round fire weather forecasts for Mecklenburg County.

Figure 4.24 – Fire Weather Forecast, Mecklenburg County



Source: National Weather Service

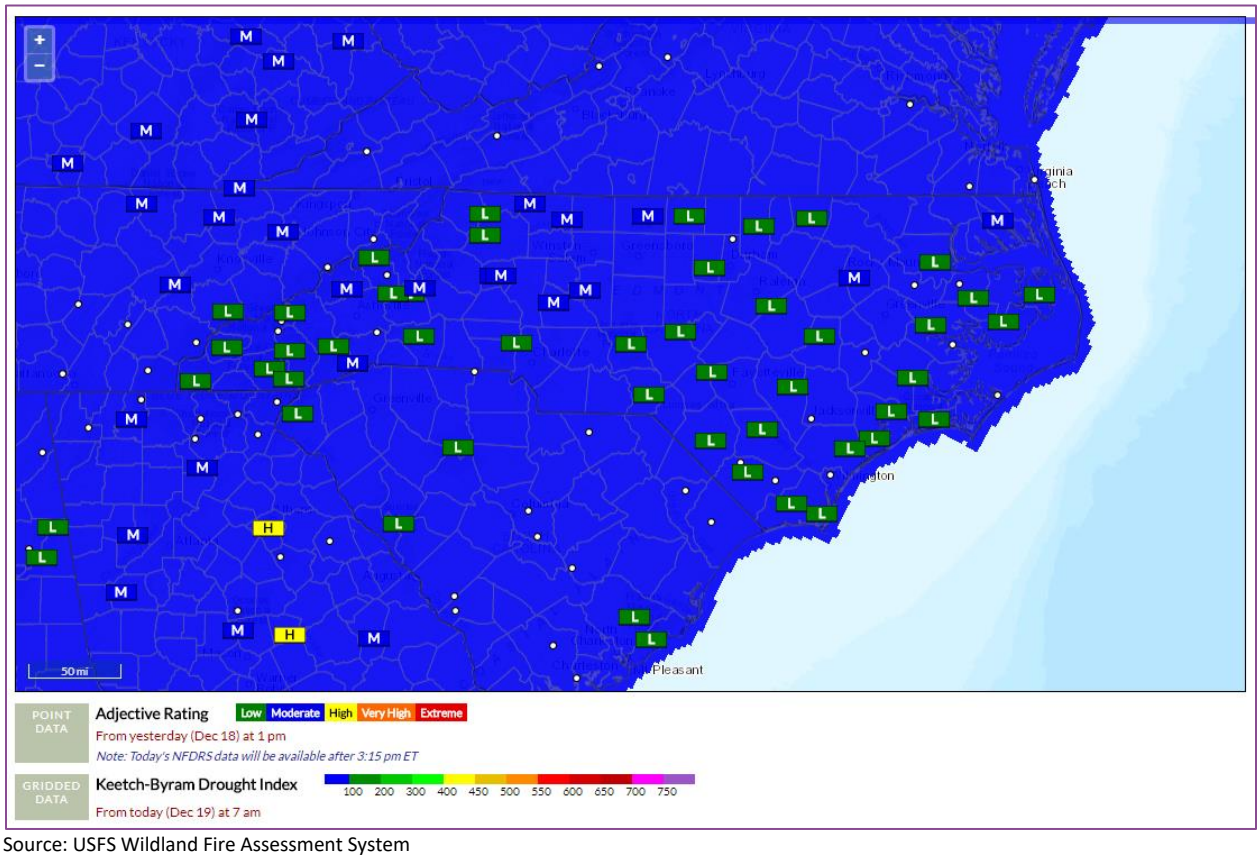
Weather conditions favorable to wildfire include drought, which increases flammability of surface fuels, and winds, which aid a wildfire's progress. The combination of wind, temperature, and humidity affects how fast wildland fires can spread. Rapid response can contain wildfires and limit their threat to property.

Mecklenburg County experiences a variety of wildfire conditions found in the Keetch-Byram Drought Index, which is described in Table 4.80. The Keetch-Byram Drought Index (KBDI) for December 19, 2018 is shown in Figure 4.25 along with a Daily Fire Danger Estimate Adjective Rating for certain points across the state. The KBDI for Mecklenburg County at this time was below 100, and the Fire Danger Estimate for the nearby area was "Low."

Table 4.80 – 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 sports 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 4.25 – Keetch-Byram Drought Index, December 2018



Source: USFS Wildland Fire Assessment System

Warning Time: 4 – Less than six hours

Duration: 3 – Less than one week

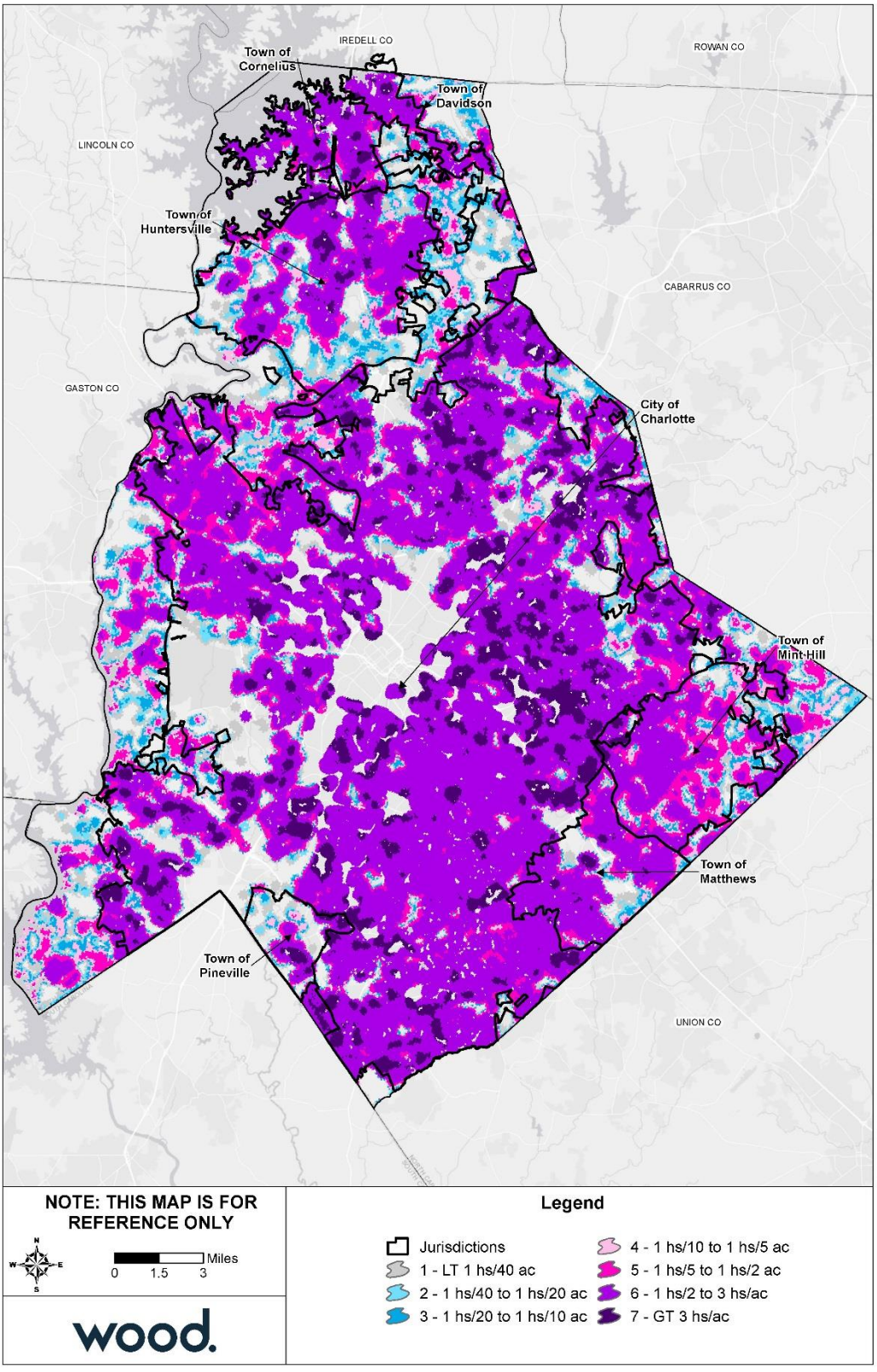
Location

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 over 90 percent of the Mecklenburg County 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 4.81 details the extent of the WUI in Mecklenburg County, and Figure 4.26 maps the WUI.

Table 4.81 – Wildland Urban Interface, Population and Acres

	Housing Density	WUI Population	Percent of WUI Population	WUI Acres	Percent of WUI Acres
	LT 1hs/40ac	313	0.0 %	17,117	6.1 %
	1hs/40ac to 1hs/20ac	516	0.1 %	11,507	4.1 %
	1hs/20ac to 1hs/10ac	1,737	0.2 %	17,150	6.1 %
	1hs/10ac to 1hs/5ac	4,446	0.5 %	20,821	7.4 %
	1hs/5ac to 1hs/2ac	18,614	2.2 %	35,939	12.9 %
	1hs/2ac to 3hs/1ac	517,023	62.1 %	149,913	53.6 %
	GT 3hs/1ac	290,182	34.8 %	27,159	9.7 %
	Total	**832,831**	**100.0 %**	**279,606**	**100.0 %**

Figure 4.26 – Wildland Urban Interface, Mecklenburg County



Source: Southern Wildfire Risk Assessment

Extent

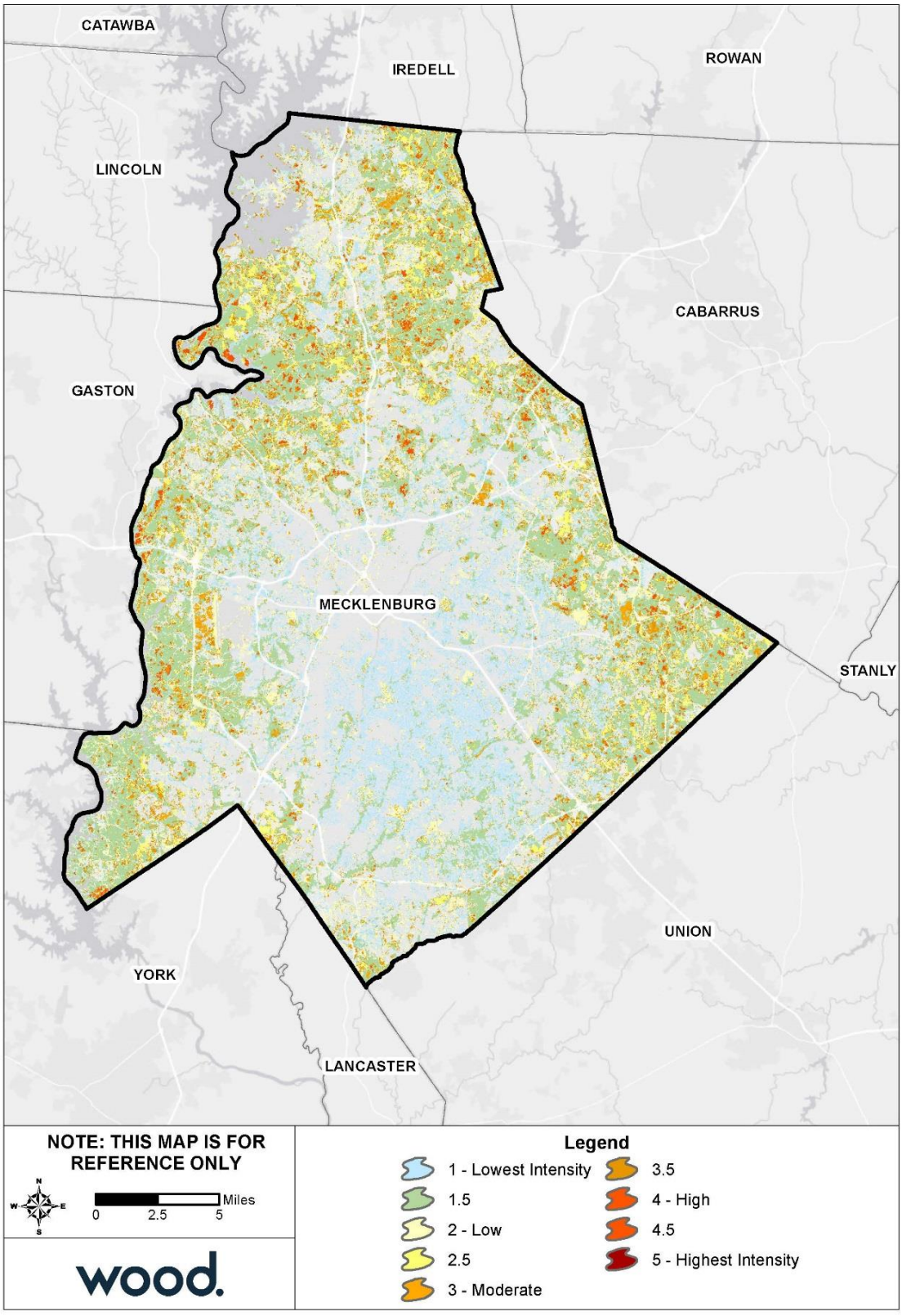
Wildfire extent can be defined by the fire's intensity and measured by the Characteristic Fire Intensity Scale, which identifies areas where significant fuel hazards which could produce dangerous fires exist. Fire Intensity ratings identify where significant fuel hazards and dangerous fire behavior potential 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 4.27 shows the potential fire intensity within the WUI across Mecklenburg County. Detailed maps of fire intensity by jurisdiction are provided in each community's annex.

Table 4.82 – Fire Intensity Scale

Class	Description
1, Very Low	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.
2, Low	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.
3, Moderate	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.
4, High	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.
5, Very High	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 4.27 – Characteristic Fire Intensity, Mecklenburg County



Source: Southern Wildfire Risk Assessment

A small portion, approximately 1.1 percent, of Mecklenburg County may experience up to a Class 4 Fire Intensity, which poses significant harm or damage to life and property. Almost 4 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 (42%) or would face a Class 1 or Class 2 Fire Intensity, which are easily suppressed.

Impact: 1 – Minor

Spatial Extent: 2 – Small

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 4.83 lists past occurrences of wildfire in Mecklenburg County since 1999 as provided by the North Carolina Forest Service in July 2019. This data only accounts for occurrences within unincorporated Mecklenburg County, 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 4.83 – Records for Wildfire in Mecklenburg County, 1999-2018

Year	Number of Fires	Acreage Burned	Homes/Structures Protected	Value of Protected Homes/Structures
1999	133	69.9	n/a	n/a
2000	45	40.6	n/a	n/a
2001	47	94.4	n/a	n/a
2002	43	40.6	n/a	n/a
2003	17	6.9	n/a	n/a
2004	17	9.6	n/a	n/a
2005	13	8.1	n/a	n/a
2006	25	14.8	n/a	n/a
2007	59	61.5	n/a	n/a
2008	72	51.8	n/a	n/a
2009	49	17.0	88	$8,851,000
2010	49	26.1	43	$7,799,580
2011	62	37.8	200	$32,807,000
2012	50	23.9	62	$9,300,100
2013	26	9.8	10	$1,878,000
2014	25	8.2	33	$4,252,900
2015	20	8.6	17	$2,305,000
2016	33	8.0	17	$2,675,000
2017	21	8.6	4	$386,400
2018	13	25.0	8	$681,000
Total	**819**	**571.2**	**482**	**$70,935,980**

Source: NC Forest Service

On average, Mecklenburg County experiences 41 fires and 28.6 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

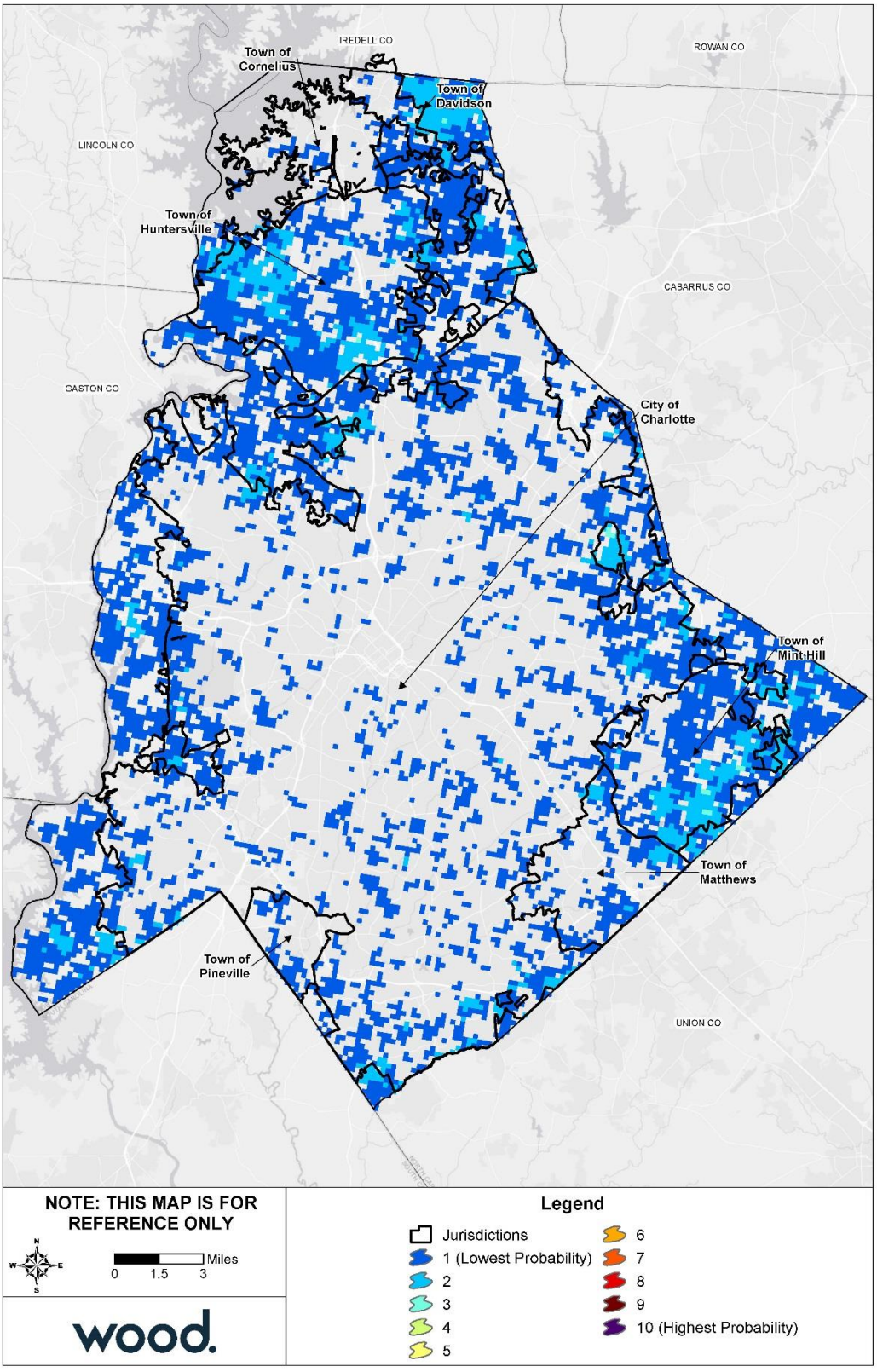
The Southern Wildfire Risk Assessment provides a Burn Probability analysis which predicts the probability of an area burning based on landscape conditions, weather, historical ignition patterns, and historical fire prevention and suppression efforts. Burn Probability data is generated by simulating fires 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 Mecklenburg County is presented in Table 4.84 and illustrated in Figure 4.28.

Table 4.84 – Burn Probability, Mecklenburg County

Class	Acres	Percent
1	109,435	85.2 %
2	18,735	14.6 %
3	234	0.2 %
4	0	0.0 %
5	0	0.0 %
6	0	0.0 %
7	0	0.0 %
8	0	0.0 %
9	0	0.0 %
10	0	0.0 %
Total	**128,404**	**100.0 %**

Source: Southern Wildfire Risk Assessment

Figure 4.28 – Burn Probability, Mecklenburg County



Source: Southern Wildfire Risk Assessment

All of Mecklenburg County has a relatively low burn probability, with the highest probabilities reaching a rating of 3 or less, and 85.2% of the county rated 1. The areas of moderate burn probability are located primarily in the northern portion of the county and around the county borders, away from urban Charlotte; specific areas more susceptible to fire include the unincorporated county, Davidson and Mint Hill. The probability of wildfire across the county 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

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.

Vulnerability Assessment

Methodologies and Assumptions

Population and property at risk to wildfire was estimated using data from the North Carolina Emergency Management (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 4.85 details the population estimated to be at risk to wildfire according to the NCEM IRISK database.

Table 4.85 – 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
Unincorporated Mecklenburg County	46,144	4,908	10.6%	4,070	433	10.6%	3,436	365	10.6%
Charlotte	735,550	26,426	3.6%	64,886	2,331	3.6%	54,768	1,968	3.6%
Cornelius	23,911	4,755	19.9%	2,109	419	19.9%	1,780	354	19.9%
Davidson	10,481	401	3.8%	935	36	3.9%	777	30	3.9%

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
Huntersville	46,538	8,275	17.8%	4,105	730	17.8%	3,465	616	17.8%
Matthews	27,087	4,880	18%	2,389	430	18%	2,017	363	18%
Mint Hill	22,719	7,625	33.6%	2,005	673	33.6%	1,691	568	33.6%
Pineville	7,420	948	12.8%	654	84	12.8%	552	71	12.9%
Total	**919,850**	**58,218**	**6.3%**	**81,153**	**5,136**	**6.3%**	**68,486**	**4,335**	**6.3%**

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.

The sectors facing the greatest risk to wildfire in Mecklenburg County are commercial facilities, transportation systems, government facilities, and critical manufacturing.

Table 4.86 details the buildings at risk to wildfire in Mecklenburg County, and Table 4.87 shows critical facilities exposed to wildfire by sector.

Table 4.86 – 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
Unincorporated Mecklenburg County	24,114	2,394	9.9%	$373,614,525	113	0.5%	$253,156,268	74	0.3%	$110,863,063	2,581	10.7%	$737,633,855
Charlotte	246,117	8,215	3.3%	$1,508,242,651	297	0.1%	$899,409,882	63	0%	$159,342,681	8,575	3.5%	$2,566,995,213
Cornelius	10,558	1,957	18.5%	$478,779,604	153	1.4%	$155,345,713	28	0.3%	$47,787,095	2,138	20.3%	$681,912,413
Davidson	3,871	136	3.5%	$39,664,085	13	0.3%	$11,759,223	3	0.1%	$13,832,902	152	3.9%	$65,256,210
Huntersville	19,555	3,264	16.7%	$640,838,450	208	1.1%	$343,100,015	51	0.3%	$182,654,114	3,523	18%	$1,166,592,578
Matthews	10,030	1,662	16.6%	$262,379,642	75	0.7%	$76,584,151	33	0.3%	$159,130,946	1,770	17.6%	$498,094,739
Mint Hill	9,883	3,144	31.8%	$514,830,062	174	1.8%	$131,056,357	44	0.4%	$54,495,793	3,362	34%	$700,382,212
Pineville	2,731	274	10%	$50,633,109	44	1.6%	$38,539,584	1	0%	$3,351,878	319	11.7%	$92,524,571
Total	**326,859**	**21,046**	**6.4%**	**$3,868,982,128**	**1,077**	**0.3%**	**$1,908,951,193**	**297**	**0.1%**	**$731,458,472**	**22,420**	**6.9%**	**$6,509,391,791**

Source: NCEM Risk Management Tool

Table 4.87 – Estimated Buildings Impacted by Wildfire by Sector

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	22	$16,449,941
Commercial Facilities	746	$1,128,199,821
Critical Manufacturing	188	$295,490,879
Energy	2	$35,490
Food and Agriculture	5	$117,133,851
Government Facilities	156	$487,403,658
Healthcare and Public Health	56	$100,439,315
Transportation Systems	201	$495,292,195
All Sectors	**1,376**	**$2,640,445,150**

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 4.88 summarizes the potential detrimental consequences of wildfire.

Table 4.88 – 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 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.

Category	Consequences
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. Wildfires can also have positive effects on local economies. Positive effects come from economic activity generated in the community during fire suppression and post-fire rebuilding. These may include forestry support work, such as building fire lines and performing other defenses, or providing firefighting teams with food, ice, and amenities such as temporary shelters and washing machines.
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: • The jurisdiction's actions taken pre-disaster to mitigate and prepare for impacts, including the amount of public education provided • The jurisdiction's efforts to provide warning to residents • The jurisdiction's actions taken to respond to the event • The jurisdiction's actions taken to recover from the impacts and return impacted communities to the same or better state before the wildfire occurred

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. Impact ratings were based on fire intensity data from SWRA; there are no clusters of significant fire intensity risk in any jurisdictions. Probability ratings were determined based on burn probability data from SWRA, which is low across all jurisdictions.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score	Priority
Charlotte	2	1	2	4	3	2.0	M
Cornelius	2	1	2	4	3	2.0	M
Davidson	2	1	2	4	3	2.0	M
Huntersville	2	1	2	4	3	2.0	M
Matthews	2	1	2	4	3	2.0	M
Mint Hill	2	1	2	4	3	2.0	M
Pineville	2	1	2	4	3	2.0	M
Mecklenburg County	2	1	2	4	3	2.0	M

4.5.13 Cyber Threat

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. One 2017 study found ransomware payments over a two-year period totaled more than $16 million. Even if a victim is perfectly prepared with full offline data backups, recovery from a sophisticated ransomware attack typically costs far more than the demanded ransom. However according to a 2016 study by Kaspersky Lab, roughly one in five ransomware victims who pay their attackers are still not able to retrieve their data.

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.

Cybercrime 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's 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 where computing devices are used. Incidents may involve a single location or multiple geographic areas. A disruption can have far-reaching

effects beyond the location of the targeted system; disruptions that occur far outside the state can still impact people, businesses, and institutions within Mecklenburg County.

Historical Occurrences

Mecklenburg County government was hit with a ransomware attack in December 2017 when an employee inadvertently opened a phishing email. Nearly 200 systems were infected, requiring several weeks to restore. Recovery costs were estimated at $10,000, less than the requested $25,000 ransom.

The City of Atlanta was also hit by a major ransomware attack in 2018, recovery from which wound up costing a reported $2.6M, significantly more than the $52,000 ransom demand. A similar attack against the city of Baltimore in 2019 affected the city government's email, voicemail, property tax portal, water bill and parking ticket payment systems, and delayed more than 1,000 pending home sales.

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 294,415 records. While none of those breaches were specifically targeted at systems in Mecklenburg County (the 2017 ransomware attack was not listed), some of them almost certainly included information on individuals who live in the county. Similarly, some county residents were almost certainly affected by national and international data breaches.

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: 1 – Minor

Spatial Extent: 2 – Small

Probability of Future Occurrence

Cyber-attacks occur daily, but most have negligible impacts at the county level. The possibility of a larger disruption affecting the county exists at all times, 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 commonplace occurrences, but are usually stopped with minimal impact. Similarly data breaches impacting the information of Mecklenburg County residents are almost certain to happen in coming years. Major attacks or breaches specifically targeting systems in the county are less likely, but cannot be ruled out.

Probability: 2 – Possible

Climate Change

Climate change is not expected to affect incidence of cyber-attacks.

Vulnerability Assessment

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.

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 are typically limited to computer systems.

Environment

The vast majority of cyber incidents have little to no environmental impact. 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 4.89 summarizes the potential consequences of a cyber-attack.

Table 4.89 – 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.

Category	Consequences
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.

Hazard Summary by Jurisdiction

The table below summarizes cyber threat risk by jurisdiction. Risk does not vary across the planning area.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score	Priority
Charlotte	2	1	2	4	4	2.5	H
Cornelius	2	1	2	4	4	2.5	H
Davidson	2	1	2	4	4	2.5	H
Huntersville	2	1	2	4	4	2.5	H
Matthews	2	1	2	4	4	2.5	H
Mint Hill	2	1	2	4	4	2.5	H
Pineville	2	1	2	4	4	2.5	H
Mecklenburg County	2	1	2	4	4	2.5	H

4.5.14 Hazardous Materials Incident

Hazard Background

Generally, a hazardous material is a substance or combination of substances which, because of quantity, concentration, or physical, chemical, or infectious characteristics, may either cause or significantly contribute to an increase in mortality or serious illness. Hazardous materials may also pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed. Hazardous material incidents can occur while a hazardous substance is stored at a fixed facility, or while the substance is being transported along a road corridor or railroad line or via an enclosed pipeline or other linear infrastructure.

The U.S. Department of Transportation (DOT), U.S. Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA) all have responsibilities relating to the transportation, storage, and use of hazardous materials and waste. The Right to Know Network (RTK NET), maintained by the EPA's National Response Center (NRC), is a primary source of information on the use and storage of hazardous materials, as well as data regarding spills and releases.

Hazardous materials are typically divided into the following classes:

- Explosives
- Compressed gases: flammable, non-flammable compressed, poisonous
- Flammable or combustible liquids
- Flammable solids: spontaneously combustible, dangerous when wet
- Oxidizers and organic peroxides
- Toxic materials: poisonous material, infectious agents
- Radioactive material
- Corrosive material: destruction of human skin, corrodes steel

It is common to see hazardous materials releases as escalating incidents resulting from other hazards such as floods, wildfires, and earthquakes that may cause containment systems to fail or affect transportation infrastructure. The release of hazardous materials can greatly complicate or even eclipse the response to the natural hazards disaster that caused the spill.

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. While these incidents can sometimes involve large quantities of materials, their locations can be more easily predicted and monitored.

Transportation Hazardous Materials Incident

A transportation hazardous materials incident is the accidental release of chemical substances or mixtures during transport. Transportation hazardous materials incidents 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 Score: 4 – Less than six hours

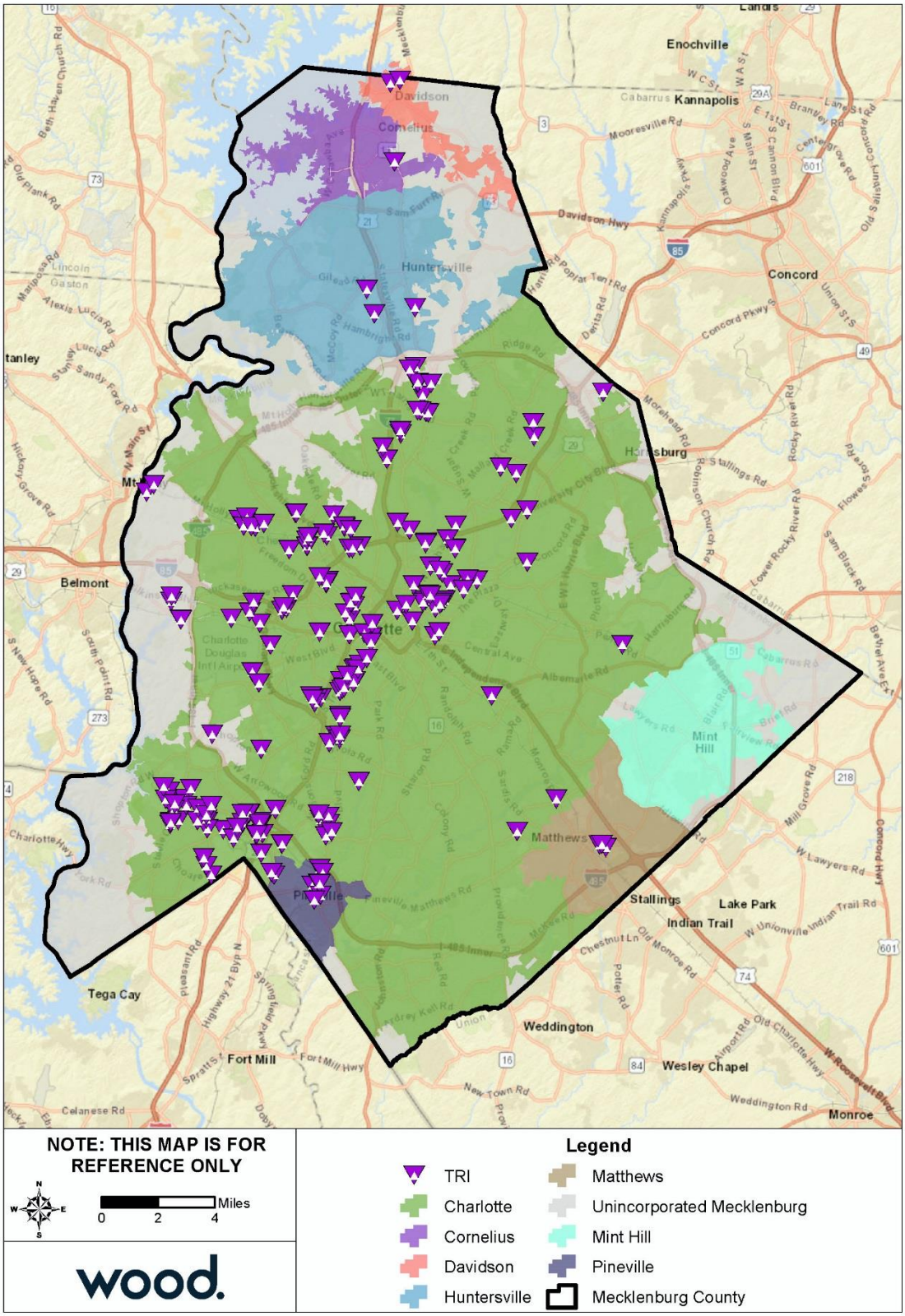
Duration Score: 2 – Less than 24 hours

Location

The Toxic 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 208 sites with hazardous materials in the county. These sites are shown in Figure 4.29.

The EPA requires facilities containing certain extremely hazardous substances to generate Risk Management Plans (RMPs) and resubmit these plans every five years. According to RTK NET, as of May 2019 there are currently 23 RMP facilities located in the planning area.

Figure 4.29 – Major Hazardous Materials Facilities in Mecklenburg County



Source: EPA Toxic Release Inventory

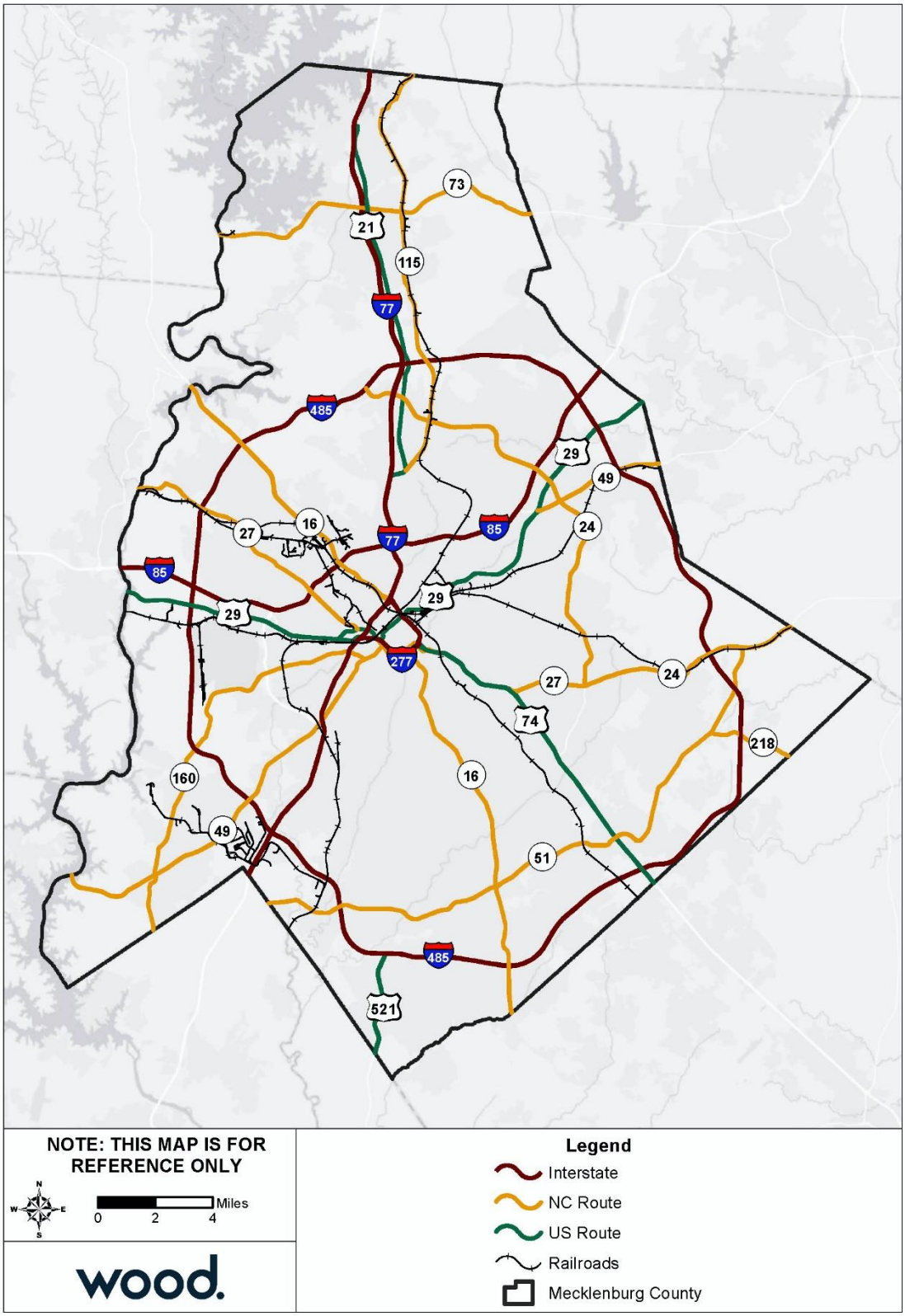
In transit, hazardous materials generally follow major transportation routes, including road, rail and pipelines, creating a risk area immediately adjacent to these routes. There are no designated or restricted hazardous materials routes in the planning area; all the area's roads have the potential for hazardous material incidents, particularly state and U.S. highways as shown in Figure 4.30.

Hazardous materials are also transported by railroad. Multiple freight and passenger rail lines through the county as shown in Figure 4.30. While railroad hazardous materials releases are less common than highway releases, the enormous quantities transported by rail greatly increases the potential extent of railroad incidents.

Lastly, many hazardous materials are transported through airports, to include Charlotte Douglas International Airport, as well as Wilgrove Air Park. In practice, most airplane crashes are categorized as hazardous materials incidents based solely on the amount of fuel involved.

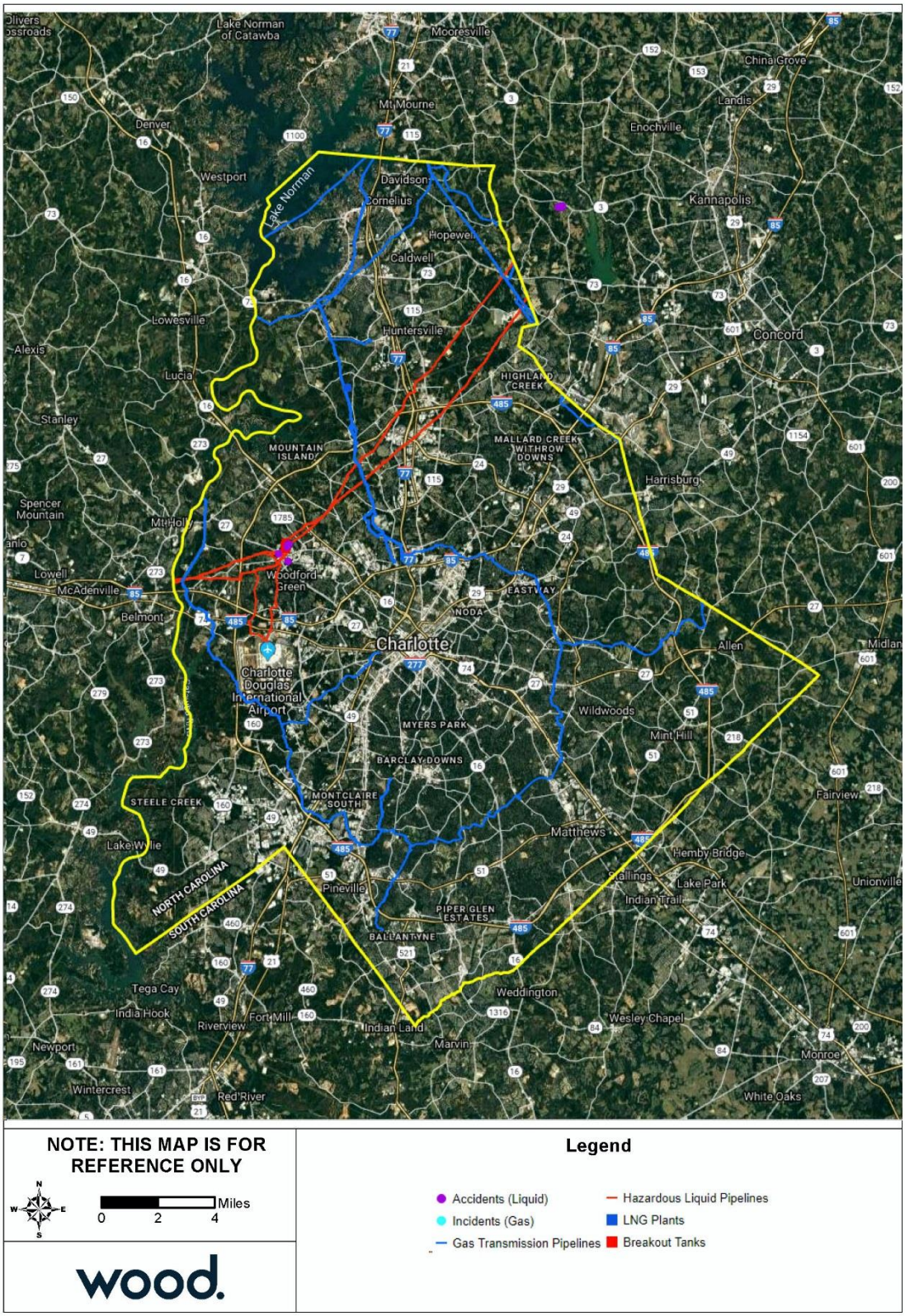
The U.S. Department of Transportation (USDOT) Pipeline and Hazardous Materials Safety Administration (PHMSA) maintains an inventory of the location of all gas transmission and hazardous liquid pipelines as well as liquid natural gas plants and hazardous liquid breakout tanks. The location of pipelines and pipeline infrastructure in the county are shown in Figure 4.31, as reported in the public viewer of the National Pipeline Mapping System. Per the PHMSA viewer there is a Liquid Natural Gas plant located in Huntersville and multiple breakout tanks in Charlotte. This map also shows the location of liquid accidents and gas incidents. There have been five recorded liquid accidents in the vicinity of the breakout tanks resulting in the release of gasoline, fuel oil, and refined and/or petroleum products.

Figure 4.30 – Pipelines and Pipeline Infrastructure in the Planning Area



Source: NAVTEQ

Figure 4.31 – Pipelines and Pipeline Infrastructure in the Planning Area



Source: US Department of Transportation, Pipeline and Hazardous Materials Safety Administration, National Pipeline Mapping System

The locations of past incidents are shown in Table 4.90 below.

Table 4.90 – Hazardous Materials Incidents in Mecklenburg County by Location, 1987 – 2018

Location	Recorded Incidents
Charlotte	870
(City Left Blank)	35
Huntersville	27
Matthews	24
Cornelius	22
Pineville	17
Paw Creek	8
Davidson	7
Arrowood	6
Harrisburg	4
Newell	4
Griffith	3
Belmont	2
Hahn	2
Junker	2
Mint Hill	2
Stanley	2
Cadarrus	1
Carolton	1
Chlorine	1
Concord	1
Durham	1
Mt Holly	1
Raleigh	1
Rama	1
South Belmont	1

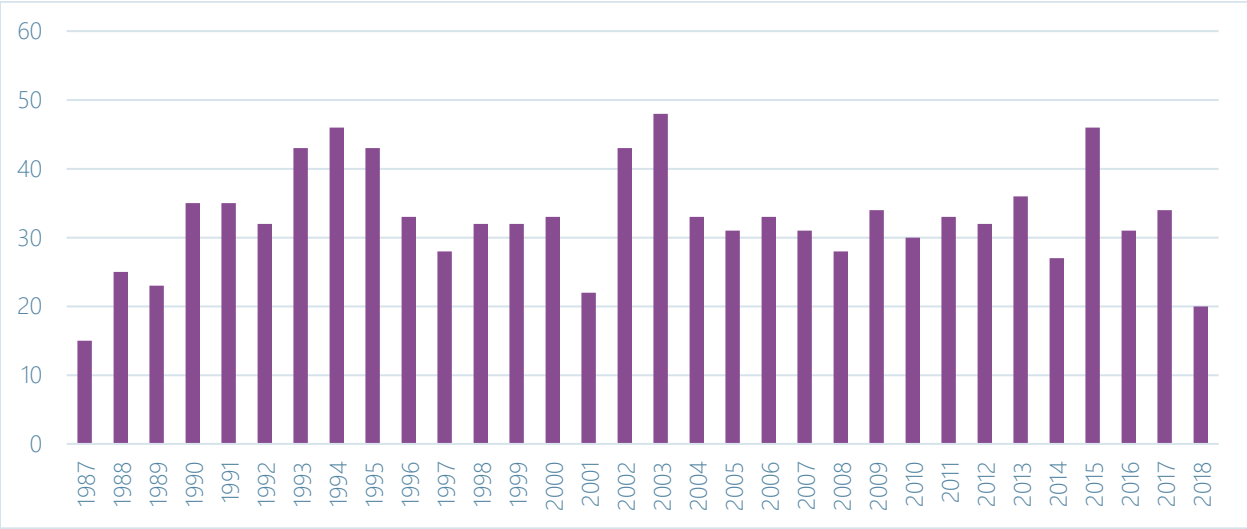
Source: U.S. EPA Right-to-Know Network (http://www.rtk.net), analysis by Wood

Historical Occurrences

Multiple hazardous materials incidents take place in Mecklenburg County every year. The most fatalities associated with a hazardous materials incident was when a DC-9 aircraft crashed into a Charlotte residence on July 3, 1994; 37 people were killed and another 20 injured in the crash and resulting fire. On August 14, 1995, a storage tank in north Charlotte containing 150 pounds of anhydrous ammonia ruptured, causing over 150 people to be evacuated, although thankfully no one was injured. On June 19, 2006 a natural gas pipeline ruptured in southeast Charlotte, sending two people to the hospital and causing $500,000 in property damage.

The EPA's Right To Know network lists 1,047 hazardous materials incidents in the county from 1987 through 2018. This represents 6.4% of the 16,333 incidents reported statewide during the same time period. These numbers break down to an average of 32.7 per year, although the number of incidents varies greatly from year to year, as can be seen in Figure 4.32. Despite this variation, over the last 30 years the overall number of incidents has remained relatively constant.

Figure 4.32 – Hazardous Materials Incidents in Mecklenburg County by Year, 1987-2018



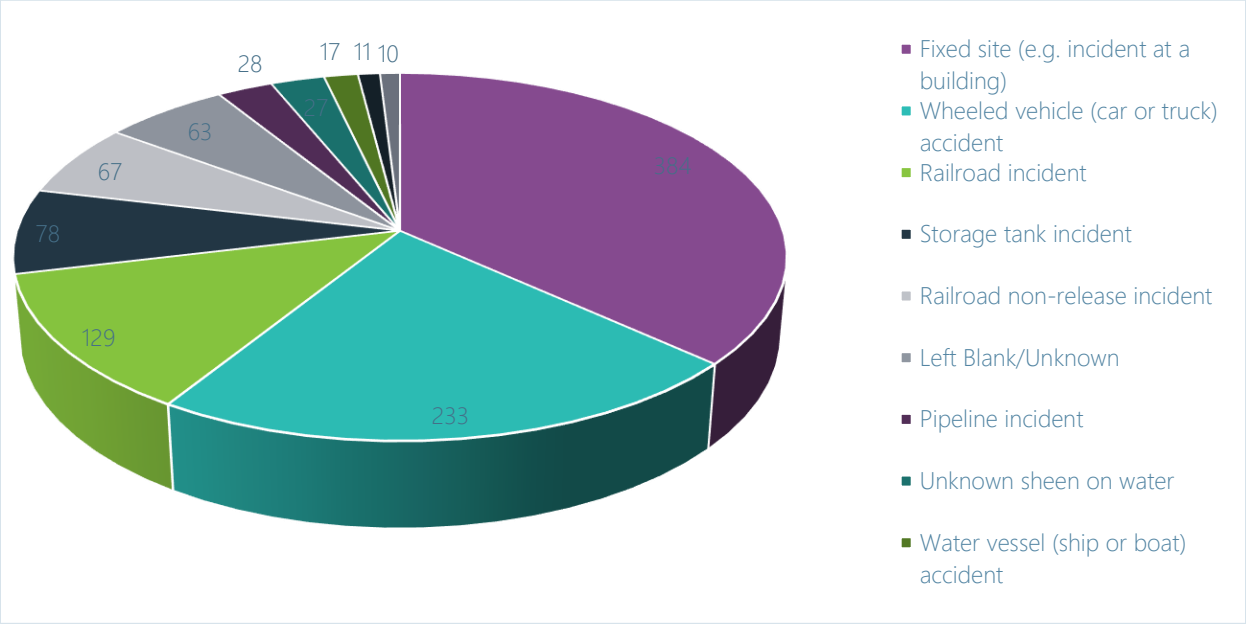
Source: U.S. EPA Right-to-Know Network (http://www.rtk.net), analysis by Wood

While the majority of these incidents were relatively minor with localized impacts, 121 incidents (11.6%) resulted in fatalities, injuries, evacuations, or significant damage:

- Incidents resulting in fatalities: 44
- Persons killed: 748
- Incidents resulting in injuries or hospitalization: 57
- Persons injured: 1,517
- Persons hospitalized: 827
- Incidents leading to evacuations: 29
- Persons evacuated: 40,721
- Incidents resulting in property damage: 15
- Damages: $24,748,649

The types of hazardous materials incidents are shown in Figure 4.33. Of the 1,047 incidents recorded by the EPA, 46% (484) were transportation related, while 44% (462) were at fixed sites or storage tanks.

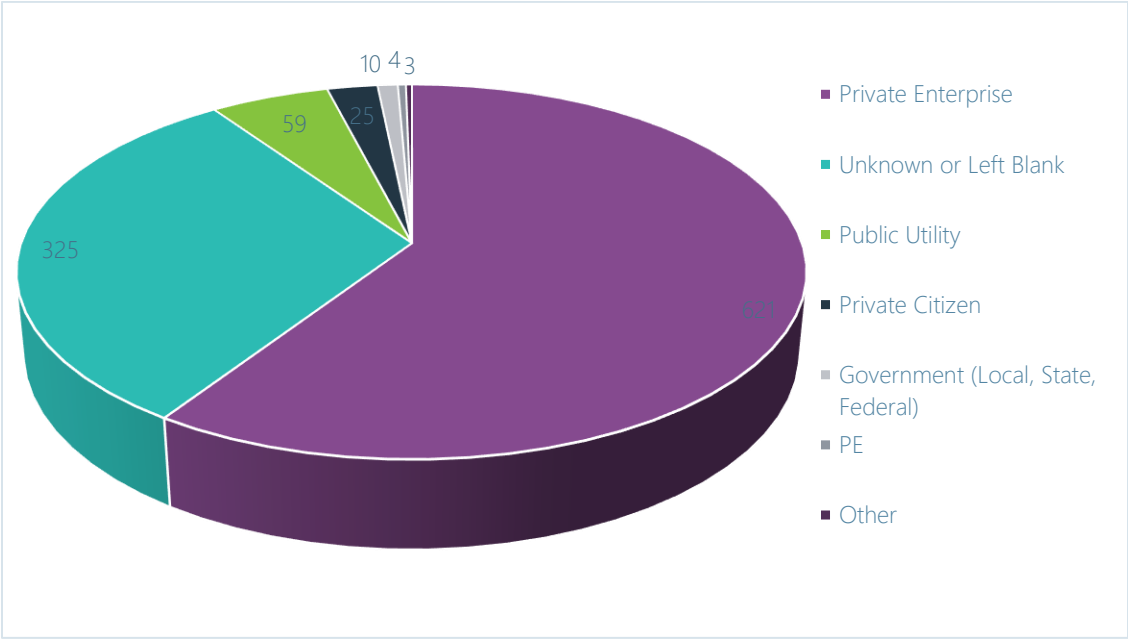
Figure 4.33 – Hazardous Materials Incidents in Mecklenburg County by Type, 1987-2018



Source: U.S. EPA Right-to-Know Network (http://www.rtk.net), analysis by Wood

As shown in Figure 4.34, the party responsible for discharging the hazardous material was a private enterprise in 59% of incidents. The responsible party was not known or left blank in 31% of incidents. The bulk of the remaining incidents were from public utilities (5.6%), private citizens (2.4%), or government entities (1.0%).

Figure 4.34 – Hazardous Materials Incidents in Mecklenburg County by Discharger, 1987-2018



Source: U.S. EPA Right-to-Know Network (http://www.rtk.net), analysis by Wood

The most commonly-released substances (where the substance was known/listed) are listed in Table 4.91.

Table 4.91 – 20 Most Commonly Released Hazardous Materials in Mecklenburg County, 1987 – 2018

Material	Count of Releases
ODS: Oils: diesel	118
GAS: Gasoline: automotive (unleaded)	50
OUN: Unknown oil	48
OTD: Oils, fuel: 2-D	43
OTF: Oils, miscellaneous: transformer	42
OMN: Oils, miscellaneous: mineral	42
OMT: Oils, miscellaneous: motor	32
OHY: Hydraulic oil	32
OTH: Other oil	31
ONG: Natural gas	23
EGL: Ethylene glycol	23
BDI: Butadiene	20
GAT: Gasolines: automotive (less than 4.23g lead/gal)	18
OLB: Oils, miscellaneous: lubricating	16
AMA: Ammonia, anhydrous	16
TOL: Toluene	12
PCB: Polychlorinated biphenyl	11
HCL: Hydrochloric acid	11
CLX: Chlorine	10
OWA: Waste oil	9

Source: U.S. EPA Right-to-Know Network (http://www.rtk.net), analysis by Wood

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.

The release or spill of hazardous materials can also require different emergency responses depending on the amount, type, and location of the spill incident. Potential losses can vary greatly for hazardous material incidents. For even a small incident, there are cleanup and disposal costs. In a larger scale incident, cleanup can be extensive and protracted. There can be deaths or injuries requiring doctor's visits and hospitalization, disabling chronic injuries, soil and water contamination can occur, necessitating costly remediation. Evacuations can disrupt home and business activities. Large-scale incidents can easily reach $1 million or more in direct damages, with clean-ups that can last for years.

Impact: 3 – Critical

Spatial Extent: 2 – Small

Probability of Future Occurrence

Based on historical occurrences, there have been 1,047 hazardous materials release in the 32-year period from 1987 through 2018. While the number of incidents varies from year to year, the overall trend shows no increase or decrease in the number. Thus, the planning area can expect approximately 33 hazardous materials incident a year, or roughly 2.7 per month. The majority of these (83%) will be in or near Charlotte.

However, the number of hazardous materials incidents that result in fatalities, injuries, evacuations, or property damage is significantly lower: only 121 in 32 years. This means that based on historical data the planning area can expect an average of 3-4 damaging hazardous materials incident per year.

Probability: 4 – Highly Likely

Climate Change

Climate change is not expected to impact hazardous materials incidents.

Vulnerability Assessment

The impacts of a hazardous materials incident vary based on the type and quantity of material released, as well as the location, time of day, and weather conditions.

Methodologies and Assumptions

Vulnerability to hazardous materials incidents was assessed based on past occurrences in the region and nationally and the known behavior of these materials.

People

Hazardous materials incidents can cause injuries, hospitalizations, and even death to people nearby. People living near hazardous facilities and along transportation routes may be at a higher risk of exposure, particularly those living or working downstream and downwind from such facilities. For example, a toxic spill or a release of an airborne chemical near a populated area can lead to significant evacuations and have a high potential for loss of life. Individuals working with or transporting hazardous materials are also at heightened risk.

In addition to the immediate health impacts of releases, a handful of studies have found long term health impacts such as increased incidence of certain cancers and birth defects among people living near certain chemical facilities. However there has not been sufficient research done on the subject to allow detailed analysis.

The primary economic impact of hazardous material incidents results from lost business, delayed deliveries, property damage, and potential contamination. Large and publicized hazardous material-related events can deter tourists and could potentially discourage residents and businesses. Economic effects from major transportation corridor closures can be significant.

Property

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

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

Table 4.92 summarizes the potential detrimental consequences of hazardous materials incident.

Table 4.92 – 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.
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.

Hazard Summary by Jurisdiction

The table below summarizes hazardous materials incident risk by jurisdiction. Probability was determined based on past incidents. All other factors do not vary by jurisdiction.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score	Priority
Charlotte	4	3	2	4	2	3.1	H
Cornelius	3	3	2	4	2	2.8	H
Davidson	3	3	2	4	2	2.8	H
Huntersville	3	3	2	4	2	2.8	H
Matthews	3	3	2	4	2	2.8	H
Mint Hill	3	3	2	4	2	2.8	H
Pineville	3	3	2	4	2	2.8	H
Mecklenburg County	3	3	2	4	2	2.8	H

4.5.15 Radiological Emergency

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 incidents 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 4.93 shows these classifications, as well as descriptions of each.

Table 4.93 – 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 six hours

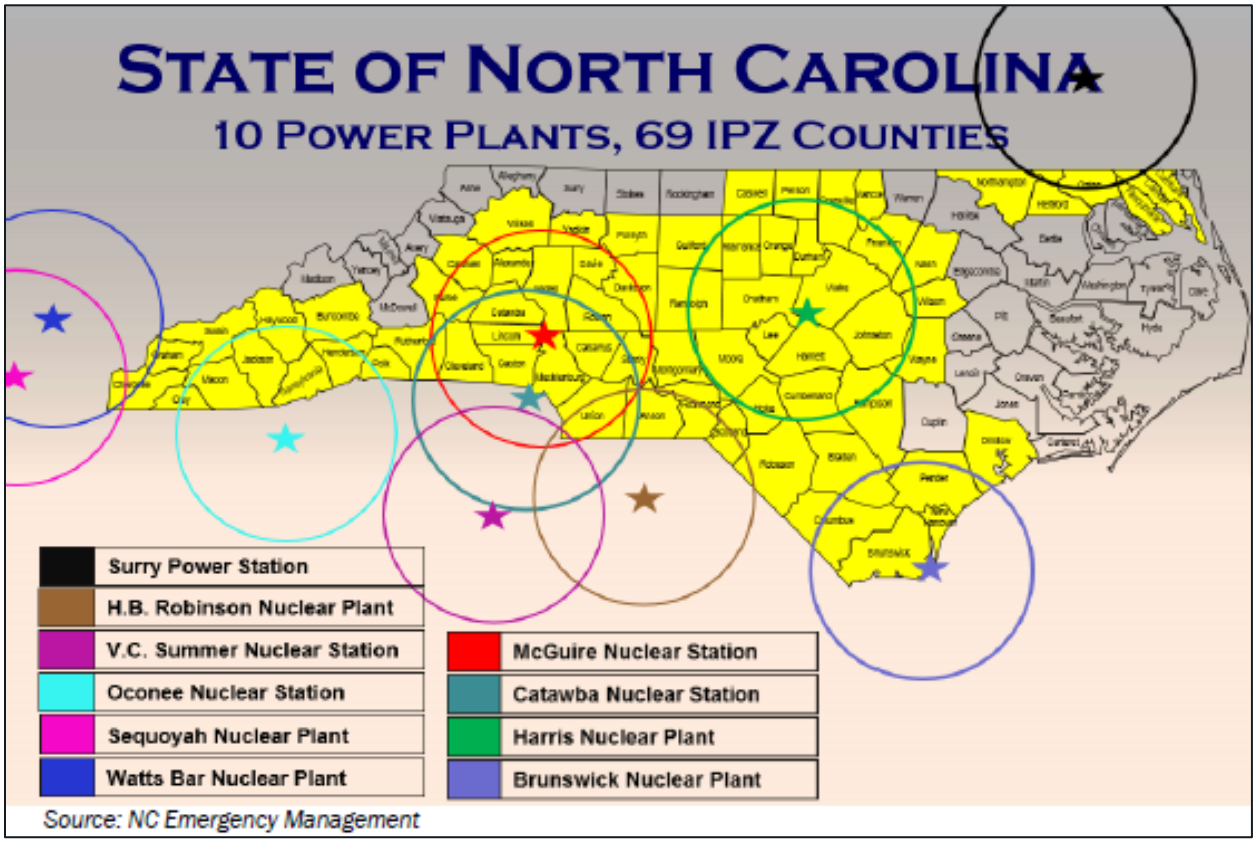
Duration: 4 – More than one week

Location

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 change 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 4.35 – Nuclear Power Plants in North Carolina



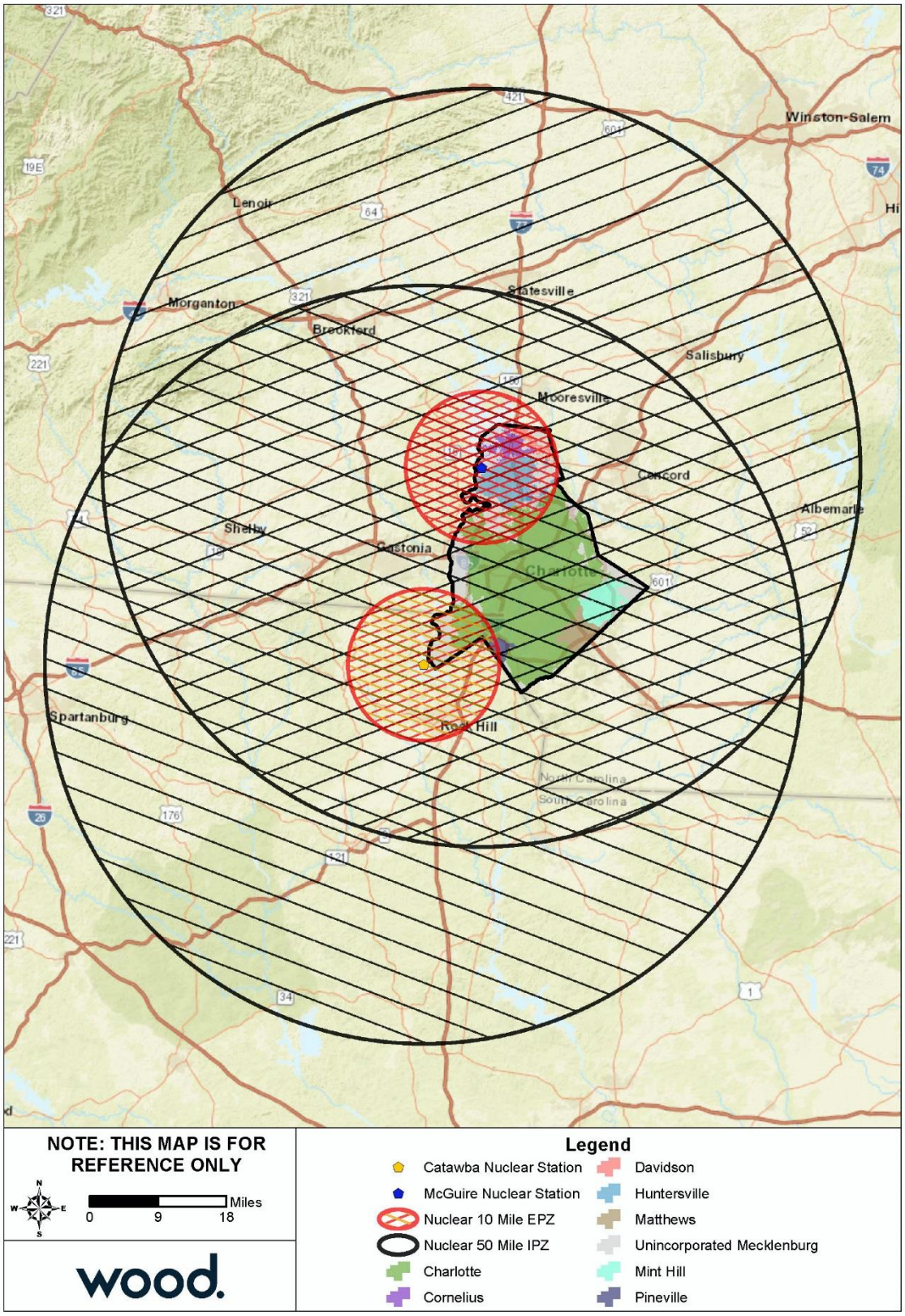
The McGuire Nuclear Station is located on Lake Norman in Mecklenburg County, about 17 miles north of Charlotte. Lake Norman was built by Duke Energy in 1963 and is the state's largest man-made lake. The first unit of the station commenced operation in 1981, and the second in 1984. It has a capacity to produce 2,316 megawatts of power and employs more than 1,200 employees.

The plant lies in between North Carolina's largest city, Charlotte, and the Hickory/Statesville area. These highly populated nearby cities are home to many universities, big industries, and airports. In Charlotte alone, the population rose by 1.8% from 2015-2016, and population and employment are continuing to increase. As more people move to the surrounding area, the population is therefore more vulnerable to potential emergencies at the McGuire Nuclear Station.

The Catawba Nuclear Station is located on Lake Wylie in York County, South Carolina; however, it is jointly owned by North Carolina Municipal Power Agency Number One. Its first unit began operating in 1985, followed by the next unit in 1986. It has a capacity for 2,290 megawatts of power and is only 11 miles southwest of Charlotte.

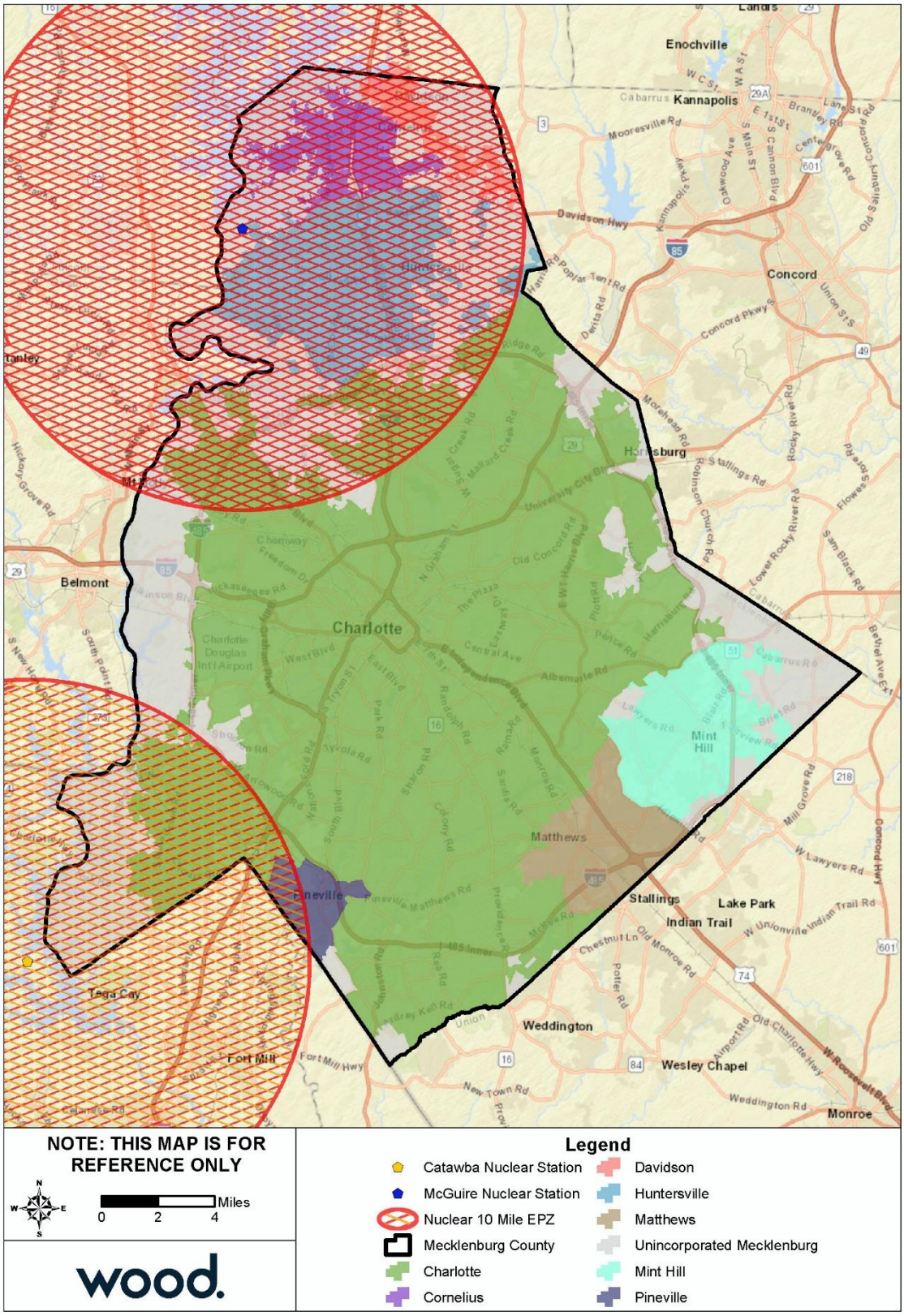
Figure 4.36 shows the location of McGuire Nuclear Station and Catawba Nuclear Station and the EPZ and IPZ areas around each plant. Figure 4.37 show the location of participating jurisdictions in relation to the EPZ range for McGuire Nuclear Station and Catawba Nuclear Station. Unincorporated Mecklenburg County, Charlotte, Cornelius, Davidson, Huntersville, and Pineville are all within the EPZ for these plants.

Figure 4.36 – McGuire Nuclear Station and Catawba Nuclear Station EPZ and IPZ Range



Source: GIS analysis

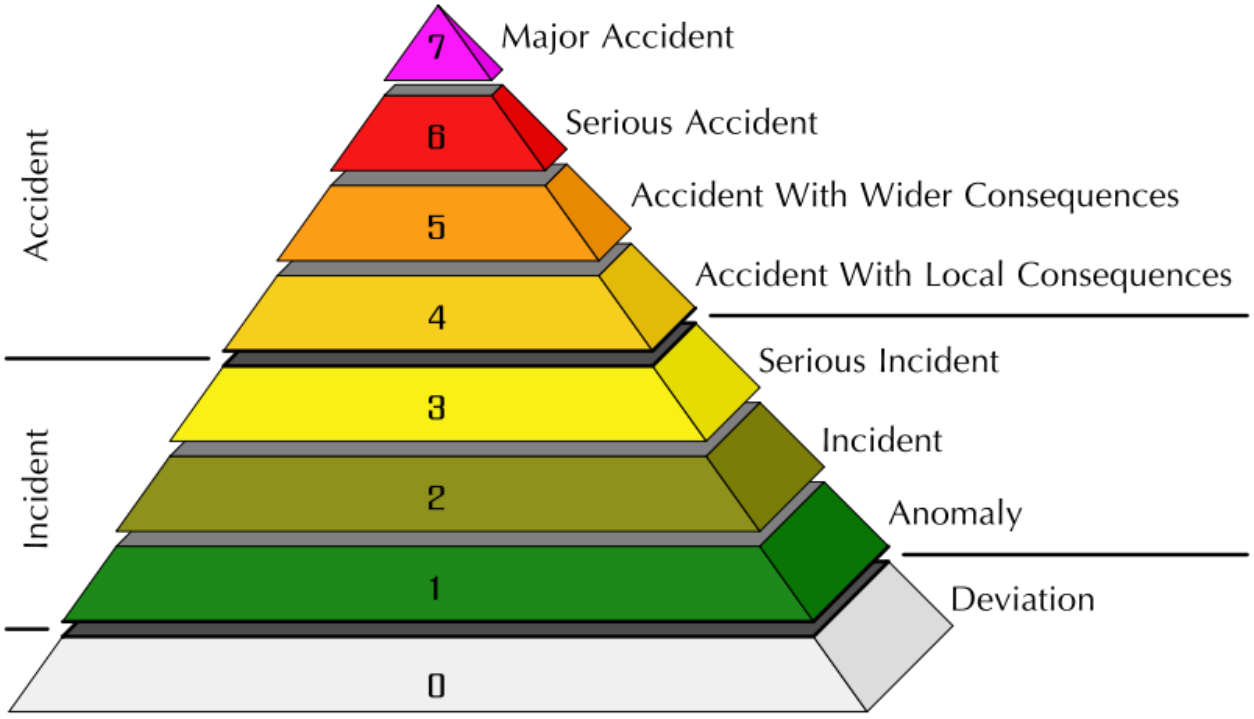
Figure 4.37 – Jurisdictions in McGuire Nuclear Station and Catawba Nuclear Station EPZ Range



Source: GIS analysis

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: 3 – Critical

Spatial Extent: 4 – Large

Historical Occurrences

As reported in the 2018 State Hazard Mitigation Plan, there have been no major release events in North Carolina nuclear facilities; there was one situation in 2008 where the nuclear material was being monitored for criticality that occurred within the fuel rod fabrication facility.

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

Climate Change

Climate change is not projected to have any impact on a potential radiological incident.

Vulnerability Assessment

People

People located within the 50-mile EPZ are at risk of exposure through ingestion of contaminated food and water, but generally do not require evacuation. 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. 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.

Consequence Analysis

Table 4.94 summarizes the potential detrimental consequences of radiological incident.

Table 4.94 – Consequence Analysis – Radiological Emergency

Category	Consequences
Public	High levels of radiation could cause serious illness or death. Those living and working closest to the nuclear station 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 station 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 station 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.

Hazard Summary by Jurisdiction

The table below summarizes radiological emergency risk by jurisdiction. Impact is rated higher for those jurisdictions within the EPZ. Otherwise, risk does not vary by jurisdiction.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score	Priority
Charlotte	1	3	4	4	4	2.8	H
Cornelius	1	3	4	4	4	2.8	H
Davidson	1	3	4	4	4	2.8	H
Huntersville	1	3	4	4	4	2.8	H
Matthews	1	2	4	4	4	2.5	H
Mint Hill	1	2	4	4	4	2.5	H
Pineville	1	3	4	4	4	2.8	H
Mecklenburg County	1	3	4	4	4	2.8	H

4.5.16 Electromagnetic Pulse (EMP)

Hazard Background

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

- Lightning electromagnetic pulse
- Electrostatic discharge
- Meteoric electromagnetic pulse, and
- Coronal mass ejection, also known as a solar electromagnetic pulse.

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

In 2015, Congress amended the Homeland Security Act of 2002 by passing the Critical Infrastructure Protection Act (CIPA), which protects Americans from an EMP. It also required reporting of EMP threats, research and development, and a campaign to educate planners and emergency responders about EMP events. In 2019, an Executive Order was issued to assess and study potential risks of an electromagnetic attack on U.S. infrastructure.

Warning Time: 4 – Less than six hours

Duration: 4 – More than one week

Location

Whether natural or man-made, an EMP could have widespread impacts across the county. An EMP can happen anywhere and the hazard is relatively unpredictable. Highly populated and technology-reliant communities are especially susceptible to the impacts of an EMP, due to the prevalence of technology in everyday life. The State Hazard Mitigation Plan notes that Charlotte may be at increased risk to and EMP due to this fact.

Historical Occurrences

North Carolina has not experienced an EMP occurrence within its borders.

The first recorded damage from an electromagnetic pulse came with a solar storm in 1859, called the Carrington Event. It was the largest solar storm in recorded history. A similar but milder storm occurred in March 1989. It knocked out power in Quebec, and jammed radio signals and weather satellites. To date, there have been no man-made EMP-specific attacks recorded.

Extent

The extent or magnitude/severity of an EMP is variable depending on the nature of the event. For example, a nuclear device detonated at high altitudes can generate a pulse with tens of kilovolts per meter and impact a radius from hundreds to thousands of kilometers. This type of event can disable very large electrical and electronic systems such as power and long-haul communications.

Impact: 3 – Critical

Spatial Extent: 4 – Large

Probability of Future Occurrence

The probability of an EMP, whether natural or man-made is unlikely.

Probability: 1 – Unlikely

Climate Change

Climate change is not projected to have any impact on a potential EMP incident, though specific ties between potential EMP impacts and climate change are not entirely well-understood.

Vulnerability Assessment

Methodologies and Assumptions

Vulnerability to EMPs was assessed based on hypothetical scenarios and potential impacts based on scientific study, as well as publicly available information on these vulnerabilities. The impacts below are based on the detonation of a stand-alone EMP device or a natural phenomenon; EMP impacts as a byproduct of a larger detonation of a nuclear weapon would have compounded effects due to the nuclear weapon itself.

People

According to research, a stand-alone (not attached to a nuclear detonation) EMP event would not have any direct physical impact on the population after detonation. Major impacts would occur when technology used to facilitate everyday life was knocked out of commission, potentially for an extended period of time, including electronics and communications.

Property

An EMP would cause no structural or physical damage to infrastructure itself, though it has the potential to disrupt the electronic systems that make much of that infrastructure function.

Environment

An EMP is not predicted to cause short or long term direct environmental impacts.

Consequence Analysis

Table 4.95 summarizes the potential consequences of an EMP.

Table 4.95 – Consequence Analysis – Electromagnetic Pulse

Category	Consequences
Public	No direct impacts on public after detonation; long-term impacts as common systems used by the public are disrupted.
Responders	EMPs can disrupt both electronics and communications, crippling the 911 and emergency response system.
Continuity of Operations (including Continued Delivery of Services)	The impacts of an EMP could cause long-term disruptions in government systems and services.
Property, Facilities and Infrastructure	A stand-alone EMP device would not have any direct physical impacts on property, though it could potentially disrupt any system that relies on electronics to function.
Environment	A stand-alone EMP device would not have any direct physical impacts on the environment.

Category	Consequences
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 could impact public confidence. An attack could raise questions regarding the security of using electronic systems for government services.

Hazard Summary by Jurisdiction

The table below summarizes EMP risk by jurisdiction. Risk does not vary by jurisdiction.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score	Priority
Charlotte	1	3	4	4	4	2.8	H
Cornelius	1	3	4	4	4	2.8	H
Davidson	1	3	4	4	4	2.8	H
Huntersville	1	3	4	4	4	2.8	H
Matthews	1	3	4	4	4	2.8	H
Mint Hill	1	3	4	4	4	2.8	H
Pineville	1	3	4	4	4	2.8	H
Mecklenburg County	1	3	4	4	4	2.8	H

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 4.96 summarizes the degree of risk assigned to each identified hazard using the PRI method.

Table 4.96 – Summary of PRI Results

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Dam & Levee Failure	Possible	Limited	Negligible	Less than 6 hrs	Less than 1 week	2.1
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	Critical	Moderate	6 to 12 hours	Less than 1 week	3.0
Hurricane & Tropical Storm	Possible	Limited	Large	More than 24 hrs	Less than 24 hrs	2.3
Landslide	Unlikely	Minor	Negligible	Less than 6 hrs	Less than 6 hrs	1.3
Severe Weather: Hail[1]	Highly Likely	Minor	Small	Less than 6 hrs	Less than 6 hrs	2.4
Severe Weather: Lightning[1]	Highly Likely	Minor	Negligible	Less than 6 hrs	Less than 6 hrs	2.2
Severe Weather: Thunderstorm Winds[1]	Highly Likely	Limited	Moderate	Less than 6 hrs	Less than 6 hrs	2.9
Severe Winter Storm	Highly Likely	Limited	Large	More than 24 hrs	Less than 1 week	3.0
Sinkhole	Possible	Minor	Negligible	Less than 6 hrs	Less than 6 hrs	1.6
Tornado	Likely	Critical	Small	Less than 6 hrs	Less than 6 hrs	2.7
Wildfire	Possible	Minor	Small	Less than 6 hrs	Less than 1 week	2.0
Cyber Attack	Possible	Minor	Small	Less than 6 hrs	More than 1 week	2.1
Hazardous Materials Incident	Highly Likely	Critical	Small	Less than 6 hrs	Less than 24 hrs	3.1
Radiological Emergency	Unlikely	Catastrophic	Large	Less than 6 hrs	More than 1 week	3.1
EMP	Unlikely	Critical	Large	Less than 6 hrs	More than 1 week	2.8

[1]Note: Severe Weather hazards average to a score of 2.5 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 4.97:

- **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.
- **Moderate 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 4.97 – Summary of Hazard Risk Classification

High Risk (> 2.4)	Extreme Heat Hazardous Materials Incident Radiological Emergency Severe Winter Storm Flood Electromagnetic Pulse (EMP) Tornado Drought Severe Weather
Moderate Risk (2.0 – 2.4)	Hurricane & Tropical Storm Dam & Levee Failure Cyber Attack Wildfire
Low Risk (< 2.0)	Earthquake Sinkhole Landslide

Note: Low risk hazards are not prioritized for mitigation.

5 Capability Assessment

This section discusses the capability of the Mecklenburg County Planning Area 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 Mecklenburg County planning area 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 planning area's ability to implement hazard mitigation actions. Other indicators included information related to the planning area'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 Mecklenburg County Planning Area 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 Mecklenburg County planning area, 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 Mecklenburg County planning area. A checkmark (√) indicates that the given item is currently in place and being implemented. An asterisk (*) indicates that the given item is currently being developed for future implementation. 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.

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
Mecklenburg County	√	√	√		√	*	+	√	√	√	√	√	√	√	√	√	√	√	√	*	*	√	√	√	√	√
Charlotte	√	*	+	+	√	√	√	√	√	√	√	√	√		√	√	√	√	√	*		√	√		√	√
Cornelius	√	√	+	√	+	+	+	+	+	√	+	√	√	√	√		√	√	√	√	+	+	+	+	+	
Davidson	√	√	+	√	+	+	+	+	√		+	√	√	√	√		√	√	√			+	+	+	√	
Huntersville	√	√	+		√	√	+	+	√		+	√	√	√	√		√	√	√	√	√	+	+	+	+	
Matthews	√	√	+	√	√	√	+	+				√		+	√	√	√	√	√	√		+	+		√	
Mint Hill	√	√	+	*	+	+	+	+	+				*	*	+	√	√	√	√	√		+	+		√	
Pineville	√	√	+	+	+	+	+	+	+	+	+	√	√	√	*		√	√	√	√		+	+		+	+

Source: Local Capability Assessment Survey

Based upon the responses summarized in the above table, jurisdictions in the Mecklenburg County planning area could target several areas for improvement of regulatory capability:

- Developing post-disaster redevelopment ordinances would set requirements for rebuilding after a disaster and allow the communities to plan for potential changes to current development patterns that could mitigate future risk.
- Developing an open space management plan could be an effective tool to address flood risk by designating open space areas, targeting areas for future open space acquisition, and managing open space areas in ways that mitigate risk.
- The county and its jurisdictions could work cooperatively to develop a Community Wildfire Protection Plan (CWPP); however, the basic requirements of a CWPP are now included in this plan update.
- While Mecklenburg County has many regulatory resources in place, finding ways to expand and share those resources with incorporated areas could improve the resilience of the entire county.

A more detailed discussion on the planning area'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 participating jurisdictions' 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.

- All participating jurisdictions have been covered by the 2015 Mecklenburg County Multi-Jurisdictional 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.

- 6 of the 8 participating jurisdictions are covered by a disaster recovery plan in place. (2 jurisdictions have one in place; 4 are covered under the 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. (3 jurisdictions have one in place; 1 has one under development; and 4 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.

- 7 of the 8 participating jurisdictions have a continuity of operations plan in place.

5.3.1.2 General Planning

The implementation of hazard mitigation activities often involves agencies and individuals beyond the emergency management profession. Stakeholders may include local planners, public works officials, economic development specialists, and others. In many instances, concurrent local planning efforts will help to achieve or complement hazard mitigation goals, even though they 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 planning area.

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. (One jurisdiction is in the process of developing a new comprehensive plan).

Capital Improvements Plan

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

- 7 of the 8 participating jurisdictions have a capital improvements plan in place or under development.

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.

- 7 of the 8 participating jurisdictions have an historic preservation plan in place or under development.

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 or under development.

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 or under development.

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

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 Mecklenburg County.

All jurisdictions in the planning area 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 building inspection program. 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 comments intended to make the CRS more user friendly, and extensive technical assistance available for communities who request it.

- Mecklenburg County, the City of Charlotte, and the Town of Pineville are CRS participants. Mecklenburg County and Pineville are Class 6 communities, and Charlotte is a Class 4 community.

Table 5.2 – NFIP Policy and Claim Information

Jurisdiction	Date of First FHBM or FIRM	Current Effective Map Date	NFIP Policies in Force	Insurance in Force	Written Premium in Force	Closed Losses	Total Payments
Mecklenburg County	10/22/76	11/16/18	213	$55,588,200	$125,313	186	$4,211,748
City of Charlotte	06/28/74	11/16/18	2,945	$803,488,700	$1,908,405	2,335	$41,096,752
Town of Cornelius	10/22/76	11/16/18	140	$43,335,900	$55,539	8	$101,082
Town of Davidson	10/22/76	11/16/18	68	$22,067,500	$27,067	2	$4,942
Town of Huntersville	02/04/04	11/16/18	158	$47,996,900	$64,920	1	$4,858
Town of Matthews	02/04/04	02/19/14	70	$22,316,000	$35,865	13	$140,215
Town of Mint Hill	02/04/04	11/16/18	54	$16,154,300	$23,328	3	$27,461
Town of Pineville	06/21/74	09/02/15	59	$16,246,400	$63,348	5	$19,718
Total	-	-	**3,707**	**$1,027,193,900**	**$2,303,785**	**2,553**	**$45,606,776**

Source: FEMA NFIP Policy Statistics via NC Risk Management Tool; updated from FEMA Community Information System

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.

- All participating jurisdictions have a floodplain management plan in place.

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.

- 6 of the 8 participating jurisdictions have an open space management plan in place or under development.

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.

- All participating jurisdictions have a stormwater management plan in place.

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 geographic information systems (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 planning area with regard to relevant staff and personnel resources. A checkmark indicates the presence of a staff member(s) in that jurisdiction with the specified knowledge or skill.

Table 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
Mecklenburg County	√	√	√	√	√	√		√	√	√	√	√	√	√
Charlotte	√	√	√		√		√	√	√	√	√	√	√	√
Cornelius	√		√							√			√	√
Davidson	√		√		√					√	√	√		√
Huntersville	√	√	√				√		√	√	√	√	√	√
Matthews	√	√	√	√	√	√			√	√		√	√	√
Mint Hill	√	√								√	√	√		√
Pineville	√	√	√		√	√				√		√		

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 participating jurisdictions' fiscal capability through the identification of locally available financial resources.

Table 5.4 provides a summary of the results for the planning area 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
Mecklenburg County	√	√	√		√	√		√	√		√
Charlotte	√	√	√		√	√	√		√	√	
Cornelius	√	√		√				√			
Davidson	√	√	√			√		√			
Huntersville	√	√	√	√		√		√	√	√	√
Matthews	√	√	√			√		√	√	√	√
Mint Hill						√		√			
Pineville	√	√		√	√	√	√	√	√	√	

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 planning area 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
Mecklenburg County	√	√	√	√			√
Charlotte	√	√	√			√	
Cornelius		√				√	
Davidson	√	√	√			√	
Huntersville		√					
Matthews	√	√	√				√
Mint Hill		√					
Pineville		√				√	

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?
Mecklenburg County	√	√	√	√
Charlotte	√	√		√
Cornelius				
Davidson				
Huntersville			√	√
Matthews				√
Mint Hill				
Pineville	√			√

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.

The Local Capability Self-Assessment was used to capture information on political capability of the planning area. 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 (e.g., building codes, floodplain management, etc.).

In Mecklenburg County, all jurisdictions stated that their local political leaders are willing to implement mitigation measures. Some jurisdictions also noted having local standards related to mitigation that exceed state requirements, such as the Mecklenburg County and City of Charlotte floodplain ordinances.

The county noted that there are some impediments to mitigation at the state level; specifically, the use of any standards above the North Carolina State Building Code must be approved by the Building Code Council. Additionally, updates to the building code are also controlled by the Building Code Council.

5.3.7 Local Self-Assessment Rating

In addition to the inventory and analysis of specific local capabilities, the Local Capability Self-Assessment asked all jurisdictions in Mecklenburg County 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 results of the self-assessment ratings for each community in the planning area.

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
Mecklenburg County	High	High	High	Moderate	High	High	Moderate
Charlotte	High	High	High	High	High	High	High
Pineville	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Matthews	High	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Huntersville	Moderate	Moderate	Moderate	Limited	Moderate	Moderate	Limited
Cornelius	Moderate	Moderate	High	Moderate	High	Moderate	Limited
Davidson	Moderate	High	Moderate	High	High	High	Moderate
Mint Hill	High	High	High	Moderate	Moderate	Moderate	Limited

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 Mecklenburg County planning area 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 94, which falls into the Moderate capability ranking.

Table 5.8 – Capability Assessment Results

Jurisdiction	Overall Capability Score	Overall Capability Rating
Mecklenburg County	111	High
Charlotte	117	High
Pineville	88	Moderate
Matthews	90	Moderate
Huntersville	94	Moderate
Cornelius	90	Moderate
Davidson	70	Low
Mint Hill	90	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 Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan. It describes how the County 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 Mecklenburg County planning area, 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 County and its 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.

6.1.2 Goal Setting

At the second planning meeting, held on March 13, 2019, the HMPC reviewed and discussed the goals from the 2015 Plan. The following revised goals were provided to the HMPC for discussion and feedback:

#1	Identify and implement hazard mitigation projects designed to reduce the impact of future hazard events on existing critical facilities and infrastructure as well as public and private property.
#2	Conduct education and outreach activities intended to better inform people about hazards and encourage personal responsibility for preparedness and mitigation.
#3	Improve emergency preparedness and response capabilities.
#4	Enact planning and policy measures to reduce the impacts of identified hazards and make future development more resilient to hazards.

There was one comment on the goal revisions regarding the proposed Goal #4, which targets hazard mitigation and development management in known hazard areas. The HMPC expressed that it is also important to consider hazard mitigation outside of these areas, because the effects of development may be felt outside known hazard areas, as is the case with stormwater flooding.

In addition to the revised goals, the HMPC reviewed a set of objectives proposed by the planning consultant. The HMPC made several minor revisions to these objectives. With the inclusion of these comments, the HMPC approved of the recommended 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:

Goal 1 – Identify and implement hazard mitigation projects designed to reduce the impact of future hazard events on existing critical facilities and infrastructure as well as public and private property.

Objective 1.1: Acquire or retrofit buildings and infrastructure to protect against damage from hazards.

Objective 1.2: Implement natural, infrastructure, and structural projects to avert hazards and reduce future damage.

Objective 1.3: Ensure critical facilities can maintain operations during hazard events.

Goal 2 – Conduct education and outreach activities intended to better inform people about hazards and encourage personal responsibility for preparedness and mitigation.

Objective 2.1: Conduct awareness activities in person and via web and social media.

Objective 2.2: Assist vulnerable populations through targeted outreach.

Objective 2.3: Promote and incentivize private mitigation activities.

Goal 3 – Improve emergency preparedness and response capabilities.

Objective 3.1: Conduct training and exercises intended to better prepare government officials to respond to, mitigate against and recover from emergencies and disasters.

Objective 3.2: Improve ability to notify people of impending hazards and disasters.

Objective 3.3: Establish traffic control procedures intended to reduce injuries and the loss of life before, during, and after emergencies and disasters.

Goal 4 – Enact planning and policy measures to reduce the impacts of identified hazards and make future development more resilient to hazards.

Objective 4.1: Adopt development regulations to limit or prevent development in hazard areas.

Objective 4.2: Enforce building codes and development regulations.

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
- Flood
- Hazardous Materials Incident
- EMP
- Radiological Emergency
- Hurricane & Tropical Storm
- Tornado
- Drought
- Severe Weather
- Dam & Levee Failure
- Cyber Attack
- Wildfire

Note: In a few cases, actions were also identified for sinkhole, landslide, and earthquake despite their being low priority hazards. Additionally, while there are technological and human-caused hazards in the above list, only natural hazards were necessarily prioritized for mitigation. Development of mitigation actions for technological and 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 Education and Awareness

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.

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 either assigned a priority to an action or their ratings for the prioritization criteria were input into NCEM's Risk Management Tool (RMT), which provided 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

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:

- Mecklenburg County
- City of Charlotte
- Town of Cornelius
- Town of Davidson
- Town of Huntersville
- Town of Matthews
- Town of Mint Hill
- Town of Pineville

Additional details on each mitigation action are provided by jurisdiction in their respective annex of this plan.

Table 7.1 – Mitigation Action Plan, Mecklenburg County

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Mecklenburg-1	Seek grant funding to retrofit 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, 320 or 361 compliant safe rooms, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	1.3	Moderate	Property Protection	Mecklenburg County Code Enforcement & Mecklenburg County Fire Marshal's Office	TBD	Local, State, Federal	More than 5 years	Carry Forward	Identified specific locations for improvements. Retrofits not yet completed due to competing priorities.
Mecklenburg-2	Maintain continued compliance with the National Flood Insurance Program (NFIP) through implementation and periodic evaluation of the following higher regulatory standards (in addition to basic required compliance actions): a) Development standards linked to Community Floodplain (Future Conditions) b) Require critical facilities protection to 500-year flood levels c) Require parking lots to be elevated (no more than six inches deep in any parking space during Community Flood event) d) Require dry land access for new or substantially improved buildings (above Community Flood BFE) e) Levee restrictions f) Cumulative substantial damage improvement provision g) Prohibit basements below flood level on filled lots	Flood	4.1	High	Prevention	Mecklenburg County / Storm Water	TBD	SWS Operating budget / grant	More than 5 years	Carry Forward	County revised floodplain ordinance in November 2018 following extensive review by stakeholder group, advisory council, and County attorney. Goal was to improve clarity, conform with state model ordinance, and adopt newly effective FIRM panels. Higher standards maintained.
Mecklenburg-3	Continue participation in the NFIP Community Rating System (CRS) with the goal of increasing CRS credit points to become a Class 5 community or better within five years.	Flood	4.1	High	Prevention	Mecklenburg County / Storm Water	TBD	SWS Operating budget	2-3 years	Carry Forward	Mecklenburg County has maintained participation in the CRS and is currently a Class 6 community.
Mecklenburg-4	Update Flood Insurance Rate Maps to provide most accurate depiction of flood risk.	Flood	4.1	High	Public Education & Awareness	Mecklenburg County / Storm Water	TBD	Storm Water Services Capital Fund / CTP grant	More than 5 years	Carry Forward	Several FIRM panels were revised in 2018.
Mecklenburg-5	Identify, fund, and implement eligible flood mitigation projects. FEMA-defined and locally verified "repetitive loss properties" to receive high priority.	Flood	1.1	High	Property Protection	Mecklenburg County / Storm Water	Variable	FEMA Unified Hazard Mitigation Assistance / Storm Water Services capital fund	More than 5 years	Carry Forward	In the interval since 2015 HMP update 61 flood-prone buildings have been acquired and demolished at a cost of $16.8M (93% local / 7% federal) Two FMA grants awarded for structure elevation, budget shortfall prevented project implementation. Floodplain Stream Restoration grant application and Acquisition /Demolition grant application submitted under NCDEM HMGP DR-4393 (Florence), FEMA review pending

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Mecklenburg-6	Research possibility of using new H&H models to provide flood forecasting in the Flood Information Notification System (FINS). Research possibility of FINS system to provide inundation mapping based on results of new H&H models and explore alternate methods and expansion into other locations.	Flood	3.2	Moderate	Prevention	Mecklenburg County Storm Water	TBD	TBD	More than 5 years	New	Combination of 2010 actions #6 & #7.
Mecklenburg-7	As determined necessary and upon request from municipal jurisdictions, provide informative presentations and/or work sessions for newly elected officials and new appointees to planning commissions and appeals/variance boards to provide an overview of floodplain management, the importance of participating in the NFIP, and the implications of failing to enforce the requirements of the program or failing to properly handle variance requests. On an annual basis, coordinate with Charlotte-Mecklenburg Emergency Management on a widespread public outreach activity to provide information on all natural hazards facing the area to local residents, including methods for mitigating and preventing damages from hazardous conditions and how to respond when an imminent hazard threatens. On an annual basis, coordinate with Charlotte-Mecklenburg Emergency Management to provide information on all natural hazards facing the area to local planning staff and elected officials. This should be combined with an annual progress report on the status of local mitigation actions as identified in the Multijurisdictional Hazard Mitigation Plan.	All Hazards	2.1	Moderate	Public Education & Awareness	Charlotte-Mecklenburg Emergency Management Office/ Mecklenburg County Storm Water	Staff time	Local	2020-2025	New	Implementation in progress. Combination of 2010 actions #10, #11, & #12 to align with an overall Program for Public Information.
Mecklenburg-8	Install back-up emergency generators at the following critical facilities/emergency shelters: Tuckaseegee Recreation Center, Grady Cole Center, Naomi Drennan Recreation Center	All Hazards	1.3	Low	Property Protection	County Asset and Facility Management	$925,000	Mecklenburg County Capital Reserve	2-3 years	New	

Table 7.2 – Mitigation Action Plan, City of Charlotte

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Charlotte-1	Consider the need to add or revise existing policies or regulations to more thoroughly address natural hazards during the update of the City's Zoning Ordinance.	All Hazards	4.1	Moderate	Prevention	City of Charlotte Planning Department, in coordination with Emergency Management and Storm Water Division	Local Staff time	Planning Department budget	2020-2025	Carry Forward	Under development- Stormwater regulations will be incorporated in the Charlotte Unified Development Ordinance.
Charlotte-2	Enhance area planning activities to better address potential natural hazards.	All Hazards	4.1	Moderate	Prevention	City of Charlotte Planning Department, in coordination with Emergency Management and Storm Water Division	Local Staff time	Planning Department budget	2020-2025	Carry Forward	Under development- These elements will be considered and incorporated in the Charlotte 2040 Comprehensive Plan.
Charlotte-3	Maintain continued compliance with the National Flood Insurance Program (NFIP) through implementation and periodic evaluation of the following higher regulatory standards (in addition to basic required compliance actions): a) Development standards linked to Community Floodplain (Future Conditions); b) Require critical facilities protection to 500-year flood levels; c) Require parking lots to be elevated (no more than six inches deep in any parking space during Community Flood event); d) Require dry land access for new or substantially improved buildings (above Community Flood BFE); e) Levee restrictions; f) Cumulative substantial damage improvement provision; g) Prohibit basements below flood level on filled lots	Flood	4.1	High	Prevention	Storm Water Division, in coordination with CMSWS	Local staff time	N/A	2020-2025	Carry Forward	In Progress: A stakeholder group (made up of staff, advisory committee members, engineers, developers and environmental representatives) is evaluating and recommending changes to floodplain ordinances as part of the Physical Map Revision PMR3 that is effective November 16, 2018.
Charlotte-4	Continue participation in the NFIP Community Rating System (CRS) with the goal of increasing CRS credit points to become a Class 4 community or better within five years.	Flood, Dam & Levee Failure	4.1	High	Prevention	Storm Water Division, in coordination with CMSWS	Local staff time	N/A	2020-2025	Carry Forward	Class 4 achieved and continuing participating.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Charlotte-5	Seek opportunities to provide information and education to Planning staff regarding risks associated with natural hazards and potential prevention/mitigation planning strategies.	All Hazards	2.1	Moderate	Prevention	City of Charlotte Planning Department, in coordination with Emergency Management and Storm Water Division	Local staff time	Emergency Management and/or other staff to provide training and/or utilize resources made available through the American Planning Association (including PAS Report: Integrating Hazard Mitigation into Local Planning)	2020-2025	Carry Forward	Planning staff will continue to seek American Planning Association (APA) related training in conjunction with American Institute of Certified Planners (AICP) Certification Maintenance (CM) credits. On April 12, 2019, we hosted a group viewing of the **Principles for Preparing a Community's Disaster Recovery Plan** webinar. The 2-hour course is sponsored by the APA Hazard Mitigation and Disaster Recovery Planning Division and **eligible for 2 CM credits**.
Charlotte-6	On an annual basis, coordinate with municipalities on a widespread public outreach activity to provide information on all natural hazards facing the area to local residents, including methods for mitigating and preventing damages from hazardous conditions and how to respond when an imminent hazard threatens.	All Hazards	2.3	Moderate	Public Education & Awareness	Emergency Management	Local staff time and resources	Emergency Management budget/EMPG	2020-2025	Carry Forward	All Hazards Advisory Committee (AHAC) Conference held 11-14-19
Charlotte-7	On an annual basis, coordinate with municipalities to provide information on all natural hazards facing the area to local planning staff and elected officials. This should be combined with an annual progress report on the status of local mitigation actions as identified in the Multi-jurisdictional Hazard Mitigation Plan.	All Hazards	3.1	Moderate	Public Education & Awareness	Emergency Management	Local staff time and resources	Emergency Management budget/EMPG	2020-2025	Carry Forward	All Hazards Advisory Committee (AHAC) Conference held 11-14-19
Charlotte-8	Implement spring public information campaign aimed at tornado and severe weather awareness to include information on safe rooms.	Tornadoes, Severe Weather	2.1	Moderate	Public Education & Awareness	Emergency Management	$3,000	Storm Water Services budget, FEMA and American Red Cross materials free of charge (see FEMA Publication 320— Taking Shelter from the Storm: Building a Safe Room Inside Your House), Department of Homeland Security— Citizen Corps	2021	Carry Forward	Severe Weather Week occurred March 2020. Charlotte is a Storm Ready Community

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Charlotte-9	Train emergency responders and managers for flood emergencies.	Flood	3.1	Moderate	Emergency Services	City of Charlotte Fire Department	$50,000	Emergency Management Performance Grants (EMPG), Emergency Management Institute, Department of Justice— State and Local Domestic Preparedness Exercise Support, Department of Homeland Security—Citizen Corps	2020-2025	Carry Forward	EM has conducted annual trainings
Charlotte-10	Equip emergency responders and managers for flood emergencies, including swift water rescue.	Flood	3.1	Moderate	Emergency Services	City of Charlotte Fire Department	$100,000	Hazard Mitigation Grant Program (7% set aside), Emergency Management Performance Grants (EMPG)	2020-2025	Carry Forward	Equipment evaluation is underway.
Charlotte-11	Conduct disaster drills for division managers.	All Hazards	3.1	Moderate	Emergency Services	City of Charlotte Fire Department	$25,000	Department of Justice—State and Local Domestic Preparedness Exercise Support, Department of Justice— State and Local Domestic Preparedness Training Program, FEMA—First Responder Counter-Terrorism Training assistance, Department of Homeland Security—Citizen Corps	2020-2025	Carry Forward	Tabletop exercises (TTX) held in multiple hazard areas
Charlotte-12	Provide and maintain NIMS training for all KBE's, division heads and key government officials.	All Hazards	3.1	Moderate	Emergency Services	City of Charlotte Fire Department	$25,000	Emergency Management Institute, Department of Homeland Security—Citizen Corps	2020-2025	Carry Forward	On-going ICS/NIMS training programs have been established.
Charlotte-13	Develop evacuation routes that are not adversely affected by flooding.	All Hazards	3.3	Moderate	Emergency Services	City of Charlotte Department of Transportation	Local staff time and resources	N/A	2020-2025	Carry Forward	Coordinating with 83rd Civil Affairs Battalion, US Army, in ongoing planning and consultation
Charlotte-14	Improve the dissemination of hazard information, including maps, broadcasts, Internet Web site(s) and listservs.	All Hazards	2.1	Moderate	Public Education & Awareness	Emergency Management	Local staff time and resources	N/A, FEMA and American Red Cross materials free of charge, Department of Homeland Security—Citizenship Education and Training	2020-2025	Carry Forward	All Hazards Advisory Committee (AHAC) Conference was held 11-14-19
Charlotte-15	Provide information regarding encroachments, abandonments, new construction, and leases.	All Hazards	2.1	Moderate	Public Education & Awareness	Code Enforcement, Planning	Local staff time and resources	N/A	2020-2025	Carry Forward	City zoning and planning provide ongoing outreach
Charlotte-16	Inspect the condition of 50% of the critical assets (culverts greater than 48 inches that are under City-maintained streets) on a regular schedule (every 5 years).	Flood, Dam/Levee Failure	1.3	High	Prevention	Storm Water Services Division	Local staff time	Storm Water Services budget	2021-2025	New	

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Charlotte-17	Identify, rank and prioritize capital improvement projects. Revising current criteria to strategically prioritize work by managing our assets.	Flood, Dam/Levee Failure	1.1	High	Prevention	Storm Water Services Division	Local staff time	Storm Water Services budget	2021-2025	New	
Charlotte-18	Initiate (plan, design and construct) capital improvement projects to improve 20 linear miles of system between 2020 and 2025.	Flood, Dam/Levee Failure	1.1	High	Structural Projects	Storm Water Services Division	To be determined	Storm Water Services budget	2021-2025	New	
Charlotte-19	Identify and map known areas/streets subject to flooding that are outside of currently mapped floodplain areas based on: (1) drainage concerns reported through 311; and (2) past incident reports from the Fire Department and the Charlotte-Mecklenburg Police Department for flooding calls, road closings, swift water rescues, etc.	Flood	2.1	Moderate	Prevention	Storm Water Services Division	Local staff time and resources	Storm Water Services budget	2021-2025	New	
Charlotte-20	Maintain continued compliance with the National Flood Insurance Program (NFIP) through implementation and periodic evaluation of the following higher regulatory standards (in addition to basic required compliance actions): a) Implement updates in methodology to Community Floodplain (Future Conditions) b) Additional 1-foot freeboard in the interim before Community Floodplains are updated	Flood	4.1	High	Prevention	Storm Water Services Division, in coordination with Charlotte-Mecklenburg Storm Water Services	Local staff time	N/A	2021-2025	New	
Charlotte-21	Strive to have all other NFIP Community Rating System (CRS) municipalities in Mecklenburg County reach a Class 5 rating or better.	Flood, Dam/Levee Failure	4.1	High	Prevention	Storm Water Services Division, in coordination with Charlotte-Mecklenburg Storm Water Services	Local staff time	N/A	2021-2025	New	
Charlotte-22	Create media campaign/message to relay to local media and the general public prior to forecasted severe storm events.	Flood, Hurricane & Tropical Storm, Severe Weather, Tornado, Dam/Levee Failure	3.2	Moderate	Public Education & Awareness	Storm Water Services Division, in coordination with Charlotte-Mecklenburg Storm Water Services, Charlotte Communications & Marketing and Mecklenburg County Public Information	Local staff time and resources	Storm Water Services budget	2021-2025	New	

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Charlotte-23	Conduct annual inspections on ponds/dams that City of Charlotte Storm Water Services has accepted maintenance responsibility.	Flood, Dam/Levee Failure	1.3	Moderate	Prevention	Storm Water Services Division	Local staff time and resources	Storm Water Services budget	2021-2025	New	
Charlotte-24	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, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	1.1	Moderate	Property Protection	City of Charlotte	To be determined on a case-by-case basis	Local, State Grants, UHMA Grants, other federal grants	2021-2025	New	
Charlotte-25	Install and maintain backup generators or quick connect hook ups for mobile generators on any newly constructed City-owned critical facilities.	All Hazards	1.3	Moderate	Property Protection	City of Charlotte	To be determined on a case-by-case basis	Local, State Grants, UHMA Grants, other federal grants	2021-2025	New	
Charlotte-26	Develop a plan to identify and map fueling sites with underground storage tanks and either install backup generators or quick connect hook ups for mobile generators.	All Hazards	1.3	Moderate	Emergency Services	City of Charlotte	To be determined on a case-by-case basis	Local, State Grants, UHMA Grants, other federal grants	2021-2025	New	

Table 7.3 – Mitigation Action Plan, Town of Cornelius

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Cornelius-1	Implement storm water mitigation projects, including the grading of ditches and replacing failing/potentially failing storm water structures.	Flood	1.2	High	Structural Projects	Town of Cornelius Public Works Department	$70,000	CMSWS funds	2020-2025	Carry Forward	Public Works identifies, prioritizes, and implements improvements annually.
Cornelius-2	Conduct an annual tabletop exercise addressing potential hazards faced by Town. This exercise would bring together representatives from all Town departments that would work together creating and implementing a plan to effectively deal with the hazard.	All Hazards	3.1	High	Emergency Services	Town of Cornelius Police Department and Public Works Department	$0	N/A	2020-2025	Carry Forward	No progress made due to limited staff availability and competing priorities.
Cornelius-3	Review the peninsula evacuation plan that was completed in 2014.	All Hazards	3.1	High	Emergency Services	Town of Cornelius Police Department and Public Works Department	Staff time	N/A	2020-2025	New	
Cornelius-4	Monitor utility companies, local, state, and federal websites and social media accounts, and push out information on the Town's website and social media platforms	All Hazards	2.1	High	Public Education & Awareness	Town of Cornelius Public Information Office	$0	N/A	2020-2025	New	
Cornelius-5	Update the Town’s Land Use Plan and integrate the risk assessment findings and the mitigation goals and objectives into the plan.	All Hazards	4.1	Moderate	Prevention	Town of Cornelius Planning Department	Staff time	N/A	2021-2022	New	

Table 7.4 – Mitigation Action Plan, Town of Davidson

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Davidson-1	Seek grant 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	1.3	Moderate	Property Protection	Town of Davidson	To be determined on a case-by-case basis	Local, State Grants, UHMA Grants, other federal grants	2020-2025	Carry Forward	Added new generator to Fire Station #2. New monthly test/power transfer for town hall generator.
Davidson-2	Seek grant funding to install backup generators or quick connect hook ups for mobile generators on any newly constructed county/town critical facilities.	All Hazards	1.3	Moderate	Property Protection	Town of Davidson	To be determined on a case-by-case basis	Local, State Grants, UHMA Grants, other federal grants	2020-2025	Carry Forward	New generator was installed at FS #2
Davidson-3	Maintain continued compliance with the National Flood Insurance Program (NFIP) through implementation and periodic evaluation of the following higher regulatory standards (in addition to basic required compliance actions): a) Require critical facilities protection to 500-year flood levels b) Require parking lots to be elevated (no more than six inches deep in any parking space during Community Flood event) c) Require dry land access for new or substantially improved buildings (above Community Base Flood Elevation) d) Levee restrictions e) Floors of new or substantially improved buildings allowed by variance in the floodplain must be elevated at least one (1) foot above the Community (future) Base Flood Elevation. f) Prohibit basements below flood level on filled lots	Flood	4.1	High	Prevention	Planning Department, Public Works Department, in coordination with CMEMO	Staff time	N/A	2020-2025	Carry Forward	The Town has maintained compliance with the NFIP.
Davidson-4	Implement recommendations of the 2006 Tree Canopy Inventory including pruning and removal of branches and trees that threaten public utilities and structures	Hurricane & Tropical Storm, Severe Weather, Tornado, Severe Winter Storm, Wildfire	1.2	Moderate	Prevention	Planning Department, Public Works Department	Staff time and resources	N/A	2020-2025	Carry Forward	Town has increased tree budget again and has completed another tree inventory. Started removals of most dangerous trees first. Continue tree pruning yearly. Hired a full time arborist on staff to manage inventory and create a canopy management plan.
Davidson-5	On an annual basis, coordinate with Charlotte-Mecklenburg Emergency Management on a widespread public outreach activity to provide information on all natural hazards facing the area to local residents, including methods for mitigating and preventing damages from hazardous conditions and how to respond when an imminent hazard threatens.	All Hazards	2.1	Moderate	Public Education & Awareness	Planning Department, Public Works Department, in coordination with CMEMO	Staff time and resources	N/A	2020-2025	Carry Forward	No progress made due to limited staff time and competing priorities.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Davidson-6	On an annual basis, coordinate with Charlotte-Mecklenburg Emergency Management to provide information on all natural hazards facing the area to local planning staff and elected officials. This should be combined with an annual progress report on the status of local mitigation actions as identified in the Multi-jurisdictional Hazard Mitigation Plan.	All Hazards	3.1	Moderate	Public Education & Awareness	Planning Department, in coordination with CMEMO	Staff time and resources	N/A	2020-2025	Carry Forward	No progress made due to limited staff time and competing priorities.
Davidson-7	Develop growth policies that account for identified hazard areas	Flood, Severe Weather	4.1	High	Prevention	Planning Department	Staff time and resources	N/A	2025	Carry Forward	A new comprehensive plan is currently in progress. Tree budget has increased and pruning/removals are continuing as needed.
Davidson-8	Implement stormwater management plan.	Flood	4.1	High	Prevention	Public Works Department	$50,000	NRCS-Watershed Protection and Flood Prevention Program, NRCS-Watershed Surveys and Planning, USACE-Floodplain Management Services, HMGP	2020-2025	Carry Forward	Revised. Stormwater Management Plan was approved and implementation of recommended projects is underway. Beatty Dam has another leak since the repairs made in 2014. Engineers are currently working on solutions.

Table 7.5 – Mitigation Action Plan, Town of Huntersville

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Huntersville-1	Seek grant 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	1.3	Moderate	Property Protection	Town of Huntersville	To be Determined on a case-by-case basis	Local, State Grants, UHMA Grants, other federal grants	2020-2025	Carry Forward	No actions were needed in the last five years due to other priorities. The Town will continue to seek funding to equip new and/or existing Town-owned facilities with materials and technology that will improve resilience to hazards.
Huntersville-2	Implement storm water mitigation projects, including the grading of ditches and replacing failing/potentially failing storm water structures	Flood	1.2	High	Structural Projects	Town of Huntersville Public Works Department	To be determined	CMSWS funds	2020-2025	New	
Huntersville 3	Conduct an annual tabletop exercise addressing potential hazards faced by Town. This exercise would bring together representatives from all Town departments that would work together creating and implementing a plan to effectively deal with the hazard.	All Hazards	3.1	High	Emergency Services	Huntersville Police Department	$0	N/A	2020-2025	New	
Huntersville 4	Coordinate with Cher-Meck EM to relay critical information on the Towns Social Media Sites regarding potential hazards, localized emergencies, preparedness, and property protection options.	All Hazards	2.1	High	Public Education & Awareness	Town of Huntersville /HPD PIO	$0	N/A	2020-2025	New	
Huntersville 5	Provide and maintain NIMS training for town employees and government officials likely to be involved with hazard mitigation or emergency response. .	All Hazards	3.1	Moderate	Emergency Services	Town of Huntersville	$0	N/A	2020-2025	New	

Table 7.6 – Mitigation Action Plan, Town of Matthews

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Matthews-1	Develop a second full-function Emergency Operations Center (EOC) at the Fire Department as a backup to the current EOC at the Police Department.	All Hazards	1.3	Moderate	Emergency Services	Matthews Police and Fire	$16,000	Town Funds, FEMA	5 years	Carry Forward	Backup police communication ability available at Fire Station 1, looking at moving the EOC to Police HQ
Matthews-2	Prepare and maintain a map of areas that flood frequently, particularly those areas outside of FEMA floodplains. Digitize and add to County GIS on the Internet.	Flood	2.1	High	Prevention	Public Works in coordination with Planning GIS	$10,000	Town Storm Water Fees	1 year	Carry Forward	Continual update, mapping reviewed annually and updated as new data is available.
Matthews-3	Paint the bonnets on all fire hydrants in the Town Limits to match the NFPA flow color so that all arriving units will be able to visually see the tested flow of the hydrant.	Wildfire	3.1	High	Emergency Services	Fire Department	$1,000 material, labor in house staff time	General Funds	5 years	Carry Forward	In process as time and resources allow. Not a priority since GIS Mapping provides same capability to identify flow.
Matthews-4	Seek grant 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	1.3	Moderate	Property Protection	Town of Matthews Public Works Department	TBD case by case	Local, State Grants, UHMA Grants, other federal grants	5 years	Carry Forward	Resiliency will be assessed and retrofit will be evaluated as renovations take place and funding is made available.
Matthews-5	Seek grant funding to install backup generators or quick connect hook ups for mobile generators on any newly constructed county/town critical facilities.	All Hazards	1.3	Moderate	Property Protection	Town of Matthews Public Works Department	TBD case by case	Local, State Grants, UHMA Grants, other federal grants	5 years	Carry Forward	Critical facilities, PD, Fire, and PW now have generators. The need for emergency generators will be assessed as new town facilities are constructed.
Matthews-6	Maintain continued compliance with the National Flood Insurance Program (NFIP) through implementation and periodic evaluation of the following higher regulatory standards (in addition to basic required compliance actions): a) Development standards linked to Community Floodplain (Future Conditions) b) Require critical facilities protection to 500-year flood levels c) Require parking lots to be elevated (no more than six inches deep in any parking space during Community Flood event) d) Require dry land access for new or substantially improved buildings (above Community Flood BFE) e) Levee restrictions f) Cumulative substantial damage improvement provision g) Prohibit basements below flood level on filled lots	Flood	4.1	High	Prevention	Public Works in coordination with CMSWS	Local staff time	N/A	3-5 years	Carry Forward	Partially Completed/In Progress. Continued compliance through planning ordinance; will continue to enforce. (See Section 7.)

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Matthews-7	Coordinate with Mecklenburg County Storm Water Services to consider applying for and joining FEMA's Community Rating System (CRS).	Flood	4.1	Moderate	Prevention	Public Works in coordination with CMSWS	Local staff time	N/A	3-5 years	Carry Forward	Deferred. Intended to be a result of this 2020 Hazard Mitigation Plan update.
Matthews-8	Mitigate localized flooding caused by existing road and railroad structures by means of increasing the dimensions of drainage culverts in problem areas.	Flood, Severe Winter Storm	1.2	Moderate	Structural Projects	Public Works	$500,000+	Bonds, power bill revenues, Army Corps project funding, Watershed Protection & flood protection funds, etc.	3-5 years	Carry Forward	Partially Completed/In Progress. The Town has worked with CSX to have CSX complete an upgrade of the culvert under the railroad that caused flooding on Tank Town Road on a regular basis. VERY FEW FLOODING EVENTS SINCE CULVERT UPGRADE. The revised culvert is designed to handle the 50-year flood event. Now working with NCDOT to replace the Sam Newell Road culvert with bridge as part of the U-2509 widening project on US74. Construction scheduled to start 2024.
Matthews-10	Provide and maintain NIMS training for all department supervisors and appropriate line employees. Review and revise the Town Emergency operating Plan as necessary. Exercise the plan annually.	All Hazards	3.1	High	Emergency Services	Matthews Fire & EMS	$1,000 annually	General Fund	More than 5 years	Carry Forward	Completed and ongoing. Annual exercise of Town EOP and refresher NIMS training.
Matthews-11	Routinely inspect the functioning of fire hydrants and report findings to CMU for repair.	Wildfire	3.1	High	Prevention	Fire Department	Staff time and resources	N/A	More than 5 years	Carry Forward	Ongoing annual hydrant maintenance program. All hydrants have been inspected and maintained annually. Flow testing every five years to comply with ISO.
Matthews-12	Train staff to educate themselves and the public regarding hazards and the steps that can be taken to reduce their impact.	All Hazards	3.1	Moderate	Public Education & Awareness	Matthews PIO Office and Mecklenburg County	$10,000	General tax revenues, FEMA Emergency Management Institute courses, FEMA and American Red Cross materials are free of charge, Hazard Mitigation Grant Program (HMGP), Department of Homeland Security—Citizenship Education and Training	1 year	Carry Forward	Training has been conducted with staff using County and online resources. FireCorps Volunteers conducted basic CERT program every other year.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Matthews-13	Relocate Town EOC to Police Department	All Hazards	1.3	Moderate	Emergency Services	Matthews Police / Matthews Emergency Management	$10,000	General fund	1 year	New	Install additional phone and computer connections, install large display monitors to track incident status, weather, CAD, and resources. Provide breakout rooms for critical decision making, analysis, and planning. Provide for a greater degree of security. Fire Dept HQ will serve as an Operations Center and back-up for Police Communications Center.
Matthews-14	Provide Information and Educate the Public about strategies for and actions to promote self-reliance during weather-related events. Provide timely information to the public via social media. Provide education to citizens based on the Community Emergency Response Training.	All Hazards	2.3	High	Public Education & Awareness	Matthews Communications Director, Fire & EMS / Fire Corps	$5,000 annually	General fund	2-3 years	New	
Matthews-15	Increase Public Works Debris Removal Capability - Increase debris collection and removal capability by purchasing a grapple attachment for backhoe & skidsteer. The equipment could be used proactively to prevent storm drainage-related flooding, as well aid in as post-event clean-up.	Flood, Hurricane & Tropical Storm, Severe Winter Storm, Severe Weather, Tornado	3.1	High	Prevention	Matthews Public Works	$150,000	Capital Improvement Funds / Storm water funds	3-5 years	New	Grapple attachments for backhoe and skidsteer have been purchased and implemented.
Matthews-16	"South Towns" PSAP: Explore the benefits and costs associated with moving the 'South Towns' (Mint Hill, Matthews, Pineville) PSAP to Pineville Police Dept, with Matthews serving as the back-up PSAP.	All Hazards	3.1	High	Emergency Services	Town of Matthews, Department TBD	TBD	TBD	3-5 years	New	

Table 7.7 – Mitigation Action Plan, Town of Mint Hill

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Mint Hill-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	1.3	Moderate	Property Protection	Mecklenburg County Buildings and Inspections Department; Town of Mint Hill Emergency Services	To be determined on a case by case basis	Local, State Grants, UHMA grants, other federal grants	2025	Carried Forward	No progress made due to funding limitations. Resiliency will be assessed and retrofits will be evaluated as renovations take place and funding is made available.
Mint Hill-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	1.3	Moderate	Property Protection	Mecklenburg County Buildings and Inspections Department; Town of Mint Hill Emergency Services	To be determined on a case by case basis	Local, State Grants, UHMA grants, other federal grants	2025	Carried Forward	Critical facilities, PD, Fire, PW and Town Hall now have generators. The need for more emergency generators will be assessed as new town Facilities are constructed.
Mint Hill-3	Maintain continued compliance with the National Flood Insurance Program (NFIP) through implementation and periodic evaluation of the following higher regulatory standards (in addition to basic required compliance actions): a) Development standards linked to Community Floodplain (Future Conditions) b) Require critical facilities protection to 500-year flood levels c) Require parking lots to be elevated (no more than six inches deep in any parking space during Community Flood event) d) Require dry land access for new or substantially improved buildings (above Community Flood BFE) e) Levee restrictions f) Cumulative substantial damage improvement provision g) Prohibit basements below flood level on filled lots	Flood	4.1	High	Prevention	Town of Mint Hill in coordination with CMSWS	Local staff time	Local	2020-2025	Carried Forward	The Town has maintained compliance with NFIP.
Mint Hill-4	Prepare and conduct a survey for critical facilities to help identify structural and/or non-structural deficiencies that may lead to increased vulnerability to natural hazards. Include recommended corrective actions in local capital improvements program.	All Hazards	1.3	Moderate	Prevention	Town of Mint Hill Public Works Department	$20,000	Local	2025	Carried Forward	Critical facilities have been reevaluated on a yearly basis to identify any deficiencies.
Mint Hill-5	Prepare and maintain a map of areas that flood frequently, particularly those areas outside of FEMA floodplains.	Flood	2.1	Moderate	Prevention	In coordination with CMSWS	$5,000	N/A	2025	Carried Forward	Mapping review completed annually. Updated as new data is available.
Mint Hill-6	Coordinate with the North Carolina Division of Forest Resources (NCDFR) to prepare Community Wildfire Protection Plans (CWWPs) for identified high risk communities.	Wildfire	4.1	Moderate	Prevention	Town of Mint Hill Voluntary Fire Department; in coordination with NCFS	$5,000	NCDFR grants; FEMA PDM or HMGP	2025	Carried Forward	This action is the responsibility of the NCFS. The Town of Mint Hill will continue to assist with this action as needed, however it is being monitored and maintained by NCFS.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Mint Hill-7	On an annual basis, coordinate with Charlotte-Mecklenburg Emergency Management on a widespread public outreach activity to provide information on all natural hazards facing the area to local residents, including methods for mitigating and preventing damages from hazardous conditions and how to respond when an imminent hazard threatens.	All Hazards	2.1	Moderate	Public Education & Awareness	Town of Mint Hill in coordination with CMEMO (Lead)	Local staff time and resources	Local	2020-2025	Carried Forward	No progress made due to limited staff and competing priorities.
Mint Hill-8	On an annual basis, coordinate with Charlotte-Mecklenburg Emergency Management to provide information on all natural hazards facing the area to local planning staff and elected officials. This should be combined with an annual progress report on the status of local mitigation actions as identified in the Multi-jurisdictional Hazard Mitigation Plan.	All Hazards	3.1	Moderate	Public Education & Awareness	Town of Mint Hill in coordination with CMEMO (Lead)	Local staff time and resources	Local	2020-2025	Carried Forward	No progress made due to limited staff and competing priorities.
Mint Hill-9	Improve growth management procedures in identified flood hazard areas.	Flood	4.1	High	Prevention	Town of Mint Hill Planning Department	Staff time and resources	Local	2025	Carried Forward	No specific procedure changes made due to competing priorities, but this is an ongoing procedure with constant evaluation and improvements.

Table 7.8 – Mitigation Action Plan, Town of Pineville

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Pineville-1	Seek grant 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	1.3	Moderate	Property Protection	Town of Pineville	Determined on case-by-case basis	Local, State Grants, UHMA Grants, other federal grants	2020-2025	Carry Forward	In progress: Mecklenburg County retroFIT flood hazard mitigation grant program rolled out in FY16 project to identify and partially fund various mitigation projects using techniques such as floodproofing.
Pineville-2	Seek grant funding to install backup generators or quick connect hook ups for mobile generators on any newly constructed county/town critical facilities.	All Hazards	1.3	Moderate	Property Protection	Town of Pineville	Determined on case-by-case basis	Local, State Grants, UHMA Grants, other federal grants	2020-2025	Carry Forward	In Progress. Grants have not yet been applied for, but staff have been gathering information and quotes to be able to apply for a grant when we find one that is suitable.
Pineville-3	Maintain continued compliance with the National Flood Insurance Program (NFIP) through implementation and periodic evaluation of the following higher regulatory standard (in addition to basic required compliance actions): a) Development standards linked to Community Floodplain (Future Conditions) b) Require critical facilities protection to 500-year flood levels c) Require parking lots to be elevated (no more than six inches deep in any parking space during Community Flood event) d) Require dry land access for new or substantially improved buildings (above Community Flood BFE) e) Levee restrictions f) Cumulative substantial damage improvement provision g) Prohibit basements below flood level on filled lots	Flood	4.1	High	Prevention	Town of Pineville in coordination with CMSWS	Local staff time	N/A	2020-2025	Carry Forward	In Progress: Municipal Ordinance Updates to City, County, and town floodplain ordinances completed as Flood Insurance Rate Map revisions become effective. Staff participated in FEMA/NCDEM training E273 “Managing Floodplain Development through the National Flood Insurance Program”.
Pineville-4	In coordination with CMSWS, continue participation in the NFIP Community Rating System (CRS) with the goal of increasing CRS credit points to become a Class 5 community of better within five years.	Flood	4.1	High	Prevention	Town of Pineville in coordination with CMSWS	Local staff time	N/A	2025	Carry Forward	In Progress: Maintained programs to remain Class 6. Researched 2017 CRS manual to prepare for upcoming Annual CRS recertification.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Pineville-5	Advertise and promote the availability of flood insurance.	Flood	2.3	High	Public Education & Awareness	Town of Pineville	No extra cost - the Town of Pineville maintains a bi-monthly newsletter that can be used to support this action	Local budget	2020-2025	Carry Forward	In Progress: Annual "Floodplain Flash" newsletter distributed by USPS in May 2015, 2016 & 2018
Pineville-6	Preserve lands subject to repetitive flooding.	Flood	1.2	Moderate	Prevention	Town of Pineville	Unknown - value of land	Land Trust, Pre-Disaster Mitigation (PDM) program, Hazard Mitigation Grant Program (HMGP), Clean Water Management Trust Fund	2020-2025	Carry Forward	In Progress. The Mecklenburg County Flood Risk Assessment and Risk Reduction Tool (RARRT) is now used to guide local mitigation program actions. Flood risk scores, mitigation priority scores and planning level mitigation techniques were developed for all buildings with property touching the floodplain with updated floodplain maps. This data is now used to develop and prioritize local mitigation efforts.
Pineville-7	Continue to limit future development in identified flood hazard areas and prohibit new critical facilities from being located with the 500-year floodplain as required in the Town's flood damage prevention ordinance.	Flood	4.1	Moderate	Prevention	Planning and Zoning/Mecklenburg County LUESA	Staff time and resources	N/A	2020-2025	Carry Forward	In Progress. Town maintains Zoning and Subdivision Ordinances to attain this goal. In process of developing a new Comprehensive Plan and updating the Zoning Ordinance. Expected to be completed in next two years.
Pineville-8	Conduct cumulative impact analysis/studies for multiple development projects within the same watershed.	Flood	4.1	Moderate	Prevention	Mecklenburg County Storm Water Services, Public Works, GIS Department	Staff time and resources	NRCS—Watershed Protection and Flood Prevention Program, NRCS—Watershed Surveys and Planning, USACE—Floodplain Management Services, HMGP	2020-2025	Carry Forward	In Progress: Staff continues to require extensive studies for development projects within watersheds.
Pineville-9	Continue to coordinate with CMEMO on enhancements to the Town's early warning system and procedures for imminent hazard events.	All Hazards	3.2	High	Emergency Services	Police and Town Manager	TBD	FEMA—All Hazards Operational Planning, HMGP	2020-2025	Carry Forward	In Progress: Continue to coordinate with CMEMO on an ongoing basis.
Pineville-10	On an annual basis, coordinate with Charlotte-Mecklenburg Emergency Management on a widespread public outreach activity to provide information on all natural hazards facing the area to local residents, including methods for preventing damages from hazardous conditions and how to respond when an imminent hazard threatens.	All Hazards	2.1	Moderate	Public Education & Awareness	In coordination with CMEMO (Lead)	Staff time and resources	N/A	2020-2025	Carry Forward	In Progress: Through the Town of Pineville website and social media platforms provide notifications and links to preventing damage during hazardous conditions and also how to respond to imminent hazards as they arise.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Pineville-11	On an annual basis, coordinate with Charlotte-Mecklenburg Emergency Management to provide information on all natural hazards facing the area to local planning staff and elected officials. This should be combined with an annual progress report on the status of local mitigation actions as identified in the Multi-jurisdictional Hazard Mitigation Plan.	All Hazards	3.1	Moderate	Public Education & Awareness	In coordination with CMEMO (Lead)	Staff time and resources	N/A	2020-2025	Carry Forward	In Progress: CMEMO hosted April 2017 planning committee meeting CMSWS hosts May 2018 planning meeting for participating CRS jurisdictions. EM still responsible for hosting 2018 planning committee meetings for all jurisdictions.
Pineville-12	Acquire safe sites for public facilities, including schools, police and fire stations, etc.	All Hazards	1.3	High	Prevention	Town Manager	Dependent on land values, existing ownership of property	Town budget	2020-2025	Carry Forward	Achieved/Ongoing. Belle Johnston Community Center can function as a safe site and any other current or future public facilities that qualify.
Pineville-13	Develop early warning system for hazard events.	All Hazards	3.2	High	Emergency Services	Police and Town Manager	$100,000	FEMA—All Hazards Operational Planning, HMGP	2020-2025	Carry Forward	In progress: Additional stream stage sensors will be installed to provide more stream height data to be used in H&H model calibration and automated real-time flood inundation mapping.
Pineville-14	Develop traffic response plan addressing how to deal with traffic in a commercial area for ingress/egress in the event of a disaster or emergency.	All Hazards	3.3	Moderate	Prevention	Police Department/NCDOT	Staff time and resources	N/A	2020-2025	Carry Forward	Completed/Ongoing. The Police Department has traffic control measures in place. The Town is currently working on re-aligning a traffic light for better and more efficient traffic flow.

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 planning 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 City of Charlotte is updating its Comprehensive Plan along with Mecklenburg County and can integrate information on known hazard risks and potential policies for mitigation. Charlotte Water is updating their Emergency Operations Plan and will incorporate findings from this risk assessment.
- The Town of Cornelius is beginning the process of updating its Land Use Plan this year and will integrate findings from the HMP in that effort.

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. Charlotte-Mecklenburg Emergency Management (CMEMO) will take the lead in all plan monitoring and update procedures. As such, CMEMO, led by the Deputy Director of Emergency Management and Emergency Management Planner, agrees to continue its 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 provide 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 County and participating jurisdictions 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. CMEMO 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 Mecklenburg County 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 County 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 CMEMO, 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 CMEMO to reconvene the HMPC and ensure 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 the Emergency Operations Center (EOC) 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 City and County 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 City and County 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 City, County and Town 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

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 on the following pages.

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

FEMA

November 30, 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: Mecklenburg County

Dear Mr. McGugan:

We are pleased to inform you that the Mecklenburg County 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. The plan is approved for a period of five (5) years effective November 23, 2020 to November 22, 2025.

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

- Town of Matthews

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

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

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

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

We strongly encourage each community to perform an annual review and assessment of the effectiveness of their hazard mitigation plan; however, a formal plan update is required at least every five (5) years. We also encourage each community to conduct a plan update process within one (1) year of being included

within a Presidential Disaster Declaration or of the adoption of major modifications to their local Comprehensive Land Use Plan or other plans that affect hazard mitigation or land use and development. When you prepare a comprehensive plan update, it must be resubmitted through the State as a "plan update" and is subject to a formal review and approval process by our office. If the plan is not updated prior to the required five (5) year update, please ensure that the Draft update is submitted at least six (6) months prior to expiration of this plan approval.

The State and the participants in the Mecklenburg County 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 Nash Edgecombe Wilson Regional Multi-Jurisdictional Hazard Mitigation Plan have any 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

2

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

FEMA

December 7, 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: Mecklenburg County

Dear Mr. McGugan:

This is a follow-up to our previous correspondence of November 23, 2020, in which we approved the Mecklenburg County 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 Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan effective December 3, 2020:

- Town of Pineville

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 Mecklenburg County 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

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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 Mecklenburg County 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

2

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

FEMA

December 10, 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: Mecklenburg County

Dear Mr. McGugan:

This is a follow-up to our previous correspondence of November 23, 2020, in which we approved the Mecklenburg County 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 Mecklenburg County Hazard Mitigation Plan effective December 8, 2020:

- Mecklenburg 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 Mecklenburg County 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.

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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 Mecklenburg County 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

2

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

FEMA

January 4, 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: Mecklenburg County

Dear Mr. McGugan:

This is a follow-up to our previous correspondence of November 23, 2020, in which we approved the Mecklenburg County 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 Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan effective January 4, 2021:

- Town of Huntersville

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 Mecklenburg County 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.

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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 Mecklenburg County 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

2

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

FEMA

January 21, 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: Mecklenburg County

Dear Mr. McGugan:

This is a follow-up to our previous correspondence of November 23, 2020, in which we approved the Mecklenburg County 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 Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan effective January 21, 2021:

- Town of Cornelius

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 Mecklenburg County 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.

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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 Mecklenburg County 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

2

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

FEMA

February 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: Mecklenburg County

Dear Mr. McGugan:

This is a follow-up to our previous correspondence of November 23, 2020, in which we approved the Mecklenburg County 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 Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan effective February 1, 2021:

- Town of Davidson

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 Mecklenburg County 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.

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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 Mecklenburg County 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

2

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

FEMA

February 23, 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: Mecklenburg County

Dear Mr. McGugan:

This is a follow-up to our previous correspondence of November 23, 2020, in which we approved the Mecklenburg County 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 Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan effective February 23, 2021:

- City of Charlotte

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 Mecklenburg County 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.

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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 Mecklenburg County 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

2

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

FEMA

March 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: Mecklenburg County

Dear Mr. McGugan:

This is a follow-up to our previous correspondence of November 23, 2020, in which we approved the Mecklenburg County 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 Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan effective March 5, 2021:

- Town of Mint Hill

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 Mecklenburg County 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.

www.fema.gov

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 Mecklenburg County 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

2

Mecklenburg County, NC
Ordinance Book 49
Document #64

RESOLUTION ADOPTING THE 2020 MECKLENBURG COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

WHEREAS, Mecklenburg County is vulnerable to an array of natural hazards that can cause loss of life and damages to public and private property; and

WHEREAS, Mecklenburg 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 natural hazards; and

WHEREAS, it is the intent of the Mecklenburg Board of County Commissioners to protect residents 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 Mecklenburg Board of County 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 Mecklenburg County; and

WHEREAS, Mecklenburg County, in coordination with all other participating jurisdictions in Mecklenburg County, has prepared a multi-jurisdictional hazard mitigation plan with input from the appropriate local and state officials; and

WHEREAS, the North Carolina Division of Emergency Management has reviewed the Mecklenburg County Multi-Jurisdictional 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 Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan to review for legislative compliance and approve following the completion of local adoption procedures;

NOW, THEREFORE, BE IT RESOLVED that the Mecklenburg Board of County Commissioners hereby:

1. Adopts the Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan; and
2. Agrees to take such other official action as may be reasonably necessary to carry out the proposed actions of the Plan.

Adopted the 1st day of December 2020

Approved as to Form

County Attorney

Clerk to the Board

February 8, 2021
Resolution Book 51, Page 214

RESOLUTION ADOPTING THE 2020 MECKLENBURG COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

WHEREAS, the City of Charlotte 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 Charlotte 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 Charlotte City Council to protect residents 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 Charlotte 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 Mecklenburg County; and

WHEREAS, the City of Charlotte, in coordination with all other participating jurisdictions in Mecklenburg County, has prepared a multi-jurisdictional hazard mitigation plan with input from the appropriate local and state officials; and

WHEREAS, the North Carolina Division of Emergency Management has reviewed the Mecklenburg County Multi-Jurisdictional 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 Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan to review for legislative compliance and approve following the completion of local adoption procedures;

NOW, THEREFORE, BE IT RESOLVED that the Charlotte City Council hereby:

1. Adopts the Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan; and

February 8, 2021
Resolution Book 51, Page 215

2. Agrees to take such other official action as may be reasonably necessary to carry out the proposed actions of the Plan.

Adopted the 8th day of February 2021

CERTIFICATION

I, Stephanie C. Kelly, City Clerk of the City of Charlotte, North Carolina, DO HEREBY CERTIFY that the foregoing is a true and exact copy of an Resolution adopted by the City Council of the City of Charlotte, North Carolina, in regular session convened on the 8th day of February 2021, the reference having been made in Minute Book 152 and recorded in full in Resolution Book 51, Page(s) 214-215.

WITNESS my hand and the corporate seal of the City of Charlotte, North Carolina, this 8th day of February 2021.

CITY OF CHARLOTTE MECKLENBURG L S 1775 NORTH CAROLINA

Stephanie C. Kelly, City Clerk, MMC, NCCMC

Resolution No. 2021- 00983

RESOLUTION ADOPTING THE MECKLENBURG COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

WHEREAS, the Town of Cornelius 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 Cornelius 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 Cornelius 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 Town of Cornelius 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 the Town of Cornelius; and

WHEREAS, the Town of Cornelius, in coordination with all other participating jurisdictions in Mecklenburg County, has prepared a multi-jurisdictional hazard mitigation plan with input from the appropriate local and state officials; and

WHEREAS, the North Carolina Division of Emergency Management has reviewed the Mecklenburg County Multi-Jurisdictional 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 reviewed the Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan for legislative compliance and has approved the plan pending the completion of local adoption procedures.

NOW, THEREFORE, BE IT RESOLVED that the Town of Cornelius Board of Commissioners hereby:

1. Adopts the Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan; and
2. Agrees to take such other official action as may be reasonably necessary to carry out the proposed actions of the Plan.

Adopted this 19th day of January 2021.

Woody Washam, Jr., Mayor

ATTESTED:

Lori A. Harrell, Town Clerk

APPROVED AS TO FORM:

Town Attorney

College Town. Lake Town. *Your Town.*

Resolution 2021-02
ADOPTING THE 2020 MECKLENBURG COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

WHEREAS, The Town of Davidson 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 Davidson 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 Davidson Board of Commissioners to protect residents 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 Davidson 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 Mecklenburg County; and

WHEREAS, the Town of Davidson, in coordination with all other participating jurisdictions in Mecklenburg County, has prepared a multi-jurisdictional hazard mitigation plan with input from the appropriate local and state officials; and

WHEREAS, the North Carolina Division of Emergency Management has reviewed the Mecklenburg County Multi-Jurisdictional 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 Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan to review for

legislative compliance and approve following the completion of local adoption procedures.

NOW, THEREFORE, be it resolved that the Board of Commissioners of the Town of Davidson hereby:

1. Adopts the Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan.

2. Agrees to take such other official action as may be reasonably necessary to carry out the objectives of the Hazard Mitigation Plan.

Adopted on the 26 day of January 2021

Rusty Knox, Mayor

Attest:

Elizabeth K. Shores, Town Clerk

Town of Huntersville
NORTH CAROLINA

RESOLUTION ADOPTING THE MECKLENBURG COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

WHEREAS, the Town of Huntersville 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 Huntersville 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 Huntersville 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 Huntersville 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 Huntersville; and

WHEREAS, the Town of Huntersville, in coordination with all other participating jurisdictions in Mecklenburg County, has prepared a multi-jurisdictional hazard mitigation plan with input from the appropriate local and state officials; and

WHEREAS, the North Carolina Division of Emergency Management has reviewed the Mecklenburg County Multi-Jurisdictional 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 Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan to review for legislative compliance and approve following the completion of local adoption procedures;

NOW, THEREFORE, BE IT RESOLVED that the Board of Commissioners of the Town of Huntersville hereby:

1. Adopts the Mecklenburg County Multi-Jurisdictional 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 19th Day of October.

Mayor John Aneralla

Town Clerk Janet Pierson

Town of Huntersville 1873 North Carolina

Resolution No. R-2020-42

Town of Matthews North Carolina

RESOLUTION ADOPTING THE MECKLENBURG COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

WHEREAS, the Town of Matthews 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 Matthews 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 Matthews 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 Matthews 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 Matthews; and

WHEREAS, the Town of Matthews, in coordination with all other participating jurisdictions in Mecklenburg County, has prepared a multi-jurisdictional hazard mitigation plan with input from the appropriate local and state officials; and

WHEREAS, the North Carolina Division of Emergency Management has reviewed the Mecklenburg County Multi-Jurisdictional 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 Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan to review for legislative compliance and approve following the completion of local adoption procedures;

NOW, THEREFORE, BE IT RESOLVED that the Town Council of the Town of Matthews hereby:

1. Adopts the Mecklenburg County Multi-Jurisdictional 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 28th day of September 2020

John F. Higdon
Mayor John F. Higdon

Lori Canapinno
Town Clerk Lori Canapinno

RESOLUTION OF ADOPTION MECKLENBURG COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

WHEREAS, The Town of Mint Hill 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 Mint Hill 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 Mint Hill 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 Mint Hill 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 The Town of Mint Hill; and,

WHEREAS, The Town of Mint Hill, in coordination with all other participating jurisdictions in Mecklenburg County, has prepared a multi-jurisdictional hazard mitigation plan with input from the appropriate local and state officials; and,

WHEREAS, the North Carolina Division of Emergency Management has reviewed the Mecklenburg County Multi-Jurisdictional 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 Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan to review for legislative compliance and approve following the completion of local adoption procedures;

NOW, THEREFORE, BE IT RESOLVED that the Mint Hill Board of Commissioners of The Town of Mint Hill hereby:

1. Adopts the Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan; and
2. Agrees to take such other official action as may be reasonably necessary to carry out the proposed actions of the Plan.

Adopted February 11, 2021.

TOWN OF MINT HILL, NORTH CAROLINA

Brad Simmons, Mayor

Attest:

Michelle Wells, Town Clerk
Town of Mint Hill

Item 9.

Pineville
NORTH CAROLINA

Resolution No. 2020-04 Adopting the Mecklenburg County
Multi-Jurisdictional Hazard Mitigation Plan

Whereas, the Town of Pineville 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 Pineville 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 Mayor and Pineville 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 Mayor and Pineville Town Council to fulfill its obligation under North Carolina General Statues, 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 Pineville; and

Whereas, the Town of Pineville, in coordination with all other participating jurisdictions in Mecklenburg County, has prepared a multi-jurisdictional hazard mitigation plan with input from the appropriate local and state officials; and

Whereas, the North Carolina Division of Emergency Management has reviewed the Mecklenburg County Multi-Jurisdictional 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 Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan to review for legislative compliance and approve following the completion of local adoption procedures;

Now, Therefore, Be It Resolved That, the Mayor and Pineville Town Council, hereby:

1. Adopt the Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan; and
2. Agree to take such other official action as may be reasonably necessary to carry out the proposed actions of the Plan.

IN WITNESS WHEREAS, we have hereunto set our hand and caused the **GREAT SEAL OF PINEVILLE** to be affixed. Done and ordered this twenty-sixth day of October in the year of our Lord two thousand and twenty.

Mayor Jack Edwards

Mayor Pro Tem Melissa Davis

Council Member Joe Maxim

Council Member Les Gladden

Council Member Amelia Stinson-Wesley

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Annex A Mecklenburg County

A.1 PLANNING PROCESS

The table below lists the HMPC members who represented Mecklenburg County unincorporated areas.

Table A.1 – HMPC Members

Representative	Agency/Department
Ted Panagiotopoulos	County Fire Department
David Love	County Stormwater
David Kroening	County Stormwater
Tim Trautman	County Stormwater
Dave Canaan	County Stormwater
Matthew Bixler	County FMO
Andrew Bridges	County FMO
Andy Goretti	Mecklenburg County GIS
John McCulloch	County Stormwater
Travis Cryan	Duke Energy

A.2 COMMUNITY PROFILE

Geography

Mecklenburg County is located in the south-central portion of North Carolina, in the Piedmont Region, along the border with South Carolina. It is neighbored by Union and Cabarrus Counties to the east, Lincoln and Gaston Counties to the west, and Iredell County to the North. It is part of the Charlotte-Concord-Gastonia, NC-SC Metropolitan Statistical Area. The County comprises a total land area of approximately 524 square miles.

Mecklenburg County was named after Charlotte of Mecklenburg-Strelitz in commemoration of her marriage to King George III of the United Kingdom. The County was formed in 1762 from the then western portion of Anson County, at which point the boundaries extended into South Carolina. The County's current boundaries were finalized in 1842.

According to data from the U.S. Fish and Wildlife Service's National Wetlands Inventory, there are approximately 78,707 acres of wetlands in the unincorporated areas of the County.

Population and Demographics

Table A.2 provides population counts and growth estimates for the County's unincorporated areas as compared to the county overall.

Table A.2 – Population Counts, Unincorporated Mecklenburg County, 2010-2018

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
Unincorporated Mecklenburg County	70,060	48,222	50,674	2,452	5.1%
Mecklenburg County Total	**695,454**	**919,628**	**1,054,314**	**134,686**	**14.6%**

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 Mint Hill and Davidson include population residing in adjacent counties.

Housing

Table A.3 details housing unit counts for Mecklenburg County unincorporated areas as compared to the county overall. Overall, housing unit estimates increased by just under one percent in unincorporated Mecklenburg County. 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 Mecklenburg County, 2010-2018

Housing Characteristics	Mecklenburg County	Unincorporated Mecklenburg County
Housing Units (2010)	**398,510**	19,694
Housing Units (2018)	**435,795**	19,884
Housing Units Percent Change (2010-2018)	**9.36%**	0.96%

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 Mecklenburg County unincorporated areas in order to estimate the total physical exposure to hazards in this area. 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.

Table A.4 – Critical Infrastructure & Key Resources by Type

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	EM	Government Facilities	Healthcare	Transportation Systems	Energy	Emergency Services	Water	Total
Unincorporated Mecklenburg County	14	3	0	691	0	397	0	181	25	288	4	0	0	**1,603**

Source: NCEM Risk Management Tool

Table A.5 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Unincorporated Mecklenburg County	80	201	87	24	2	66	3	**463**

Source: NCEM Risk Management Tool

Table A.6 – IRISK Inventory of Building Counts and Values

Jurisdiction	Building Count	Building Value
Unincorporated Mecklenburg County	24,114	$5,887,969,839

Source: NCEM Risk Management Tool

A.3.1 Dam Failure

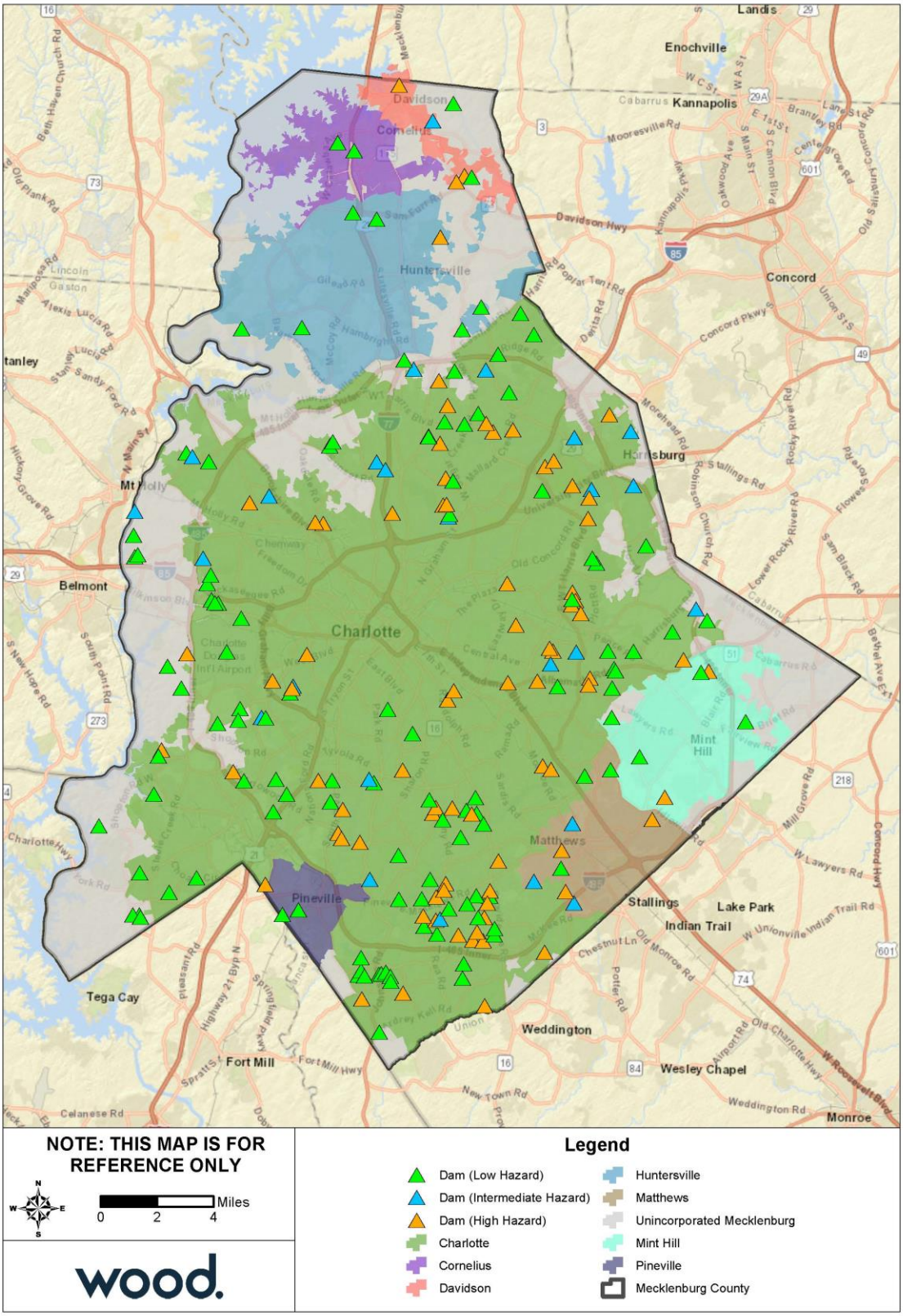
Table A.7 lists all high hazard dams identified by the North Carolina Dam Inventory as of July 2018. Dam locations throughout Mecklenburg County are shown in Figure A.1.

Table A.7 – High Hazard Dams in Unincorporated Mecklenburg County

Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
Eastfield Station Dam	NC05851	Fair	17	-

Source: NC Dam Inventory, July 2018

Figure A.1 – Dam Locations, Unincorporated Mecklenburg County



Source: NC Dam Inventory, July 2018

A.3.2 Flood

Table A.8 details the acreage of unincorporated Mecklenburg County's total area by flood zone on the effective DFIRM. Per this assessment, over 19 percent of the unincorporated area in the County falls within the mapped 1%-annual-chance floodplains.

Table A.8 – Flood Zone Acreage in Unincorporated Mecklenburg County

Flood Zone	Acreage	Percent of Total (%)
Zone AE	15,750.94	19.32%
Zone X (500-year)	112.44	0.14%
Zone X Unshaded	65,681.22	80.55%
Total	**81,544.60**	--

Source: FEMA Effective DFIRM

Figure A.2 reflects the effective mapped flood hazard zones for Alamance County, and Figure A.3 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

Table A.9 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.10 summarizes high potential loss property vulnerability by sector and flood event.

Table A.9 – Critical Facilities Exposed to Flooding, Unincorporated Mecklenburg County

Sector	Event	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	100 Year	2	$132,207
	500 Year	4	$2,082,214
Critical Manufacturing	100 Year	2	$97,239
	500 Year	4	$278,665
Food and Agriculture	500 Year	5	$19,234
All Categories	**100 Year**	**6**	**$230,681**
	500 Year	**14**	**$2,385,916**

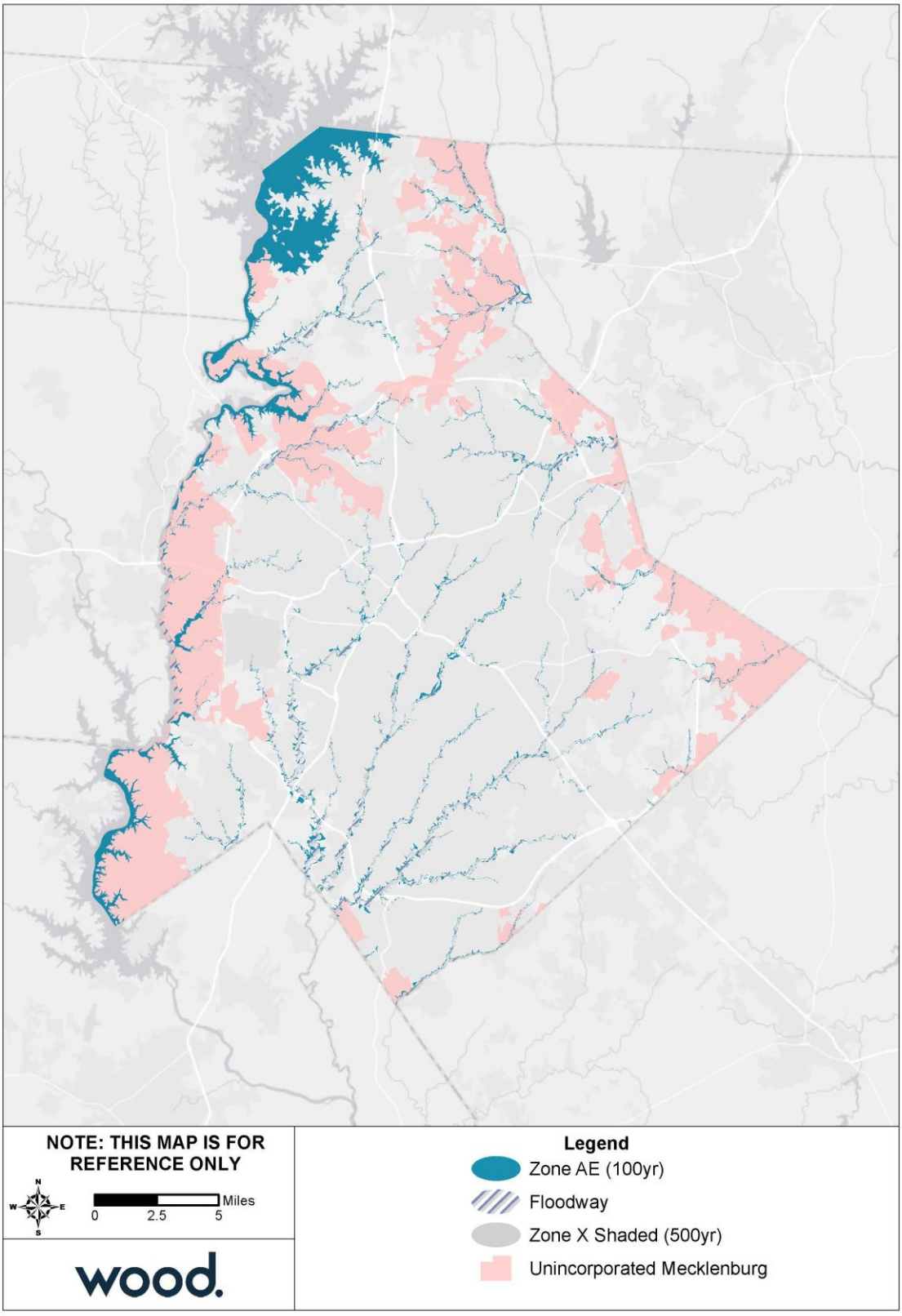
Source: NCEM Risk Management Tool

Table A.10 – High Potential Loss Properties Exposed to Flooding, Unincorporated Mecklenburg County

Category	Event	Number of Buildings at Risk	Estimated Damages
Residential	100 Year	2	$188,443
All Categories	**100 Year**	**2**	**$188,443**

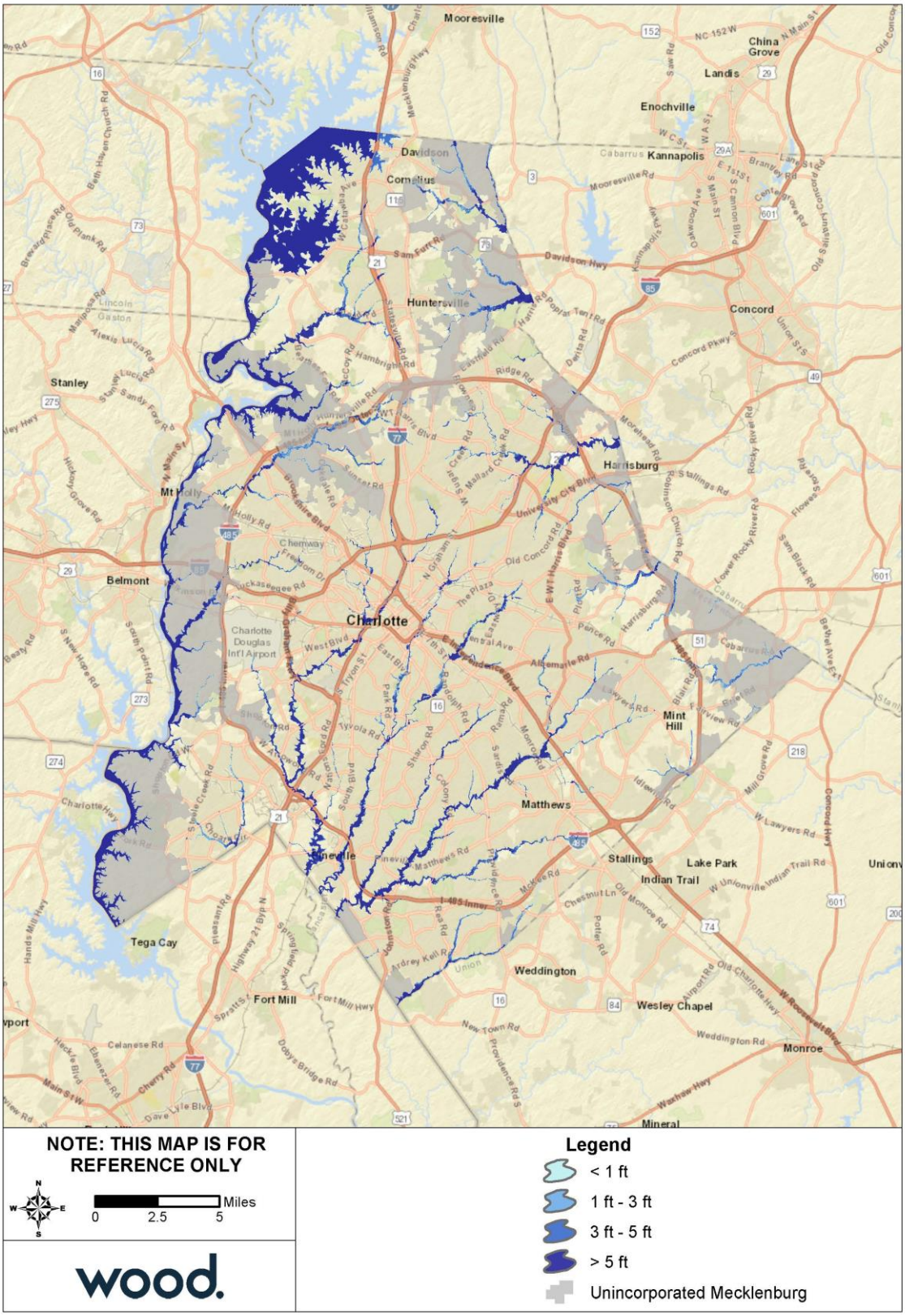
Source: NCEM Risk Management Tool

Figure A.2 – FEMA Flood Hazard Areas, Unincorporated Mecklenburg County



Source: FEMA Effective DFIRM

Figure A.3 – Flood Depth, 1%-Annual-Chance Floodplain, Unincorporated Mecklenburg County



Source: FEMA Effective DFIRM

A.3.3 Wildfire

Table A.11 summarizes the acreage in Mecklenburg 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 32 percent of unincorporated Mecklenburg County is not included in the WUI.

Table A.11 – Wildland Urban Interface Acreage, Mecklenburg County

	Housing Density	Total Acreage	Percent of Total Acreage
	Not in WUI	26,220.59	32.2%
	LT 1hs/40ac	7,888.40	9.7%
	1hs/40ac to 1hs/20ac	5,773.25	7.1%
	1hs/20ac to 1hs/10ac	8,691.22	10.7%
	1hs/10ac to 1hs/5ac	9,744.08	11.9%
	1hs/5ac to 1hs/2ac	11,582.45	14.2%
	1hs/2ac to 3hs/1ac	10,785.71	13.2%
	GT 3hs/1ac	858.91	1.1%
	Total	**81,544.60**	

Source: Southern Wildfire Risk Assessment

Figure A.4 depicts the WUI for Mecklenburg 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.5 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 Mecklenburg 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, although there are areas within the City of Charlotte and nearby suburbs outside of the WUI. Burn probability is low throughout most of the county. A small portion of unincorporated Mecklenburg County, approximately 2.6 percent, may experience a Class 4 Fire Intensity, which poses significant harm or damage to life and property. Another 12 percent of the unincorporated areas 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 unincorporated area is either non-burnable (27.7%) or would face a Class 1 or Class 2 Fire Intensity, which are easily suppressed.

Table A.12 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table A.13 provides counts and estimated damages for High Potential Loss Properties in unincorporated Mecklenburg County.

Table A.12 – Critical Facilities Exposed to Wildfire, Unincorporated Mecklenburg County

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	1	$764,495
Commercial Facilities	86	$76,763,915
Critical Manufacturing	32	$47,980,019
Food and Agriculture	5	$117,133,851
Government Facilities	38	$74,519,941
Healthcare and Public Health	7	$7,390,943
Transportation Systems	18	$39,466,167
All Categories	**187**	**$364,019,331**

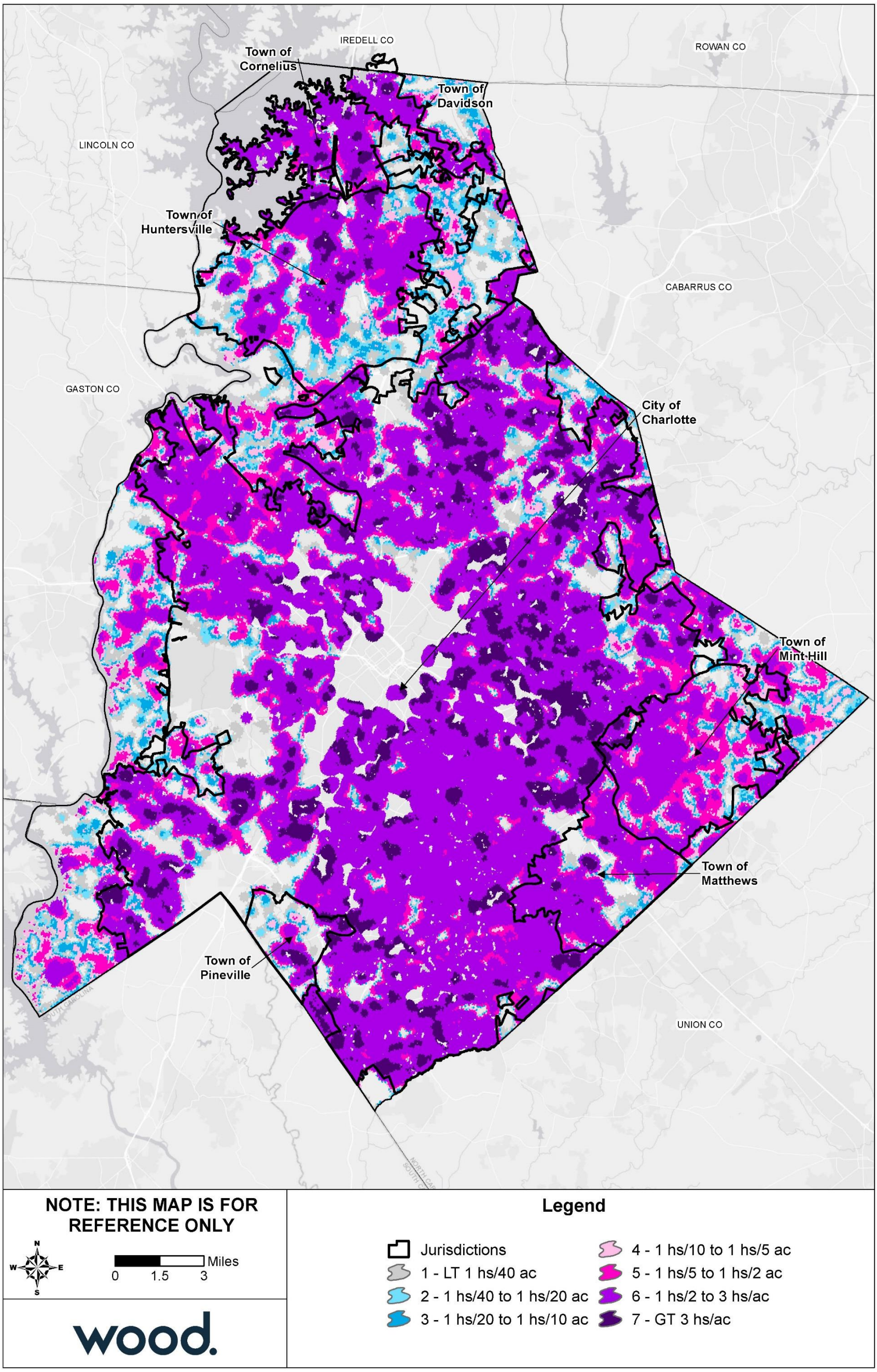
Source: NCEM Risk Management Tool

Table A.13 – High Potential Loss Properties Exposed to Wildfire, Unincorporated Mecklenburg County

Category	Number of Buildings at Risk	Estimated Damages
Agricultural	2	$116,758,417
Commercial	22	$63,048,650
Government	3	$70,182,245
Industrial	8	$39,341,762
Religious	16	$27,428,714
Residential	11	$37,897,947
All Categories	**62**	**$354,657,735**

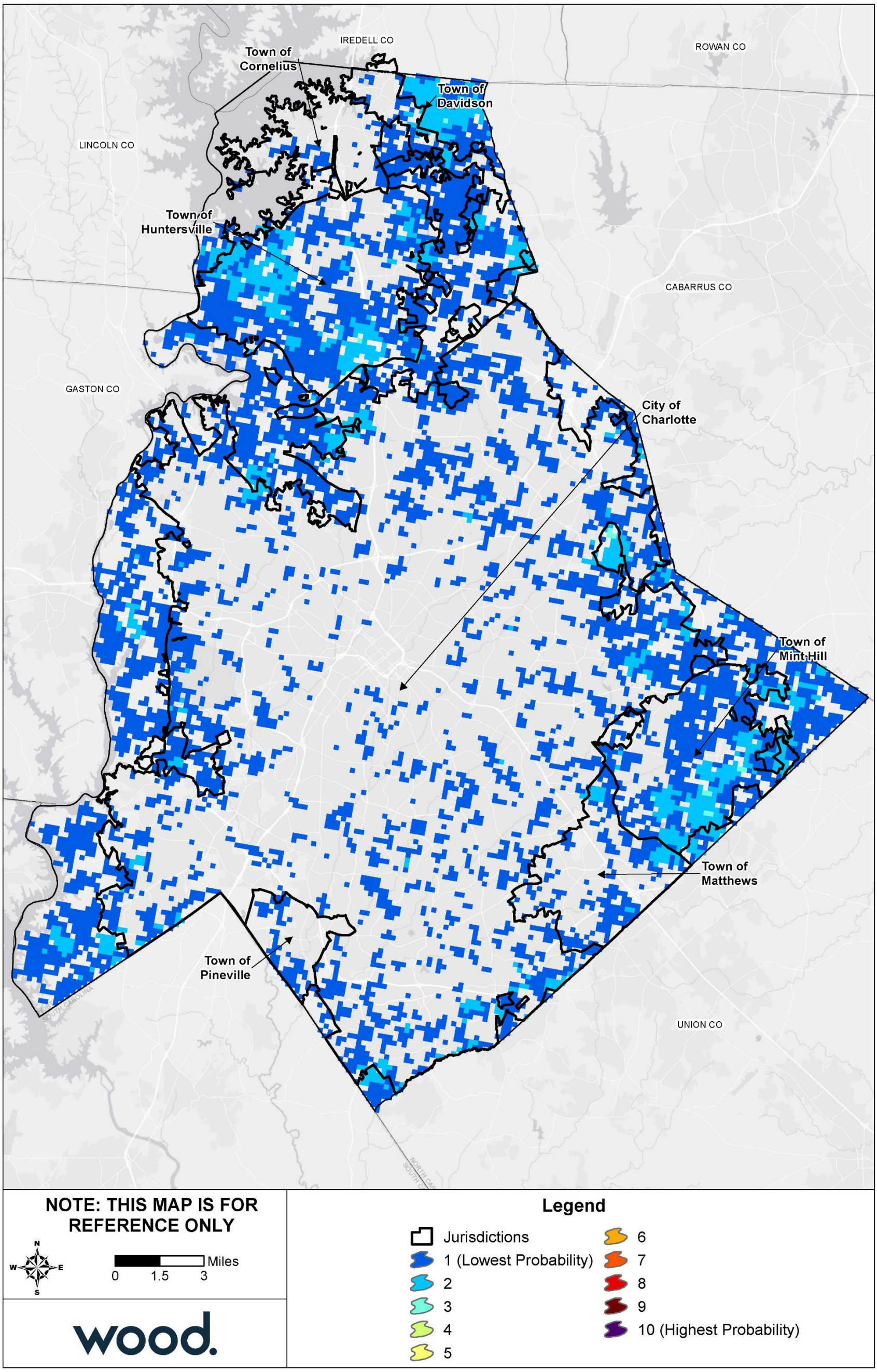
Source: NCEM Risk Management Tool

Figure A.4 – Wildland Urban Interface, Mecklenburg County



Source: Southern Wildfire Risk Assessment

Figure A.5 – Burn Probability, Mecklenburg 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 Mecklenburg 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, Mecklenburg County has a high capability rating overall. The County is currently developing a Post-Disaster Redevelopment Ordinance to set mitigation requirements for post-disaster reconstruction, which will improve regulatory capability. The County has strong administrative, fiscal, outreach and mitigation capability. The County self-assessed its own capability as moderate, particularly pointing to their education and outreach capabilities.

A.4.2 Floodplain Management

Mecklenburg County joined the NFIP emergency program in 1973 and has been a regular participant in the NFIP since June 1981. Mecklenburg County participates in the Community Rating System and is currently 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 A.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	174	$107,991	$47,819,300	168	$3,754,615.41
2-4 Family	1	$376	$350,000	2	$1,045.63
All Other Residential	31	$7,558	$3,758,300	7	$66,116.00
Non Residential	6	$18,766	$3,104,100	9	$389,970.70
Total	**212**	**$134,691**	**$55,031,700**	**186**	**$4,211,747.74**

Source: FEMA Community Information System, accessed May 2020

Table A.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	66	$74,603	$16,991,800	78	$2,618,910.66
A Zones	35	$10,013	$4,641,200	43	$536,332.98
B, C & X Zone					
Standard	17	$15,618	$4,740,700	38	$879,634.45
Preferred	94	$34,457	$28,658,000	21	$179,513.88
Total	**212**	**$134,691**	**$55,031,700**	**180**	**$4,214,391.97**

Source: FEMA Community Information System, accessed May 2020

Table A.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	25	$41,023	$5,270,600	45	$1,926,691.34
A Zones	0	$0	$0	38	$439,409.74
B, C & X Zone	21	$10,857	$5,946,700	36	$914,112.63
Standard	6	$5,579	$1,829,700	26	$796,080.88
Preferred	15	$5,278	$4,117,000	11	$124,046.36
Total	**46**	**$51,880**	**$11,217,300**	**119**	**$3,280,213.71**

Source: FEMA Community Information System, accessed May 2020

Table A.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	41	$33,580	$11,721,200	33	$692,219.32
A Zones	35	$10,013	$4,641,200	5	$96,923.24
B, C & X Zone	90	$39,218	$27,452,000	22	$139,021.09
Standard	11	$10,039	$2,911,000	12	$83,553.57
Preferred	79	$29,179	$24,541,000	10	$55,467.52
Total	**166**	**$82,811**	**$43,814,400**	**60**	**$928,163.65**

Source: FEMA Community Information System, accessed May 2020

A.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Mecklenburg-1	Seek grant funding to retrofit 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, 320 or 361 compliant safe rooms, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	1.3	Moderate	Property Protection	Mecklenburg County Code Enforcement & Mecklenburg County Fire Marshal's Office	TBD	Local, State, Federal	More than 5 years	Carry Forward	Identified specific locations for improvements. Retrofits not yet completed due to competing priorities.
Mecklenburg-2	Maintain continued compliance with the National Flood Insurance Program (NFIP) through implementation and periodic evaluation of the following higher regulatory standards (in addition to basic required compliance actions): a) Development standards linked to Community Floodplain (Future Conditions) b) Require critical facilities protection to 500-year flood levels c) Require parking lots to be elevated (no more than six inches deep in any parking space during Community Flood event) d) Require dry land access for new or substantially improved buildings (above Community Flood BFE) e) Levee restrictions f) Cumulative substantial damage improvement provision g) Prohibit basements below flood level on filled lots	Flood	4.1	High	Prevention	Mecklenburg County / Storm Water	TBD	SWS Operating budget / grant	More than 5 years	Carry Forward	County revised floodplain ordinance in November 2018 following extensive review by stakeholder group, advisory council, and County attorney. Goal was to improve clarity, conform with state model ordinance, and adopt newly effective FIRM panels. Higher standards maintained.
Mecklenburg-3	Continue participation in the NFIP Community Rating System (CRS) with the goal of increasing CRS credit points to become a Class 5 community or better within five years.	Flood	4.1	High	Prevention	Mecklenburg County / Storm Water	TBD	SWS Operating budget	2-3 years	Carry Forward	Mecklenburg County has maintained participation in the CRS and is currently a Class 6 community.
Mecklenburg-4	Update Flood Insurance Rate Maps to provide most accurate depiction of flood risk.	Flood	4.1	High	Public Education & Awareness	Mecklenburg County / Storm Water	TBD	Storm Water Services Capital Fund / CTP grant	More than 5 years	Carry Forward	Several FIRM panels were revised in 2018.
Mecklenburg-5	Identify, fund, and implement eligible flood mitigation projects. FEMA-defined and locally verified "repetitive loss properties" to receive high priority.	Flood	1.1	High	Property Protection	Mecklenburg County / Storm Water	Variable	FEMA Unified Hazard Mitigation Assistance / Storm Water Services capital fund	More than 5 years	Carry Forward	In the interval since 2015 HMP update 61 flood-prone buildings have been acquired and demolished at a cost of $16.8M (93% local / 7% federal) Two FMA grants awarded for structure elevation, budget shortfall prevented project implementation. Floodplain Stream Restoration grant application and Acquisition /Demolition grant application submitted under NCDEM HMGP DR-4393 (Florence), FEMA review pending

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Mecklenburg-6	Research possibility of using new H&H models to provide flood forecasting in the Flood Information Notification System (FINS). Research possibility of FINS system to provide inundation mapping based on results of new H&H models and explore alternate methods and expansion into other locations.	Flood	3.2	Moderate	Prevention	Mecklenburg County Storm Water	TBD	TBD	More than 5 years	New	Combination of 2010 actions #6 & #7.
Mecklenburg-7	As determined necessary and upon request from municipal jurisdictions, provide informative presentations and/or work sessions for newly elected officials and new appointees to planning commissions and appeals/variance boards to provide an overview of floodplain management, the importance of participating in the NFIP, and the implications of failing to enforce the requirements of the program or failing to properly handle variance requests. On an annual basis, coordinate with Charlotte-Mecklenburg Emergency Management on a widespread public outreach activity to provide information on all natural hazards facing the area to local residents, including methods for mitigating and preventing damages from hazardous conditions and how to respond when an imminent hazard threatens. On an annual basis, coordinate with Charlotte-Mecklenburg Emergency Management to provide information on all natural hazards facing the area to local planning staff and elected officials. This should be combined with an annual progress report on the status of local mitigation actions as identified in the Multijurisdictional Hazard Mitigation Plan.	All Hazards	2.1	Moderate	Public Education & Awareness	Charlotte-Mecklenburg Emergency Management Office/ Mecklenburg County Storm Water	Staff time	Local	2020-2025	New	Implementation in progress. Combination of 2010 actions #10, #11, & #12 to align with an overall Program for Public Information.
Mecklenburg-8	Install back-up emergency generators at the following critical facilities/emergency shelters: Tuckaseegee Recreation Center, Grady Cole Center, Naomi Drennan Recreation Center	All Hazards	1.3	Low	Property Protection	County Asset and Facility Management	$925,000	Mecklenburg County Capital Reserve	2-3 years	New	

Annex B City of Charlotte

B.1 PLANNING PROCESS

The table below lists the HMPC members who represented the City of Charlotte.

Table B.1 – HMPC Members

Representative	Agency
Tony Bateman	CMEMO
Matt Gustis	Charlotte Stormwater
Alex Alcorn	City Manager's Office
Tommy Wendelgass	Charlotte Water
Andy Babson	E&PM
Robert Graham	CMEMO
Tim Hartsell	Charlotte Fire
Andrew DeCristofaro	CMSWS
Daryl Hammock	Charlotte Stormwater
Kevin Martin	UNC Charlotte
Josh Runfola	UNC Charlotte
Shawn Kiley	UNC Charlotte

B.2 COMMUNITY PROFILE

Geography

The City of Charlotte is located in central Mecklenburg County. The City is neighbored by Huntersville to the northwest, Matthews and Mint Hill to the east, and Pineville to the southwest. Charlotte is the largest city in the Charlotte-Concord-Gastonia Metropolitan Statistical Area, which falls within the Charlotte-Concord Combined Statistical Area. As of July 1, 2019, Charlotte is the 15th largest city in the Country by population and the largest in North Carolina. Charlotte comprises a total area of 297.68 square miles, approximately 57 percent of Mecklenburg County's total land area.

According to data from the U.S. Fish and Wildlife Service's National Wetlands Inventory, there are approximately 15,444 acres of wetlands in Charlotte.

Population and Demographics

Table B.2 provides population counts and growth estimates for the City of Burlington as compared to Mecklenburg County. Table B.3 provides demographic information for Charlotte as compared to the county and the state.

Table B.2 – Population Counts, Charlotte, 2010-2018

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
City of Charlotte	540,828	731,424	841,611	110,187	15.1%
Mecklenburg County	**695,454**	**919,628**	**1,054,314**	**134,686**	**14.6%**

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

Table B.3 – Demographics and Social Characteristics, Charlotte, 2018

Demographic & Social Characteristics	Charlotte	Mecklenburg County	North Carolina
Median Age	34.1	35	38.6
% of Population Under 5 years old	6.8%	6.8%	5.9%
% of population Over 65 years old	10.0%	10.6%	15.5%
% of Population Over 25 with high school diploma	88.9%	90.1%	87.4%
% of Population Over 25 with bachelor's degree or higher	43.5%	44.8%	30.5%
% with Disability	8.4%	8.4%	13.6%
% Speak English less than "very well"	10.1%	8.9%	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 Charlotte as compared to the county overall and the state.

Table B.4 – Housing Statistics, Charlotte, 2010-2018

Housing Characteristics	Charlotte	Mecklenburg County	North Carolina
Housing Units (2010)	319,918	398,510	4,327,528
Housing Units (2018)	351,143	435,795	4,573,066
Housing Units Percent Change (2010-2018)	9.76%	9.36%	5.67%
Housing Occupancy Rate	92.2%	92.6%	85.7%
% Owner-Occupied	52.9%	56.5%	65.0%
Average Household Size	2.6	2.56	2.52
% of Housing Units with no Vehicles Available	6.7%	5.9%	5.9%
% of Housing Units that are mobile homes	1.1%	1.4%	13.0%
Median Home Value	$200,500	$219,800	$165,900

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 Charlotte as compared to the county and the state.

Table B.5 – Economic Statistics, Charlotte, 2018

Demographic & Social Characteristics	Charlotte	Mecklenburg County	North Carolina
Median Household Income	$60,886	$64,312	$52,413
Per Capita Income	$36,426	$37,298	$29,456
Unemployment Rate	6.2%	5.8	6.3%
% of Individuals Below Poverty Level	14.0	12.7	15.4
% Without Health Insurance	12.8	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 in this section are: Dam Failure, Flood, and Wildfire.

Asset Inventory

The following tables summarize the asset inventory for Charlotte in order to estimate the total physical exposure to hazards in this area. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted and displayed. Due to the high volume of CIKR facilities, a map of these buildings is not provided. However, maps of CIKR impacted by specific hazards are provided where applicable in Section 4 of this plan. Building counts provided in Table B.8 are from 2018. Because the City has experienced growth and development since then, these numbers may underestimate actual risk.

Building counts are provided based on data from the NCEM IRISK database.

Table B.6 – Critical Infrastructure & Key Resources by Type

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	EM	Government Facilities	Healthcare	Transportation Systems	Energy	Emergency Services	Water	Total
City of Charlotte	2	215	2	7,784	2	4,466	2	1,841	504	2,897	12	0	1	**17,728**

Source: NCEM Risk Management Tool

Table B.7 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
City of Charlotte	2,723	2,577	1,430	476	0	364	5	**7,575**

Source: NCEM Risk Management Tool

Table B.8 – IRISK Inventory of Building Counts and Values

Jurisdiction	Building Count	Building Value
City of Charlotte	246,117	$77,729,315,165

Source: NCEM Risk Management Tool

B.3.1 Dam Failure

Table B.9 lists the high hazard dams in the City of Charlotte identified by the North Carolina Dam Inventory as of July 2018. The locations of these dams throughout Charlotte are shown in Figure B.1.

Table B.9 – High Hazard Dams in City of Charlotte

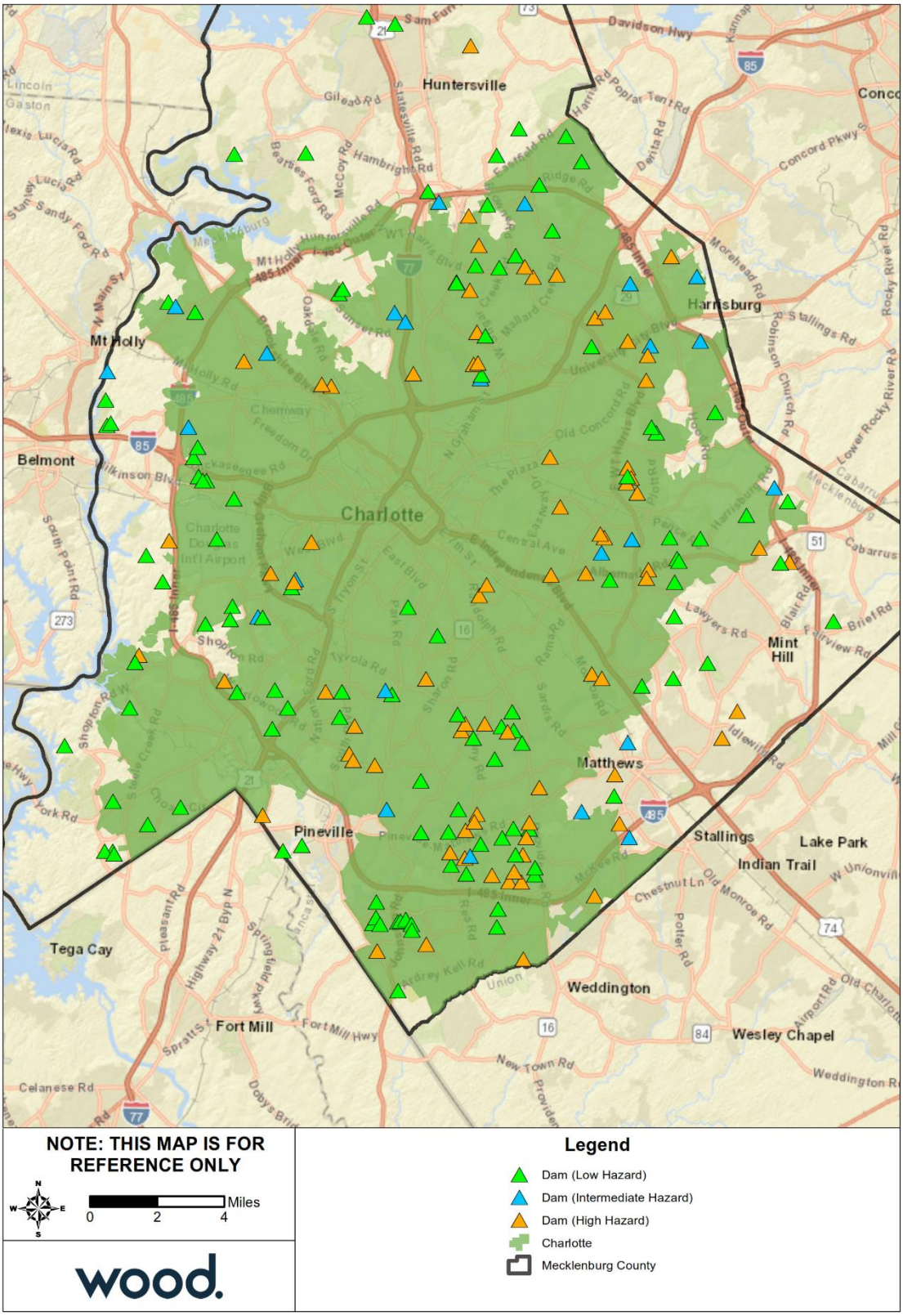
Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
Quail Acres Dam	NC00218	Fair	69	Matthews
Griffith Dam #1	NC03399	Fair	108	Derita
Windermere Dam	NC00401	Fair	52	Pineville
Danga Lake Dam	NC00417	Fair	59	Red River Sc
Arrowood Quarry Dam	NC01217	Fair	365	Pineville
Billingsley Dam	NC03400	Fair	10	Charlotte
Forest Lake Dam	NC01691	Fair	60	Charlotte

Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
Delta Lake Dam	NC01692	Fair	68	Charlotte
Moody Pond Dam	NC03402	Fair	38	
Linda Lake Dam	NC03403	Fair	45	Charlotte
Oakwood Lane Dam	NC03410	Fair	46	Charlotte
Ardrey Park Dam	NC03414	Fair	15.5	
Lock Lane Dam	NC03415	Fair	14.44	Charlotte
Sharon Lake Upper Dam	NC01696	Not Rated	29	Charlotte
Lake Plaza Dam	NC03419	Fair	30	Charlotte
Pellynwood Lake Dam	NC03421	Fair	73	Charlotte
Giverney Dam	NC03423	Fair	26.8	Charlotte
Methodist Home Dam	NC03425	Fair	78	Charlotte
Reddmans Pier Dam	NC03431	Fair	16	Charlotte
Lakeside Drive Dam	NC03432	Fair	52	Charlotte
O'Dillon Lake Dam	NC03434	Fair	76	
Quail Hollow West Dam	NC03443	Fair	23.4	Charlotte
Sharon Lake Lower Dam	NC03444	Fair	60	Charlotte
Village Lake Dam	NC03445	Fair	42.6	Charlotte
Lake Providence Dam	NC03447	Fair	40	
Hideaway Bay Dam	NC03448	Poor	42	Charlotte
Ivey's Pond Dam	NC03449	Not Rated	62.5	Charlotte
University Place Dam	NC03453	Fair	192.6	Charlotte
Withrow Dam	NC03455	Fair	48	Charlotte
Baucom Lake Dam	NC03459	Fair	48	Charlotte
Davis Lake Subdivision Dam	NC03460	Fair	172.8	Charlotte
Clearwater Lake Dam At Runaway Bay	NC03462	Fair	25.3	Charlotte
Harris Pond Dam	NC03465	Fair	3.4	
Hidden Landing Dam	NC03467	Fair	36	Charlotte
Raintree Dam #O	NC03468	Fair	31.4	Charlotte
Raintree Dam #2	NC03469	Fair	43	Charlotte
Raintree Dam #4	NC03470	Fair	11	Charlotte
Raintree Dam #7	NC03471	Fair	72	Charlotte
Radbourne Subdivision Dam	NC03474	Fair	20	Charlotte
Beverly Crest Dam	NC03486	Fair	460	Charlotte
Piper Glen Dam B	NC04814	Not Rated	36	Charlotte
Franklin Treatment Plant 250 Mg Raw Water Reservoir	NC04816	Fair	777	Charlotte
Fernhill Pond Dam	NC04818	Fair	54	Charlotte
Francis Beatty Park Dam	NC04819	Fair	67	Charlotte
Cobblestone Dam	NC04821	Fair	17	Charlotte
Cottonwood Dam	NC04825	Fair	8.4	Charlotte
Arnold Palmer Dam	NC04881	Fair	9.4	Charlotte
Ballantrae At Piper Glen	NC05315	Fair	8	Charlotte
Jordan Dam	NC05317	Fair	15.8	Charlotte
University Place On The Green Dam	NC05326	Fair	12	Charlotte
Peter's Lake Dam At The Villas	NC05329	Fair	26.4	Charlotte

Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
Carson Pond Dam	NC05332	Fair	17.6	Charlotte
Franklin Treatment Plant Raw Water Reservoir	NC05333	Poor	917	Charlotte
Lakeview Dam At Faires Farm	NC05337	Not Rated	10.7	Charlotte
Irwin Creek Flood Protection Dike	NC05344	Fair	0	Charlotte
Muddy Pond Dam	NC05346	Fair	8	Charlotte
Pierson Pond Dam	NC05348	Fair	8.97	Charlotte
Lakepointe Corporate Center Dam	NC05349	Fair	10.2	Charlotte
Symphony Park Dam	NC05566	Fair	23	Charlotte
Winery Lane Dam	NC05616	Fair	7	Charlotte
Berewick Farm Pond Dam #2	NC05678	Fair	15	
Carolina Golf and Country Club Irrigation Dam	NC05830	Fair	110	
Resource Square WQ Pond Dam	NC05849	Fair	25	Charlotte
Hunter Acres Pond Dam	NC05881	Fair	27	
Hechenbleikner Dam	NC05961	Fair	16	
McDonald Dam	NC05988	Fair	0	Charlotte
Samonds Dam	NC05992	Fair	11	Charlotte
Walden Two Dam	NC06144	Not Rated	32	
Reformed Theological Seminary Dam	NC0TEMP	Fair	0	Charlotte

Source: NC Dam Inventory, July 2018

Figure B.1 – Dam Locations, City of Charlotte



Source: NC Dam Inventory, July 2018

B.3.2 Flood

Table B.10 details the acreage of the City of Charlotte's total area by flood zone on the effective DFIRM. Per this assessment, over 5 percent of the City's total area falls within the mapped 1%-annual-chance floodplains.

Table B.10 – Flood Zone Acreage in the City of Charlotte

Flood Zone	Acreage	Percent of Total (%)
Zone AE	10,424.91	5.27%
Zone X (500-year)	28.61	0.01%
Zone X Unshaded	187,306.95	94.71%
Total	**197,760.46**	--

Source: FEMA Effective DFIRM

Figure B.2 reflects the effective mapped flood hazard zones for the City of Charlotte, and Figure B.3 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

Table B.11 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector and flood event in the City of Charlotte. Table B.12 provides building counts and estimated damages for high potential loss facilities exposed to flooding by category and event in Charlotte. Note that these tables do not account for potential damages from localized stormwater flooding.

Table B.11 – Critical Facilities Exposed to Flooding, City of Charlotte

Sector	Event	Number of Buildings at Risk	Estimated Damages
Banking and Finance	500 Year	1	$65,634
Commercial Facilities	10 Year	8	$179,342
	25 Year	28	$808,445
	50 Year	46	$1,773,627
	100 Year	61	$3,391,686
	500 Year	107	$8,786,683
Critical Manufacturing	10 Year	23	$1,266,950
	25 Year	42	$2,598,034
	50 Year	66	$3,410,123
	100 Year	107	$4,855,238
	500 Year	164	$14,339,531
Government Facilities	10 Year	2	$71,013
	25 Year	3	$167,885
	50 Year	4	$270,353
	100 Year	9	$479,464
	500 Year	22	$1,614,256
Healthcare and Public Health	25 Year	1	$3,658
	50 Year	1	$31,196
	100 Year	1	$58,227
	500 Year	2	$87,058
Transportation Systems	10 Year	14	$1,492,200
	25 Year	18	$3,022,963
	50 Year	19	$3,658,721
	100 Year	23	$5,005,226
	500 Year	36	$12,287,739

Sector	Event	Number of Buildings at Risk	Estimated Damages
All Categories	**10 Year**	**47**	**$3,009,505**
	25 Year	**92**	**$6,600,985**
	50 Year	**136**	**$9,144,020**
	100 Year	**201**	**$13,789,841**
	500 Year	**332**	**$37,180,901**

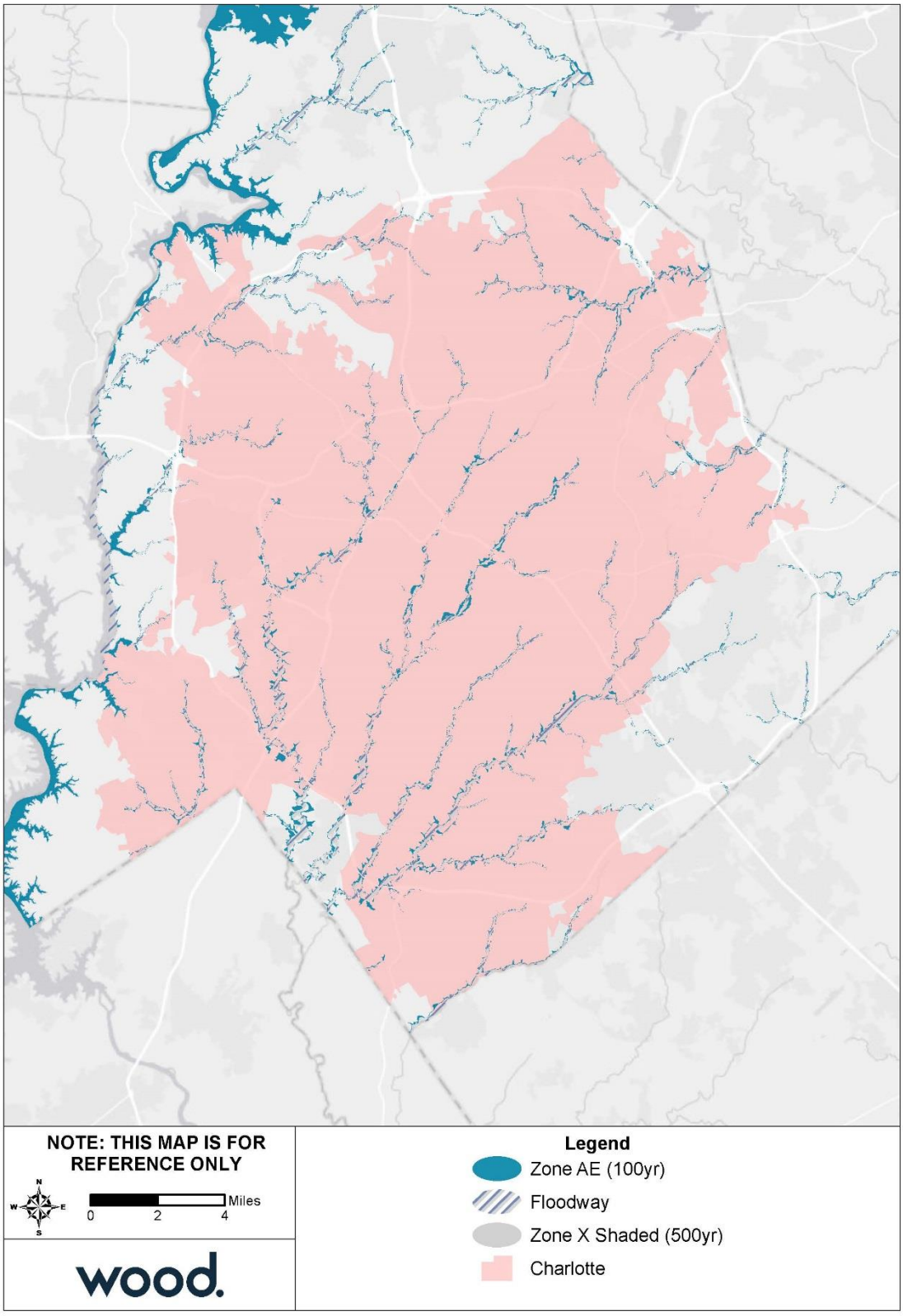
Source: NCEM Risk Management Tool

Table B.12 – High Potential Loss Properties Exposed to Flooding, City of Charlotte

Category	Event	Number of Buildings at Risk	Estimated Damages
Commercial	10 Year	2	$1,162,265
	25 Year	4	$2,291,250
	50 Year	6	$3,003,915
	100 Year	12	$5,168,111
	500 Year	23	$16,910,785
Government	25 Year	1	$71,792
	50 Year	1	$140,000
	100 Year	2	$259,912
	500 Year	5	$1,000,664
Industrial	10 Year	3	$626,825
	25 Year	6	$1,236,240
	50 Year	7	$1,593,595
	100 Year	8	$2,392,423
	500 Year	12	$6,685,230
Religious	500 Year	1	$197,911
Residential	25 Year	4	$57,900
	50 Year	14	$2,531,452
	100 Year	22	$14,272,421
	500 Year	48	$57,414,655
All Categories	**10 Year**	**5**	**$1,789,090**
	25 Year	**15**	**$3,657,182**
	50 Year	**28**	**$7,268,962**
	100 Year	**44**	**$22,092,867**
	500 Year	**89**	**$82,209,245**

Source: NCEM Risk Management Tool

Figure B.2 – FEMA Flood Hazard Areas, City of Charlotte



Source: FEMA Effective DFIRM

Figure B.3 – Flood Depth, 1%-Annual Chance Floodplain, City of Charlotte

Source: FEMA Effective DFIRM

B.3.3 Wildfire

Table B.13 summarizes the acreage in the City of Charlotte 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 Charlotte is not included in the WUI.

Table B.13 – Wildland Urban Interface Acreage, City of Charlotte

	Housing Density	Total Acreage	Percent of Total Acreage
	Not in WUI	34,331.15	17.4%
	LT 1hs/40ac	4,947.35	2.5%
	1hs/40ac to 1hs/20ac	2,654.09	1.3%
	1hs/20ac to 1hs/10ac	3,987.78	2.0%
	1hs/10ac to 1hs/5ac	5,760.36	2.9%
	1hs/5ac to 1hs/2ac	14,495.91	7.3%
	1hs/2ac to 3hs/1ac	107,799.28	54.5%
	GT 3hs/1ac	23,768.13	12.0%
	Total	197,744.04	

Source: Southern Wildfire Risk Assessment

Figure A.4 depicts the WUI for all incorporated areas in Mecklenburg County, including the City of Charlotte. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure A.5 depicts Burn Probability based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Figure B.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 Charlotte. Over half of the City is non-burnable, however there are some small clusters of moderate potential fire intensity along the edges of the city and in the north central portion of Charlotte. Overall, less than one half of one percent of the City has a potential fire intensity of Class 4.

Table B.14 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table B.15 provides counts and estimated damages for High Potential Loss Properties in the City of Charlotte.

Table B.14 – Critical Facilities Exposed to Wildfire, City of Charlotte

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	4	$2,346,363
Commercial Facilities	216	$446,132,353
Critical Manufacturing	51	$161,317,025
Government Facilities	31	$114,881,688
Healthcare and Public Health	17	$23,918,784
Transportation Systems	41	$310,156,349
All Categories	**360**	**$1,058,752,562**

Source: NCEM Risk Management Tool

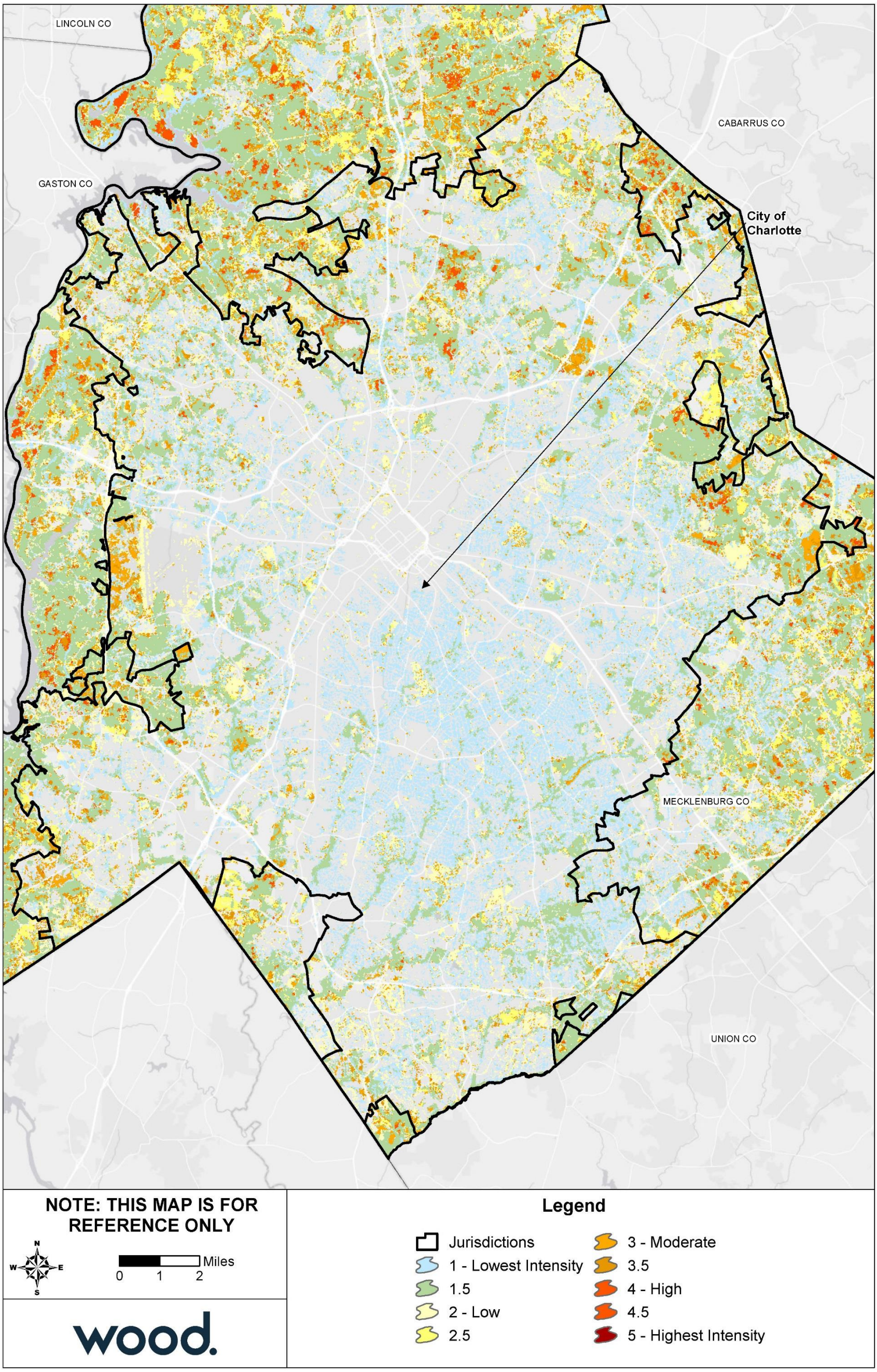
Table B.15 – High Potential Loss Properties Exposed to Wildfire, City of Charlotte

Category	Number of Buildings at Risk	Estimated Damages
Commercial	68	$672,068,964
Government	15	$109,004,432
Industrial	19	$159,490,191
Religious	14	$36,328,626

Category	Number of Buildings at Risk	Estimated Damages
Residential	26	$212,670,305
All Categories	**142**	**$1,189,562,518**

Source: NCEM Risk Management Tool

Figure B.4 – Fire Intensity Scale, City of Charlotte



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 Charlotte 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/ to increase emergency preparedness. The City has strong administrative, fiscal, outreach, and structural mitigation capability. The City Self-Assesses their own capability as high in all of these categories.

B.4.2 Floodplain Management

The City of Charlotte joined the NFIP emergency program in 1973 and has been a regular participant in the NFIP since August 1978. The City is a participant in the Community Rating System and is a Class 4 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 B.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	2,152	$1,131,332	$591,762,800	1,551	$17,286,244.90
2-4 Family	87	$78,296	$15,643,200	111	$1,995,363.29
All Other Residential	572	$369,208	$129,444,100	511	$14,420,914.63
Non Residential	158	$342,728	$71,370,700	159	$7,345,158.09
Total	**2,969**	**$1,921,564**	**$808,220,800**	**2,332**	**$41,047,680.91**

Source: FEMA Community Information System, accessed May 2020

Table B.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	1,275	$1,131,308	$297,282,400	1,601	$33,270,907.45
A Zones	2	$2,483	$467,900	23	$651,656.85
B, C & X Zone					
Standard	272	$217,091	$72,039,500	475	$5,008,781.00
Preferred	1,420	$570,682	$438,431,000	209	$2,125,544.05
Total	**2,969**	**$1,921,564**	**$808,220,800**	**2,308**	**$41,056,889.35**

Source: FEMA Community Information System, accessed May 2020

Table B.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	644	$805,943	$121,334,400	1,341	$30,311,181.41
A Zones	0	$0	$0	18	$360,279.60
B, C & X Zone	531	$279,700	$164,000,600	589	$5,697,107.35
Standard	127	$117,407	$37,778,600	449	$4,644,572.19
Preferred	404	$162,293	$126,222,000	141	$1,082,184.47
Total	**1,175**	**$1,085,643**	**$285,335,000**	**1,948**	**$36,368,568.36**

Source: FEMA Community Information System, accessed May 2020

Table B.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	631	$325,365	$175,948,000	260	$2,959,726.04
A Zones	2	$2,483	$467,900	5	$291,377.25
B, C & X Zone	1,161	$508,073	$346,469,900	92	$1,403,116.84
Standard	145	$99,684	$34,260,900	26	$364,208.81
Preferred	1,016	$408,389	$312,209,000	68	$1,043,359.58
Total	**1,794**	**$835,921**	**$522,885,800**	**357**	**$4,654,220.13**

Source: FEMA Community Information System, accessed May 2020

B.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Charlotte-1	Consider the need to add or revise existing policies or regulations to more thoroughly address natural hazards during the update of the City's Zoning Ordinance.	All Hazards	4.1	Moderate	Prevention	City of Charlotte Planning Department, in coordination with Emergency Management and Storm Water Division	Local Staff time	Planning Department budget	2020-2025	Carry Forward	Under development- Stormwater regulations will be incorporated in the Charlotte Unified Development Ordinance.
Charlotte-2	Enhance area planning activities to better address potential natural hazards.	All Hazards	4.1	Moderate	Prevention	City of Charlotte Planning Department, in coordination with Emergency Management and Storm Water Division	Local Staff time	Planning Department budget	2020-2025	Carry Forward	Under development- These elements will be considered and incorporated in the Charlotte 2040 Comprehensive Plan.
Charlotte-3	Maintain continued compliance with the National Flood Insurance Program (NFIP) through implementation and periodic evaluation of the following higher regulatory standards (in addition to basic required compliance actions): a) Development standards linked to Community Floodplain (Future Conditions); b) Require critical facilities protection to 500-year flood levels; c) Require parking lots to be elevated (no more than six inches deep in any parking space during Community Flood event); d) Require dry land access for new or substantially improved buildings (above Community Flood BFE); e) Levee restrictions; f) Cumulative substantial damage improvement provision; g) Prohibit basements below flood level on filled lots	Flood	4.1	High	Prevention	Storm Water Division, in coordination with CMSWS	Local staff time	N/A	2020-2025	Carry Forward	In Progress: A stakeholder group (made up of staff, advisory committee members, engineers, developers and environmental representatives) is evaluating and recommending changes to floodplain ordinances as part of the Physical Map Revision PMR3 that is effective November 16, 2018.
Charlotte-4	Continue participation in the NFIP Community Rating System (CRS) with the goal of increasing CRS credit points to become a Class 4 community or better within five years.	Flood, Dam & Levee Failure	4.1	High	Prevention	Storm Water Division, in coordination with CMSWS	Local staff time	N/A	2020-2025	Carry Forward	Class 4 achieved and continuing participating.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Charlotte-5	Seek opportunities to provide information and education to Planning staff regarding risks associated with natural hazards and potential prevention/mitigation planning strategies.	All Hazards	2.1	Moderate	Prevention	City of Charlotte Planning Department, in coordination with Emergency Management and Storm Water Division	Local staff time	Emergency Management and/or other staff to provide training and/or utilize resources made available through the American Planning Association (including PAS Report: Integrating Hazard Mitigation into Local Planning)	2020-2025	Carry Forward	Planning staff will continue to seek American Planning Association (APA) related training in conjunction with American Institute of Certified Planners (AICP) Certification Maintenance (CM) credits. On April 12, 2019, we hosted a group viewing of the **Principles for Preparing a Community's Disaster Recovery Plan** webinar. The 2-hour course is sponsored by the APA Hazard Mitigation and Disaster Recovery Planning Division and **eligible for 2 CM credits**.
Charlotte-6	On an annual basis, coordinate with municipalities on a widespread public outreach activity to provide information on all natural hazards facing the area to local residents, including methods for mitigating and preventing damages from hazardous conditions and how to respond when an imminent hazard threatens.	All Hazards	2.3	Moderate	Public Education & Awareness	Emergency Management	Local staff time and resources	Emergency Management budget/EMPG	2020-2025	Carry Forward	All Hazards Advisory Committee (AHAC) Conference held 11-14-19
Charlotte-7	On an annual basis, coordinate with municipalities to provide information on all natural hazards facing the area to local planning staff and elected officials. This should be combined with an annual progress report on the status of local mitigation actions as identified in the Multi-jurisdictional Hazard Mitigation Plan.	All Hazards	3.1	Moderate	Public Education & Awareness	Emergency Management	Local staff time and resources	Emergency Management budget/EMPG	2020-2025	Carry Forward	All Hazards Advisory Committee (AHAC) Conference held 11-14-19
Charlotte-8	Implement spring public information campaign aimed at tornado and severe weather awareness to include information on safe rooms.	Tornadoes, Severe Weather	2.1	Moderate	Public Education & Awareness	Emergency Management	$3,000	Storm Water Services budget, FEMA and American Red Cross materials free of charge (see FEMA Publication 320— Taking Shelter from the Storm: Building a Safe Room Inside Your House), Department of Homeland Security— Citizen Corps	2021	Carry Forward	Severe Weather Week occurred March 2020. Charlotte is a Storm Ready Community

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Charlotte-9	Train emergency responders and managers for flood emergencies.	Flood	3.1	Moderate	Emergency Services	City of Charlotte Fire Department	$50,000	Emergency Management Performance Grants (EMPG), Emergency Management Institute, Department of Justice— State and Local Domestic Preparedness Exercise Support, Department of Homeland Security—Citizen Corps	2020-2025	Carry Forward	EM has conducted annual trainings
Charlotte-10	Equip emergency responders and managers for flood emergencies, including swift water rescue.	Flood	3.1	Moderate	Emergency Services	City of Charlotte Fire Department	$100,000	Hazard Mitigation Grant Program (7% set aside), Emergency Management Performance Grants (EMPG)	2020-2025	Carry Forward	Equipment evaluation is underway.
Charlotte-11	Conduct disaster drills for division managers.	All Hazards	3.1	Moderate	Emergency Services	City of Charlotte Fire Department	$25,000	Department of Justice—State and Local Domestic Preparedness Exercise Support, Department of Justice— State and Local Domestic Preparedness Training Program, FEMA—First Responder Counter-Terrorism Training assistance, Department of Homeland Security—Citizen Corps	2020-2025	Carry Forward	Tabletop exercises (TTX) held in multiple hazard areas
Charlotte-12	Provide and maintain NIMS training for all KBE's, division heads and key government officials.	All Hazards	3.1	Moderate	Emergency Services	City of Charlotte Fire Department	$25,000	Emergency Management Institute, Department of Homeland Security—Citizen Corps	2020-2025	Carry Forward	On-going ICS/NIMS training programs have been established.
Charlotte-13	Develop evacuation routes that are not adversely affected by flooding.	All Hazards	3.3	Moderate	Emergency Services	City of Charlotte Department of Transportation	Local staff time and resources	N/A	2020-2025	Carry Forward	Coordinating with 83rd Civil Affairs Battalion, US Army, in ongoing planning and consultation
Charlotte-14	Improve the dissemination of hazard information, including maps, broadcasts, Internet Web site(s) and listservs.	All Hazards	2.1	Moderate	Public Education & Awareness	Emergency Management	Local staff time and resources	N/A, FEMA and American Red Cross materials free of charge, Department of Homeland Security—Citizenship Education and Training	2020-2025	Carry Forward	All Hazards Advisory Committee (AHAC) Conference was held 11-14-19
Charlotte-15	Provide information regarding encroachments, abandonments, new construction, and leases.	All Hazards	2.1	Moderate	Public Education & Awareness	Code Enforcement, Planning	Local staff time and resources	N/A	2020-2025	Carry Forward	City zoning and planning provide ongoing outreach
Charlotte-16	Inspect the condition of 50% of the critical assets (culverts greater than 48 inches that are under City-maintained streets) on a regular schedule (every 5 years).	Flood, Dam/Levee Failure	1.3	High	Prevention	Storm Water Services Division	Local staff time	Storm Water Services budget	2021-2025	New	

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Charlotte-17	Identify, rank and prioritize capital improvement projects. Revising current criteria to strategically prioritize work by managing our assets.	Flood, Dam/Levee Failure	1.1	High	Prevention	Storm Water Services Division	Local staff time	Storm Water Services budget	2021-2025	New	
Charlotte-18	Initiate (plan, design and construct) capital improvement projects to improve 20 linear miles of system between 2020 and 2025.	Flood, Dam/Levee Failure	1.1	High	Structural Projects	Storm Water Services Division	To be determined	Storm Water Services budget	2021-2025	New	
Charlotte-19	Identify and map known areas/streets subject to flooding that are outside of currently mapped floodplain areas based on: (1) drainage concerns reported through 311; and (2) past incident reports from the Fire Department and the Charlotte-Mecklenburg Police Department for flooding calls, road closings, swift water rescues, etc.	Flood	2.1	Moderate	Prevention	Storm Water Services Division	Local staff time and resources	Storm Water Services budget	2021-2025	New	
Charlotte-20	Maintain continued compliance with the National Flood Insurance Program (NFIP) through implementation and periodic evaluation of the following higher regulatory standards (in addition to basic required compliance actions): a) Implement updates in methodology to Community Floodplain (Future Conditions) b) Additional 1-foot freeboard in the interim before Community Floodplains are updated	Flood	4.1	High	Prevention	Storm Water Services Division, in coordination with Charlotte-Mecklenburg Storm Water Services	Local staff time	N/A	2021-2025	New	
Charlotte-21	Strive to have all other NFIP Community Rating System (CRS) municipalities in Mecklenburg County reach a Class 5 rating or better.	Flood, Dam/Levee Failure	4.1	High	Prevention	Storm Water Services Division, in coordination with Charlotte-Mecklenburg Storm Water Services	Local staff time	N/A	2021-2025	New	
Charlotte-22	Create media campaign/message to relay to local media and the general public prior to forecasted severe storm events.	Flood, Hurricane & Tropical Storm, Severe Weather, Tornado, Dam/Levee Failure	3.2	Moderate	Public Education & Awareness	Storm Water Services Division, in coordination with Charlotte-Mecklenburg Storm Water Services, Charlotte Communications & Marketing and Mecklenburg County Public Information	Local staff time and resources	Storm Water Services budget	2021-2025	New	

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Charlotte-23	Conduct annual inspections on ponds/dams that City of Charlotte Storm Water Services has accepted maintenance responsibility.	Flood, Dam/Levee Failure	1.3	Moderate	Prevention	Storm Water Services Division	Local staff time and resources	Storm Water Services budget	2021-2025	New	
Charlotte-24	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, lightning protection, hail resistant roofing, and anchoring fixed building equipment.	All Hazards	1.1	Moderate	Property Protection	City of Charlotte	To be determined on a case-by-case basis	Local, State Grants, UHMA Grants, other federal grants	2021-2025	New	
Charlotte-25	Install and maintain backup generators or quick connect hook ups for mobile generators on any newly constructed City-owned critical facilities.	All Hazards	1.3	Moderate	Property Protection	City of Charlotte	To be determined on a case-by-case basis	Local, State Grants, UHMA Grants, other federal grants	2021-2025	New	
Charlotte-26	Develop a plan to identify and map fueling sites with underground storage tanks and either install backup generators or quick connect hook ups for mobile generators.	All Hazards	1.3	Moderate	Emergency Services	City of Charlotte	To be determined on a case-by-case basis	Local, State Grants, UHMA Grants, other federal grants	2021-2025	New	

Annex C Town of Cornelius

C.1 PLANNING PROCESS

The table below lists the HMPC members who represented the Town of Cornelius.

Table C.1 – HMPC Members

Representative	Agency/Department
Gary Fournier	Planning Department
Jennifer Thompson	Police Dept.
Ed Marxen	Resident

C.2 COMMUNITY PROFILE

Geography

The Town of Cornelius is located in northern Mecklenburg County. It is neighbored by Davidson to the northeast and Huntersville to the south. The Town is part of the Charlotte-Concord-Gastonia, NC-SC Metropolitan Statistical Area. Cornelius comprises a total land area of 12.1 square miles.

According to data from the U.S. Fish and Wildlife Service's National Wetlands Inventory, there are approximately 65 acres of wetlands in Cornelius.

Population and Demographics

Table C.2 provides population counts and growth estimates for the Town of Cornelius as compared to Mecklenburg County overall.

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
Town of Cornelius	11,969	24,866	28,649	3,783	15.2%
Mecklenburg County	**695,454**	**919,628**	**1,054,314**	**134,686**	**14.6%**

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates

Table C.3 provides demographic information for Cornelius as compared to the county and the state.

Table C.2 – Population Counts, Cornelius, 2010-2018

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
Town of Cornelius	11,969	24,866	28,649	3,783	15.2%
Mecklenburg County	**695,454**	**919,628**	**1,054,314**	**134,686**	**14.6%**

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, Cornelius 2018

Demographic & Social Characteristics	Town of Cornelius	Mecklenburg County	North Carolina
Median Age	40.5	35	38.6
% of Population Under 5 years old	4.5%	6.8%	5.9%
% of population Over 65 years old	13.5%	10.6%	15.5%

Demographic & Social Characteristics	Town of Cornelius	Mecklenburg County	North Carolina
% of Population Over 25 with high school diploma	97.4%	90.1%	87.4%
% of Population Over 25 with bachelor's degree or higher	54.5%	44.8%	30.5%
% with Disability	7.5%	8.4%	13.6%
% Speak English less than "very well"	1.7%	8.9%	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 Cornelius as compared to the County and State overall.

Table C.4 – Housing Statistics, Cornelius, 2010-2018

Housing Characteristics	Cornelius	Mecklenburg County	North Carolina
Housing Units (2010)	11,947	398,510	4,327,528
Housing Units (2018)	13,027	435,795	4,573,066
Housing Units Percent Change (2010-2018)	9%	9.36%	5.67%
Housing Occupancy Rate	92.8%	92.6%	85.70%
% Owner-Occupied	69.4%	56.5%	65%
Average Household Size	2.4	2.56	2.52
% of Housing Units with no Vehicles Available	1.5%	5.9%	5.9%
% of Housing Units that are mobile homes	0.4%	1.4%	13.0%
Median Home Value	$292,400	$219,800	$165,900

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 Cornelius as compared to the county and the state.

Table C.5 – Economic Statistics, Cornelius, 2018

Demographic & Social Characteristics	Cornelius	Mecklenburg County	North Carolina
Median Household Income	$88,366	$64,312	$52,413
Per Capita Income	$51,953	$37,298	$29,456
Unemployment Rate	4%	5.8%	6.3%
% of Individuals Below Poverty Level	7.4	12.7	15.4
% Without Health Insurance	8.3	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 in this section are: Flood, and Wildfire.

Asset Inventory

The following tables summarize the asset inventory for Cornelius in order to estimate the total physical exposure to hazards in this area. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted and displayed. Due to the high volume of CIKR facilities, a map of these buildings is not provided. However, maps of CIKR impacted by specific hazards

are provided where applicable in Section 4 of this plan. Building counts provided in Table C.8 are from 2018. Because the Town has experienced growth and development since then, these numbers may underestimate actual risk.

Table C.6 – Critical Infrastructure & Key Resources by Type

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	EM	Government Facilities	Healthcare	Transportation Systems	Energy	Emergency Services	Water	Total
Town of Cornelius	0	17	0	406	0	111	0	44	10	128	0	0	0	**716**

Source: NCEM Risk Management Tool

Table C.7 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Town of Cornelius	248	137	18	9	0	17	0	**429**

Source: NCEM Risk Management Tool

Table C.8 – IRISK Inventory of Building Counts and Values

Jurisdiction	Building Count	Building Value
Town of Cornelius	10,558	$3,186,097,055

Source: NCEM Risk Management Tool

C.3.1 Flood

Table C.9 details the acreage of the Town of Cornelius' total area by flood zone on the effective DFIRM. Per this assessment, over 5 percent of Cornelius falls within the mapped 1%-annual-chance floodplains.

Table C.9 – Flood Zone Acreage in the Town of Cornelius

Flood Zone	Acreage	Percent of Total (%)
Zone AE	459.88	5.58%
Zone X (500-year)	0.00	0.00%
Zone X Unshaded	7,789.07	94.42%
Total	**8,248.96**	--

Source: FEMA Effective DFIRM

Figure C.1 reflects the effective mapped flood hazard zones for the Town of Cornelius, and Figure C.2 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

There are no estimated damages to Critical Infrastructure and Key Resources (CIKR) buildings due to flooding in the Town of Cornelius, however there are two High Potential Loss Properties at risk. These properties are detailed by sector and flood event in Table C.10.

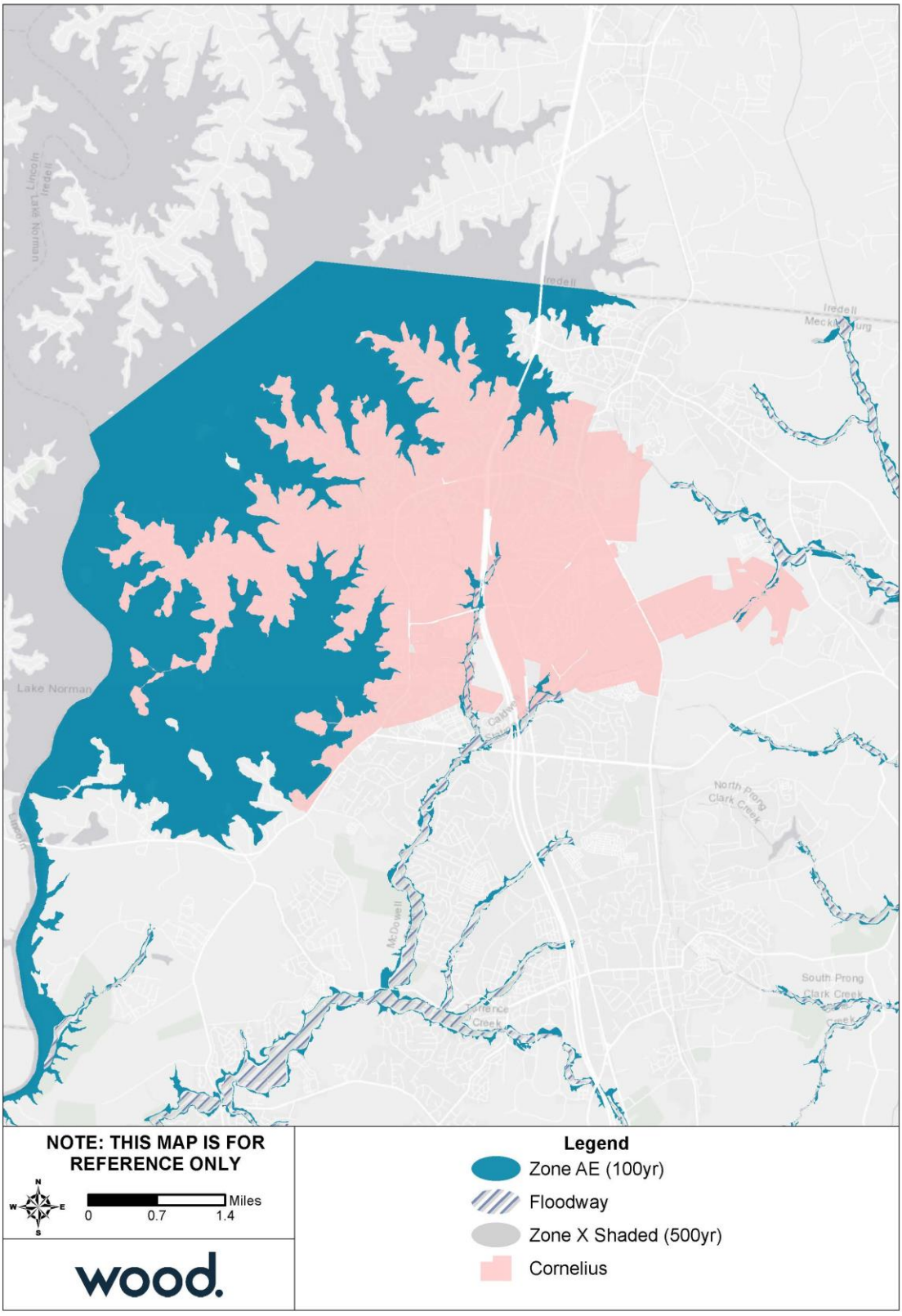
Table C.10 – High Potential Loss Properties Exposed to Flooding, Town of Cornelius

Category	Event	Number of Buildings at Risk	Estimated Damages
Residential	100 Year	2	$23,601

All Categories	**100 Year**	**2**	**$23,601**

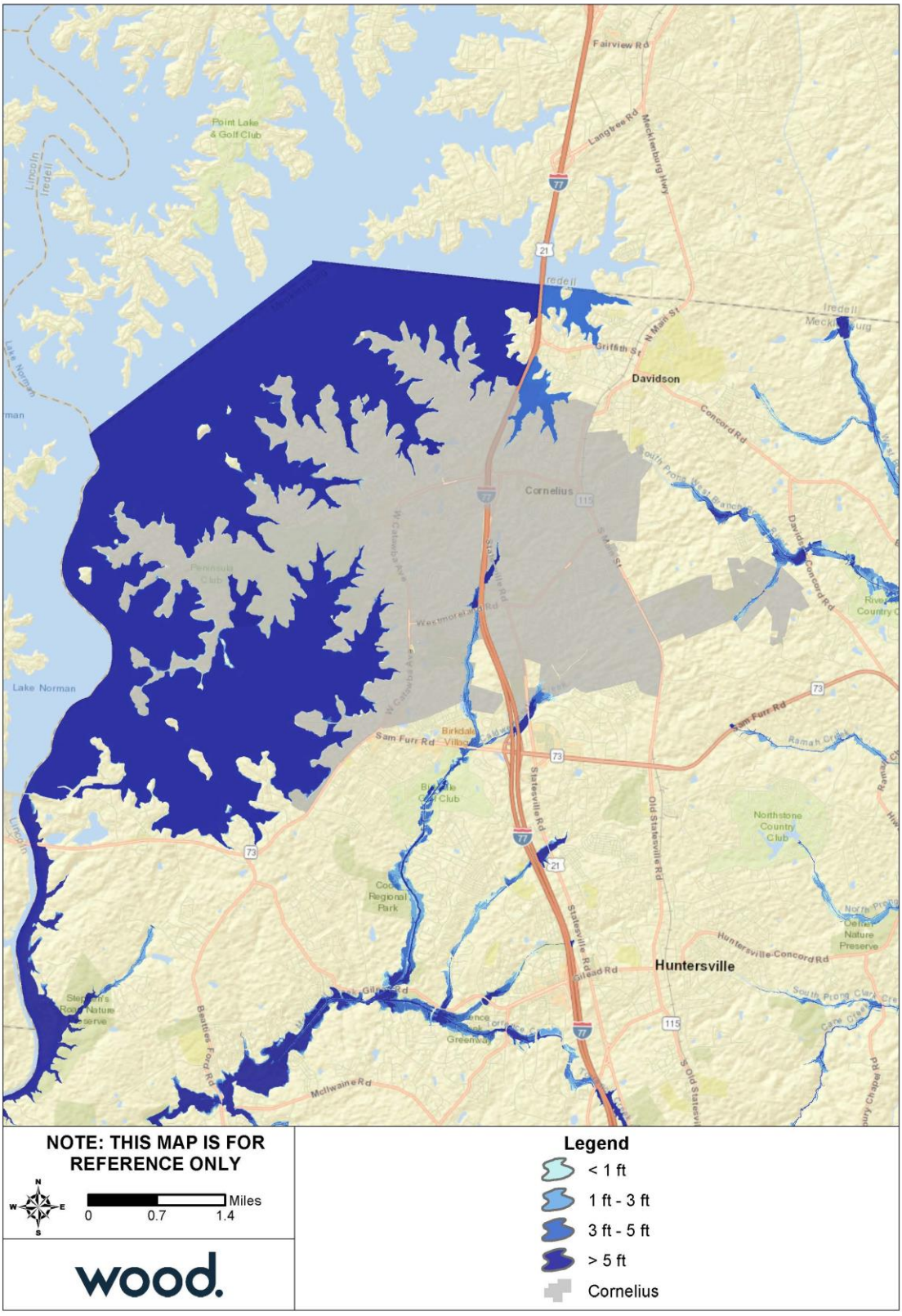
Source: NCEM Risk Management Tool

Figure C.1 – FEMA Flood Hazard Areas, Town of Cornelius



Source: FEMA Effective DFIRM

Figure C.2 – Flood Depth, 1%-Annual-Chance Floodplain, Town of Cornelius



Source: FEMA Effective DFIRM

C.3.2 Wildfire

Table C.11 summarizes the acreage in the Town of Cornelius 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 16 percent the Town of Cornelius is not included in the WUI.

Table C.11 – Wildland Urban Interface Acreage, Town of Cornelius

	Housing Density	Total Acreage	Percent of Total Acreage
	Not in WUI	1,324.40	16.1%
	LT 1hs/40ac	288.40	3.5%
	1hs/40ac to 1hs/20ac	143.79	1.7%
	1hs/20ac to 1hs/10ac	209.80	2.5%
	1hs/10ac to 1hs/5ac	248.71	3.0%
	1hs/5ac to 1hs/2ac	712.89	8.6%
	1hs/2ac to 3hs/1ac	4,768.80	57.8%
	GT 3hs/1ac	552.20	6.7%
	Total	8,248.99	

Source: Southern Wildfire Risk Assessment

Figure A.4 depicts the WUI for all incorporated areas in Mecklenburg County, including the Town of Cornelius. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure A.5 depicts Burn Probability for all of Mecklenburg County based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Figure C.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 Cornelius. There are clusters of moderate and high potential fire intensity is eastern and central- and south-western Cornelius. Overall, approximately one percent of the Town has a Class 4 fire intensity and only 11 percent has a Class 3 fire intensity while 48 percent of the Town is non-burnable. Therefore, in most of the Town a fire would be easily suppressed.

Table C.12 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table C.13 provides counts and estimated damages for High Potential Loss Properties in the Town of Cornelius.

Table C.12 – Critical Facilities Exposed to Wildfire, Town of Cornelius

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	2	$3,825,135
Commercial Facilities	82	$100,652,573
Critical Manufacturing	33	$39,386,690
Government Facilities	23	$24,940,659
Transportation Systems	41	$34,327,751
All Categories	**181**	**$203,132,808**

Source: NCEM Risk Management Tool

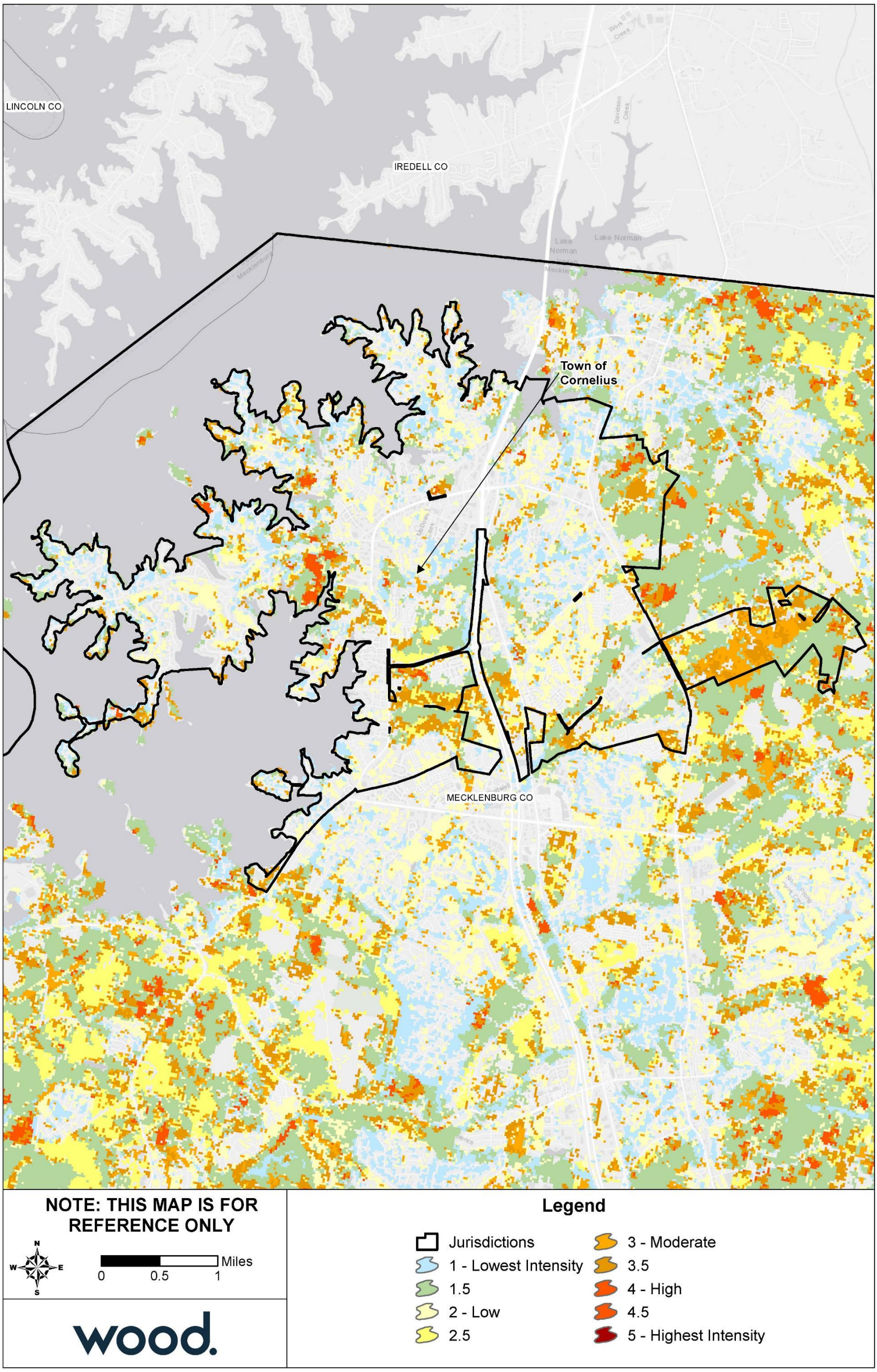
Table C.13 – High Potential Loss Properties Exposed to Wildfire, Town of Cornelius

Category	Number of Buildings at Risk	Estimated Damages
Commercial	30	$77,396,213
Government	3	$21,276,697
Industrial	2	$21,717,932
Religious	3	$22,283,804

Category	Number of Buildings at Risk	Estimated Damages
Residential	37	$139,658,905
All Categories	**75**	**$282,333,551**

Source: NCEM Risk Management Tool

Figure C.3 – Fire Intensity Scale, Town of Cornelius



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 Town of Cornelius are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, the Town has a moderate overall capability rating. The City could improve regulatory capability by developing and implementing a Flood Damage Prevention Ordinance to better address flood risk to properties. Additionally, much of the Town's planning and regulatory capability is provided through County wide plans or ordinances. The Town has limited administrative, fiscal, and outreach capabilities, but does not have structural mitigation experience.

C.4.2 Floodplain Management

The Town of Cornelius joined the NFIP through regular entry in September 1997 and has been a regular participant since. 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.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	125	$48,949	$40,786,200	6	$83,087.84
2-4 Family	3	$966	$735,000	0	$0.00
All Other Residential	8	$2,223	$1,400,000	2	$17,994.28
Non Residential	5	$3,659	$764,700	0	$0.00
Total	**141**	**$55,797**	**$43,685,900**	**8**	**$101,082.12**

Source: FEMA Community Information System, accessed May 2020

Table C.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	24	$9,015	$6,265,900	1	$0.00
B, C & X Zone					
Standard	3	$2,127	$950,000	1	$0.00
Preferred	114	$44,655	$36,470,000	6	$101,082.12
Total	**141**	**$55,797**	**$43,685,900**	**8**	**$101,082.12**

Source: FEMA Community Information System, accessed May 2020

Table C.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	1	$237	$7,500	1	$0.00
B, C & X Zone	8	$3,230	$2,800,000	1	$0.00
Standard	0	$0	$0	1	$0.00
Preferred	8	$3,230	$2,800,000	0	$0.00
Total	**9**	**$3,467**	**$2,807,500**	**2**	**$0.00**

Source: FEMA Community Information System, accessed May 2020

Table C.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	23	$8,778	$6,258,400	0	$0.00
B, C & X Zone	109	$43,552	$34,620,000	6	$101,082.12
Standard	3	$2,127	$950,000	0	$0.00
Preferred	106	$41,425	$33,670,000	6	$101,082.12
Grand Total	**132**	**$52,330**	**$40,878,400**	**6**	**$101,082.12**

Source: FEMA Community Information System, accessed May 2020

C.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Cornelius-1	Implement storm water mitigation projects, including the grading of ditches and replacing failing/potentially failing storm water structures.	Flood	1.2	High	Structural Projects	Town of Cornelius Public Works Department	$70,000	CMSWS funds	2020-2025	Carry Forward	Public Works identifies, prioritizes, and implements improvements annually.
Cornelius-2	Conduct an annual tabletop exercise addressing potential hazards faced by Town. This exercise would bring together representatives from all Town departments that would work together creating and implementing a plan to effectively deal with the hazard.	All Hazards	3.1	High	Emergency Services	Town of Cornelius Police Department and Public Works Department	$0	N/A	2020-2025	Carry Forward	No progress made due to limited staff availability and competing priorities.
Cornelius-3	Review the peninsula evacuation plan that was completed in 2014.	All Hazards	3.1	High	Emergency Services	Town of Cornelius Police Department and Public Works Department	Staff time	N/A	2020-2025	New	
Cornelius-4	Monitor utility companies, local, state, and federal websites and social media accounts, and push out information on the Town's website and social media platforms	All Hazards	2.1	High	Public Education & Awareness	Town of Cornelius Public Information Office	$0	N/A	2020-2025	New	
Cornelius-5	Update the Town's Land Use Plan and integrate the risk assessment findings and the mitigation goals and objectives into the plan.	All Hazards	4.1	Moderate	Prevention	Town of Cornelius Planning Department	Staff time	N/A	2021-2022	New	

Annex D Town of Davidson

D.1 PLANNING PROCESS

The table below lists the HMPC members who represented the Town of Davidson.

Table D.1 – HMPC Members

Representative	Agency/Department
Bo Fitzgerald	Fire Department
Penny Dunn	Police Dept.
Jesse Book	Public Works
Brad Johnson	Citizen

D.2 COMMUNITY PROFILE

Geography

The Town of Davidson is located in northern Mecklenburg County. A small portion of the Town extends north into Iredell County. All statistics summarized here are for the entirety of the Town of Davidson. It is neighbored by Cornelius and Huntersville to the southwest. The Town is part of the Charlotte-Concord-Gastonia, NC-SC Metropolitan Statistical Area. Davidson comprises a total land area of 5.8 square miles.

According to data from the U.S. Fish and Wildlife Service's National Wetlands Inventory, there are approximately 31,666 acres of wetlands in Davidson.

Population and Demographics

Table D.2 provides population counts and growth estimates for the Town of Davidson as compared to Mecklenburg County overall. Table D.3 provides demographic information for Davidson as compared to the county and the state.

Table D.2 – Population Counts, Davidson, 2010-2018

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
Town of Davidson	7,139	10,944	12,666	1,722	15.7%
Mecklenburg County	**695,454**	**919,628**	**1,054,314**	**134,686**	**14.6%**

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2014-2018 5-Year Estimates
Note: The total population of Davidson includes population residing in Iredell County.

Table D.3 – Demographic and Social Characteristics, Davidson, 2018

Demographic & Social Characteristics	Town of Davidson	Mecklenburg County	North Carolina
Median Age	36	35	38.6
% of Population Under 5 years old	5.6%	6.8%	5.9%
% of population Over 65 years old	13.2%	10.6%	15.5%
% of Population Over 25 with high school diploma	98.4%	90.10%	87.4%
% of Population Over 25 with bachelor's degree or higher	74%	44.80%	30.5%
% with Disability	6.7%	8.4%	13.6%
% Speak English less than "very well"	1.9%	8.9%	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 Davidson as compared to the County and State overall. Davidson's median home value is 92.4 percent higher than that of the County.

Table D.4 – Housing Statistics, Davidson, 2010-2018

Housing Characteristics	Davidson	Mecklenburg County	North Carolina
Housing Units (2010)	4,253	398,510	4,327,528
Housing Units (2018)	4,707	435,795	4,573,066
Housing Units Percent Change (2010-2018)	10.67%	9.36%	5.67%
Housing Occupancy Rate	90.8%	92.6%	85.70%
% Owner-Occupied	79.7%	56.5%	65%
Average Household Size	2.4	2.56	2.52
% of Housing Units with no Vehicles Available	2.2%	5.9%	5.9%
% of Housing Units that are mobile homes	0%	1.4%	13.0%
Median Home Value	$423,000	$219,800	$165,900

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 Davidson as compared to the county and the state. The median household income in the Town of Davidson is 144 percent higher than that of the County.

Table D.5 – Economic Statistics, Davidson, 2018

Demographic & Social Characteristics	Davidson	Mecklenburg County	North Carolina
Median Household Income	$128,255	$64,312	$52,413
Per Capita Income	$56,953	$37,298	$29,456
Unemployment Rate	3.2%	5.8%	6.3%
% of Individuals Below Poverty Level	3%	12.7	15.4
% Without Health Insurance	3.4%	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 Davidson in order to estimate the total physical exposure to hazards in this area. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted and displayed. Due to the high volume of CIKR facilities, a map of these buildings is not provided. However, maps of CIKR impacted by specific hazards are provided where applicable in Section 4 of this plan. Building counts provided Table D.8 are from 2018. Because the Town has experienced growth and development since then, these numbers may underestimate actual risk.

Table D.6 – Critical Infrastructure & Key Resources by Type

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	EM	Government Facilities	Healthcare	Transportation Systems	Energy	Emergency Services	Water	Total
Town of Davidson	0	3	0	101	1	35	0	35	9	137	0	0	0	**321**

Source: NCEM Risk Management Tool

Table D.7 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Town of Davidson	71	52	7	10	0	4	0	**144**

Source: NCEM Risk Management Tool

Table D.8 – IRISK Inventory of Building Counts and Values

Jurisdiction	Building Count	Building Value
Town of Davidson	3,871	$1,476,802,476

Source: NCEM Risk Management Tool

D.3.1 Dam Failure

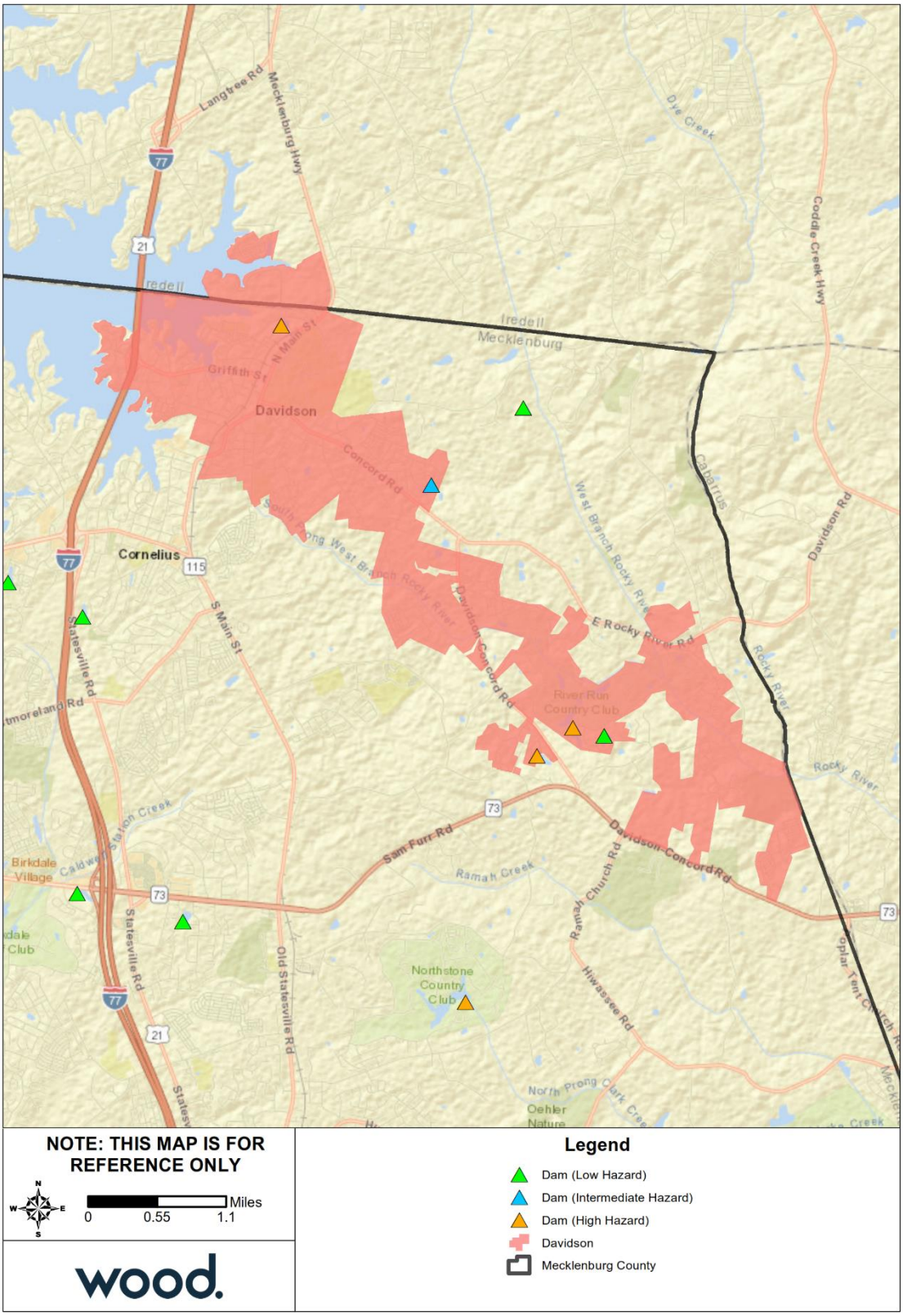
Table D.9 lists the high hazard dams in the Town of Davidson identified by the North Carolina Dam Inventory as of July 2018. All dam locations throughout Davidson are shown in Figure D.1.

Table D.9 – High Hazard Dams in Town of Davidson

Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
Maplecroft Dam	NC03479	Fair	30	
Beaty Dam	NC05328	Poor	11.7	Davidson
Page's Pond Dam	NC05351	Fair	25.5	Davidson

Source: NC Dam Inventory, July 2018

Figure D.1 – Dam Locations, Town of Davidson



Source: NC Dam Inventory, July 2018

D.3.2 Flood

Table D.10 details the acreage of the Town of Davidson's total area by flood zone on the effective DFIRM. Per this assessment, over 12 percent of the Davidson falls within the mapped 1%-annual-chance floodplains.

Table D.10 – Flood Zone Acreage in the City of Mebane

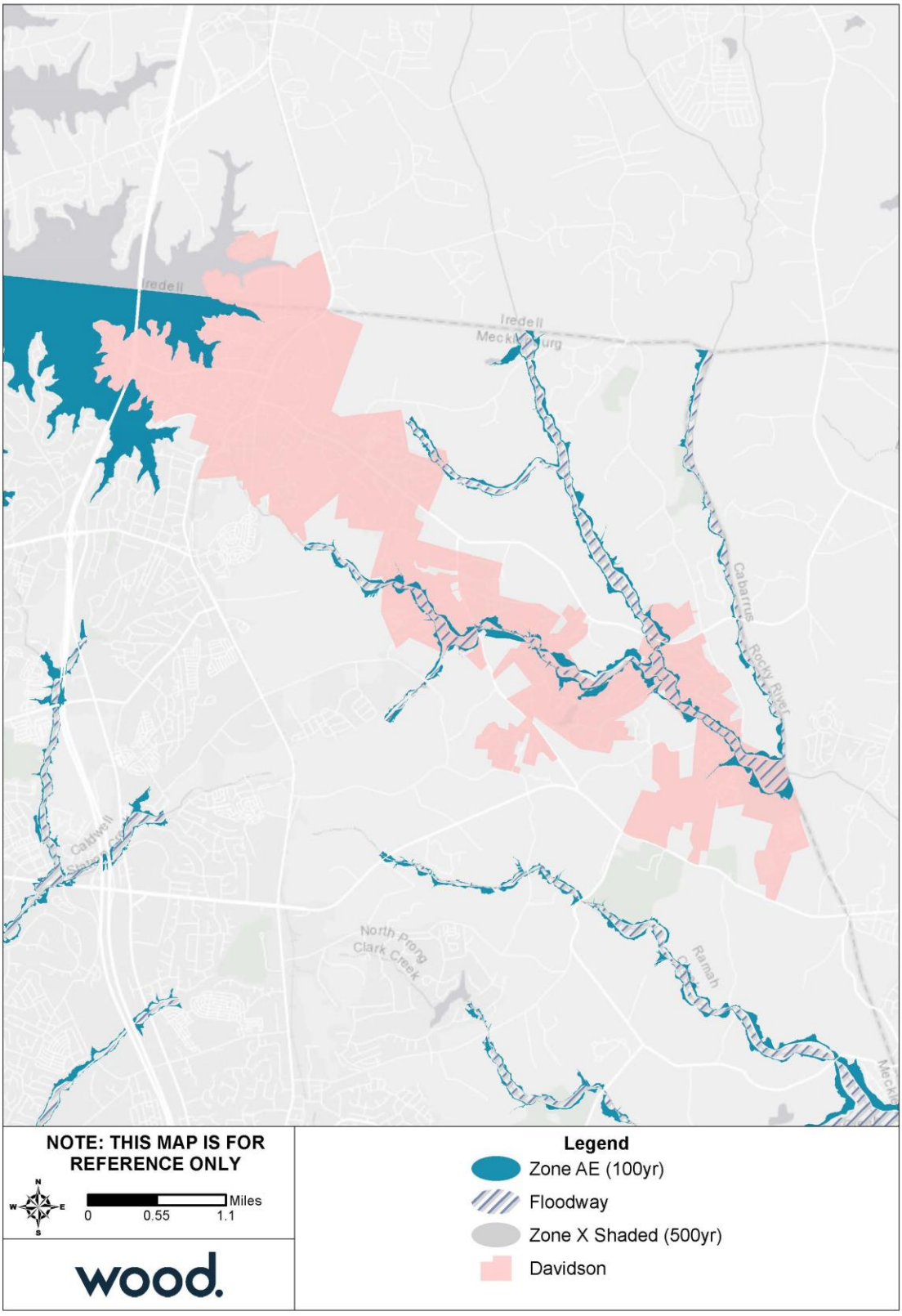
Flood Zone	Acreage	Percent of Total (%)
Zone AE	494.41	12.56%
Zone X (500-year)	0.00	0.00%
Zone X Unshaded	3,442.83	87.44%
Total	**3,937.25**	--

Source: FEMA Effective DFIRM

Figure D.2 reflects the effective mapped flood hazard zones for the Town of Davidson, and Figure D.3 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

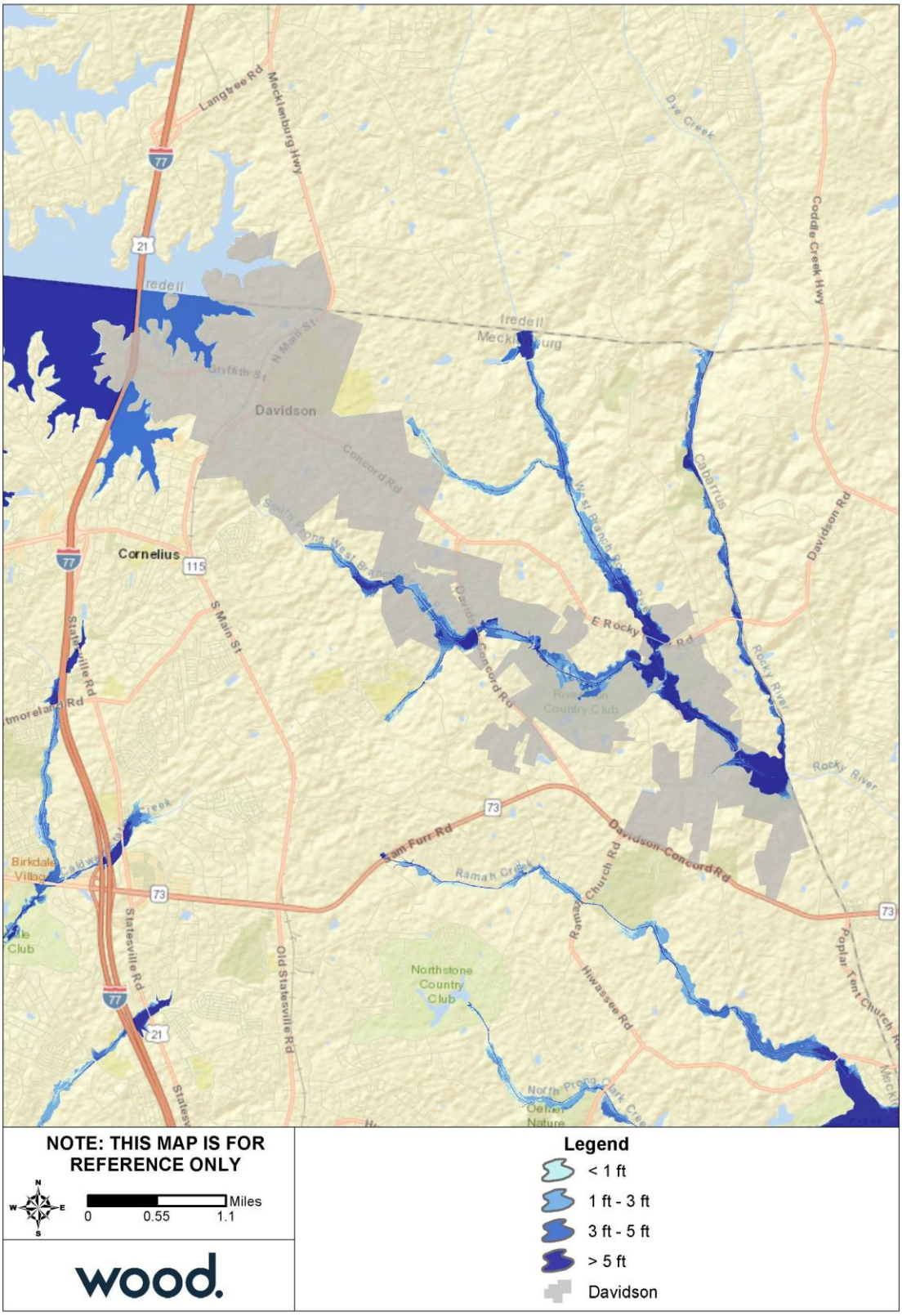
Per NCEM's Risk Management Tool, there are no Critical Facilities or High Potential Loss properties at risk to damage due to flooding in the Town of Davidson.

Figure D.2 – FEMA Flood Hazard Areas, Town of Davidson



Source: FEMA Effective DFIRM

Figure D.3 – Flood Depth, 1%-Annual-Chance Floodplain, Town of Davidson



Source: FEMA Effective DFIRM

D.3.3 Wildfire

Table D.11 summarizes the acreage in the Town of Davidson 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. 12 percent of the Town of Davidson is not included in the WUI.

Table D.11 – Wildland Urban Interface Acreage, Town of Davidson

	Housing Density	Total Acreage	Percent of Total Acreage
	Not in WUI	473.11	12.0%
	LT 1hs/40ac	147.52	3.8%
	1hs/40ac to 1hs/20ac	150.33	3.8%
	1hs/20ac to 1hs/10ac	179.56	4.6%
	1hs/10ac to 1hs/5ac	131.36	3.3%
	1hs/5ac to 1hs/2ac	456.48	11.6%
	1hs/2ac to 3hs/1ac	2,225.15	56.7%
	GT 3hs/1ac	162.95	4.2%
	Total	3,926.46	

Source: Southern Wildfire Risk Assessment

Figure A.4 depicts the WUI for all incorporated areas in Mecklenburg County, including the Town of Davidson. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure A.5 depicts Burn Probability for all of Mecklenburg County based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Figure D.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 Davidson. There are clusters of high to moderate potential fire intensity throughout Davidson, primarily in the northern and southeastern edges of the Town. Overall, less than one percent of the Town has a Class 4 fire intensity and an additional 11 percent of the Town has a Class 3 fire intensity. Therefore, in most of the Town a fire would be easily suppressed.

Table D.12 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table D.13 provides counts and estimated damages for High Potential Loss Properties in the Town of Davidson.

Table D.12 – Critical Facilities Exposed to Wildfire, Town of Davidson

Sector	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	6	$16,508,741
Government Facilities	1	$5,904,288
Transportation Systems	9	$3,179,096
All Categories	**16**	**$25,592,125**

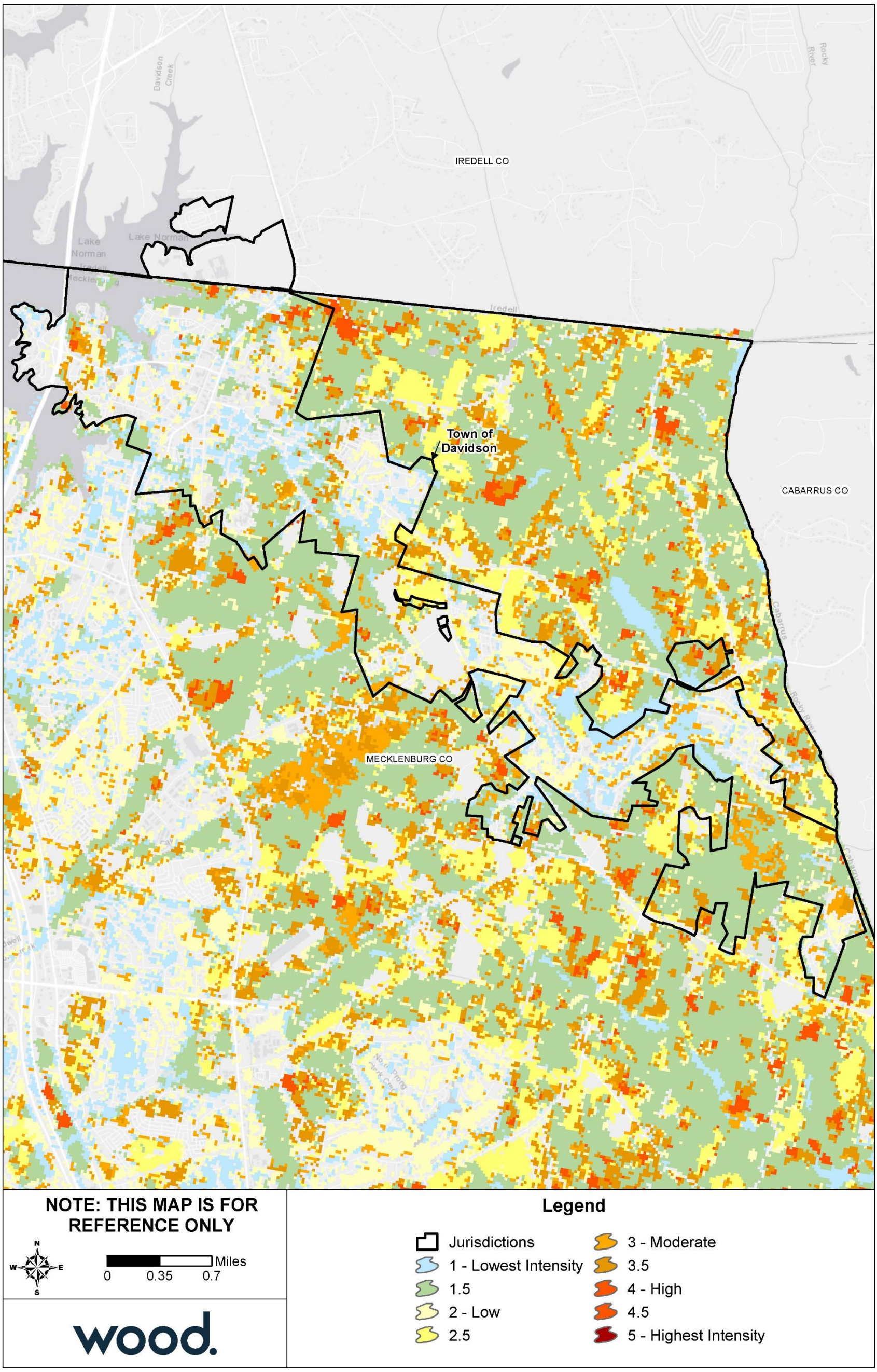
Source: NCEM Risk Management Tool

Table D.13 – High Potential Loss Properties Exposed to Wildfire, Town of Davidson

Category	Number of Buildings at Risk	Estimated Damages
Commercial	3	$8,274,233
Government	1	$5,904,288
Religious	1	$7,168,314
Residential	1	$1,168,436
All Categories	**6**	**$22,515,271**

Source: NCEM Risk Management Tool

Figure D.4 – Fire Intensity Scale, Town of Davidson



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 Town has a low overall capability rating. This contradicts the Town's self-assessed moderate capability. The Town relies on Mecklenburg County for much regulatory and planning capability support and could improve its regulatory capability by developing an Evacuation Plan, Floodplain Management Ordinance, Unified Development Ordinance, or Post-Disaster Redevelopment Ordinance. The Town has moderate outreach, fiscal, administrative, and regulatory capability, however the Town has no structural mitigation experience.

D.4.2 Floodplain Management

The Town of Davidson joined the NFIP through regular entry in October 1997 and has been a regular participant since. The following tables reflect NFIP policy and claims data for the Town categorized by structure type, flood zone, Pre-FIRM and Post-FIRM.

Table D.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	64	$25,630	$21,037,500	2	$4,942.45
All Other Residential	3	$960	$680,000	0	$0.00
Non Residential	0	$0	$0	0	$0.00
Total	**67**	**$26,590**	**$21,717,500**	**2**	**$4,942.45**

Source: FEMA Community Information System, accessed May 2020

Table D.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	11	$5,046	$3,402,500	0	$0.00
B, C & X Zone					
Standard	4	$1,717	$1,400,000	0	$0.00
Preferred	52	$19,827	$16,915,000	2	$4,942.45
Total	**67**	**$26,590**	**$21,717,500**	**2**	**$4,942.45**

Source: FEMA Community Information System, accessed May 2020

Table D.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
B, C & X Zone	2	$842	$700,000	0	$0.00
Standard	1	$421	$350,000	0	$0.00
Preferred	1	$421	$350,000	0	$0.00
Total	**2**	**$842**	**$700,000**	**0**	**$0.00**

Source: FEMA Community Information System, accessed May 2020

Table D.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	11	$5,046	$3,402,500	0	$0.00
B, C & X Zone	54	$20,702	$17,615,000	2	$4,942.45
Standard	3	$1,296	$1,050,000	0	$0.00
Preferred	51	$19,406	$16,565,000	2	$4,942.45
Total	**65**	**$25,748**	**$21,017,500**	**2**	**$4,942.45**

Source: FEMA Community Information System, accessed May 2020

D.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Davidson-1	Seek grant 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	1.3	Moderate	Property Protection	Town of Davidson	To be determined on a case-by-case basis	Local, State Grants, UHMA Grants, other federal grants	2020-2025	Carry Forward	Added new generator to Fire Station #2. New monthly test/power transfer for town hall generator.
Davidson-2	Seek grant funding to install backup generators or quick connect hook ups for mobile generators on any newly constructed county/town critical facilities.	All Hazards	1.3	Moderate	Property Protection	Town of Davidson	To be determined on a case-by-case basis	Local, State Grants, UHMA Grants, other federal grants	2020-2025	Carry Forward	New generator was installed at FS #2
Davidson-3	Maintain continued compliance with the National Flood Insurance Program (NFIP) through implementation and periodic evaluation of the following higher regulatory standards (in addition to basic required compliance actions): a) Require critical facilities protection to 500-year flood levels b) Require parking lots to be elevated (no more than six inches deep in any parking space during Community Flood event) c) Require dry land access for new or substantially improved buildings (above Community Base Flood Elevation) d) Levee restrictions e) Floors of new or substantially improved buildings allowed by variance in the floodplain must be elevated at least one (1) foot above the Community (future) Base Flood Elevation. f) Prohibit basements below flood level on filled lots	Flood	4.1	High	Prevention	Planning Department, Public Works Department, in coordination with CMEMO	Staff time	N/A	2020-2025	Carry Forward	The Town has maintained compliance with the NFIP.
Davidson-4	Implement recommendations of the 2006 Tree Canopy Inventory including pruning and removal of branches and trees that threaten public utilities and structures	Hurricane & Tropical Storm, Severe Weather, Tornado, Severe Winter Storm, Wildfire	1.2	Moderate	Prevention	Planning Department, Public Works Department	Staff time and resources	N/A	2020-2025	Carry Forward	Town has increased tree budget again and has completed another tree inventory. Started removals of most dangerous trees first. Continue tree pruning yearly. Hired a full time arborist on staff to manage inventory and create a canopy management plan.
Davidson-5	On an annual basis, coordinate with Charlotte-Mecklenburg Emergency Management on a widespread public outreach activity to provide information on all natural hazards facing the area to local residents, including methods for mitigating and preventing damages from hazardous conditions and how to respond when an imminent hazard threatens.	All Hazards	2.1	Moderate	Public Education & Awareness	Planning Department, Public Works Department, in coordination with CMEMO	Staff time and resources	N/A	2020-2025	Carry Forward	No progress made due to limited staff time and competing priorities.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Davidson-6	On an annual basis, coordinate with Charlotte-Mecklenburg Emergency Management to provide information on all natural hazards facing the area to local planning staff and elected officials. This should be combined with an annual progress report on the status of local mitigation actions as identified in the Multi-jurisdictional Hazard Mitigation Plan.	All Hazards	3.1	Moderate	Public Education & Awareness	Planning Department, in coordination with CMEMO	Staff time and resources	N/A	2020-2025	Carry Forward	No progress made due to limited staff time and competing priorities.
Davidson-7	Develop growth policies that account for identified hazard areas	Flood, Severe Weather	4.1	High	Prevention	Planning Department	Staff time and resources	N/A	2025	Carry Forward	A new comprehensive plan is currently in progress. Tree budget has increased and pruning/removals are continuing as needed.
Davidson-8	Implement stormwater management plan.	Flood	4.1	High	Prevention	Public Works Department	$50,000	NRCS-Watershed Protection and Flood Prevention Program, NRCS-Watershed Surveys and Planning, USACE-Floodplain Management Services, HMGP	2020-2025	Carry Forward	Revised. Stormwater Management Plan was approved and implementation of recommended projects is underway. Beatty Dam has another leak since the repairs made in 2014. Engineers are currently working on solutions.

Annex E Town of Huntersville

E.1 PLANNING PROCESS

The table below lists the HMPC members who represented the Town of Huntersville.

Table E.1 – HMPC Members

Representative	Agency/Department
Kevin Johnston	Police Dept.
Steve Robbins	Public Works
Dan Boone	Citizen

E.2 COMMUNITY PROFILE

Geography

The Town of Huntersville is located in north central Mecklenburg County. It is neighbored by Cornelius to the north, Davidson to the northeast, and Charlotte to the south and southeast. The Town is part of the Charlotte-Concord-Gastonia, NC-SC Metropolitan Statistical Area. Huntersville comprises a total land area of 39.6 square miles.

According to data from the U.S. Fish and Wildlife Service's National Wetlands Inventory, there are approximately 37,054 acres of wetlands in Huntersville.

Population and Demographics

Table E.2 provides population counts and growth estimates for the Town of Huntersville as compared to Mecklenburg County. Table E.3 provides demographic information for Huntersville as compared to the county and the state.

Table E.2 – Population Counts, Huntersville, 2010-2018

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
Town of Huntersville	24,960	46,773	54,572	7,799	16.7%
Mecklenburg County	**695,454**	**919,628**	**1,054,314**	**134,686**	**14.6%**

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, Huntersville, 2018

Demographic & Social Characteristics	Town of Huntersville	Mecklenburg County	North Carolina
Median Age	37	35	38.6
% of Population Under 5 years old	8.1%	6.8%	5.9%
% of population Over 65 years old	9.2%	10.6%	15.5%
% of Population Over 25 with high school diploma	96.5%	90.10%	87.4%
% of Population Over 25 with bachelor's degree or higher	55.8%	44.80%	30.5%
% with Disability	6.8%	8.4%	13.6%
% Speak English less than "very well"	3%	8.9%	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 Huntersville as compared to the County and State overall.

Table E.4 – Housing Statistics, Huntersville, 2010-2018

Housing Characteristics	Huntersville	Mecklenburg County	North Carolina
Housing Units (2010)	18,477	398,510	4,327,528
Housing Units (2018)	20,850	435,795	4,573,066
Housing Units Percent Change (2010-2018)	12.84%	9.36%	5.67%
Housing Occupancy Rate	95.20%	92.6%	85.70%
% Owner-Occupied	75.20%	56.5%	65%
Average Household Size	2.6	2.56	2.52
% of Housing Units with no Vehicles Available	2.0%	5.9%	5.9%
% of Housing Units that are mobile homes	2.0%	1.4%	13.0%
Median Home Value	$283,300	$219,800	$165,900

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 Huntersville as compared to the county and the state.

Table E.5 – Economic Statistics, Huntersville, 2018

Demographic & Social Characteristics	Huntersville	Mecklenburg County	North Carolina
Median Household Income	$97,320	$64,312	$52,413
Per Capita Income	$42,820	$37,298	$29,456
Unemployment Rate	3.7%	5.8%	6.3%
% of Individuals Below Poverty Level	5.2	12.7	15.4
% Without Health Insurance	5.9	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 Huntersville in order to estimate the total physical exposure to hazards in this area. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted and displayed. Due to the high volume of CIKR facilities, a map of these buildings is not provided. However, maps of CIKR impacted by specific hazards are provided where applicable in Section 4 of this plan. Building counts provided Table E.8 are from 2018. Because the Town has experienced growth and development since then, these numbers may underestimate actual risk.

Table E.6 – Critical Infrastructure & Key Resources by Type

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	EM	Government Facilities	Healthcare	Transportation Systems	Energy	Emergency Services	Water	Total
Town of Huntersville	1	19	0	586	0	205	0	146	50	176	6	0	6	**1,195**

Source: NCEM Risk Management Tool

Table E.7 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Town of Huntersville	81	213	39	39	0	33	1	**406**

Source: NCEM Risk Management Tool

Table E.8 – IRISK Inventory of Building Counts and Values

Jurisdiction	Building Count	Building Value
Town of Huntersville	19,555	$5,227,753,979

Source: NCEM Risk Management Tool

E.3.1 Dam Failure

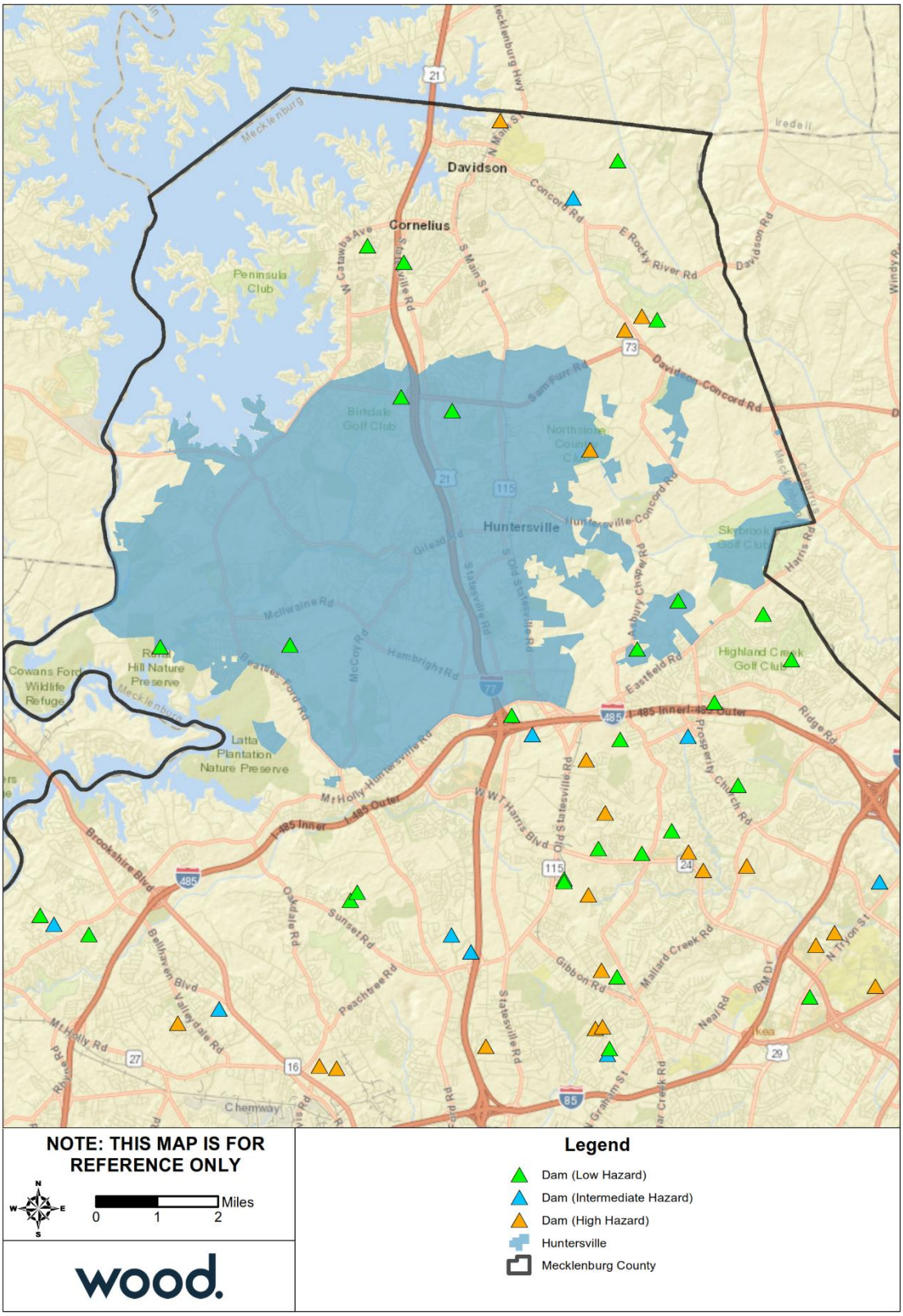
Table E.9 lists details the high hazard dam in the Town of Huntersville identified by the North Carolina Dam Inventory as of July 2018. All dam locations throughout Huntersville are shown in Figure E.1.

Table E.9 – High Hazard Dams in Town of Huntersville

Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
Clarks Creek Subdivision Dam	NC05059	Fair	228	Huntersville

Source: NC Dam Inventory, July 2018

Figure E.1 – Dam Locations, Town of Huntersville



Source: NC Dam Inventory, July 2018

E.3.2 Flood

Table E.10 details the acreage of the Town of Huntersville by flood zone on the effective DFIRM. Per this assessment, over 6 percent of the Huntersville falls within the mapped 1%-annual-chance floodplains.

Table E.10 – Flood Zone Acreage in the Town of Huntersville

Flood Zone	Acreage	Percent of Total (%)
Zone AE	1,660.99	6.36%
Zone X (500-year)	0.00	0.00%
Zone X Unshaded	24,465.73	93.64%
Total	**26,126.72**	--

Source: FEMA Effective DFIRM

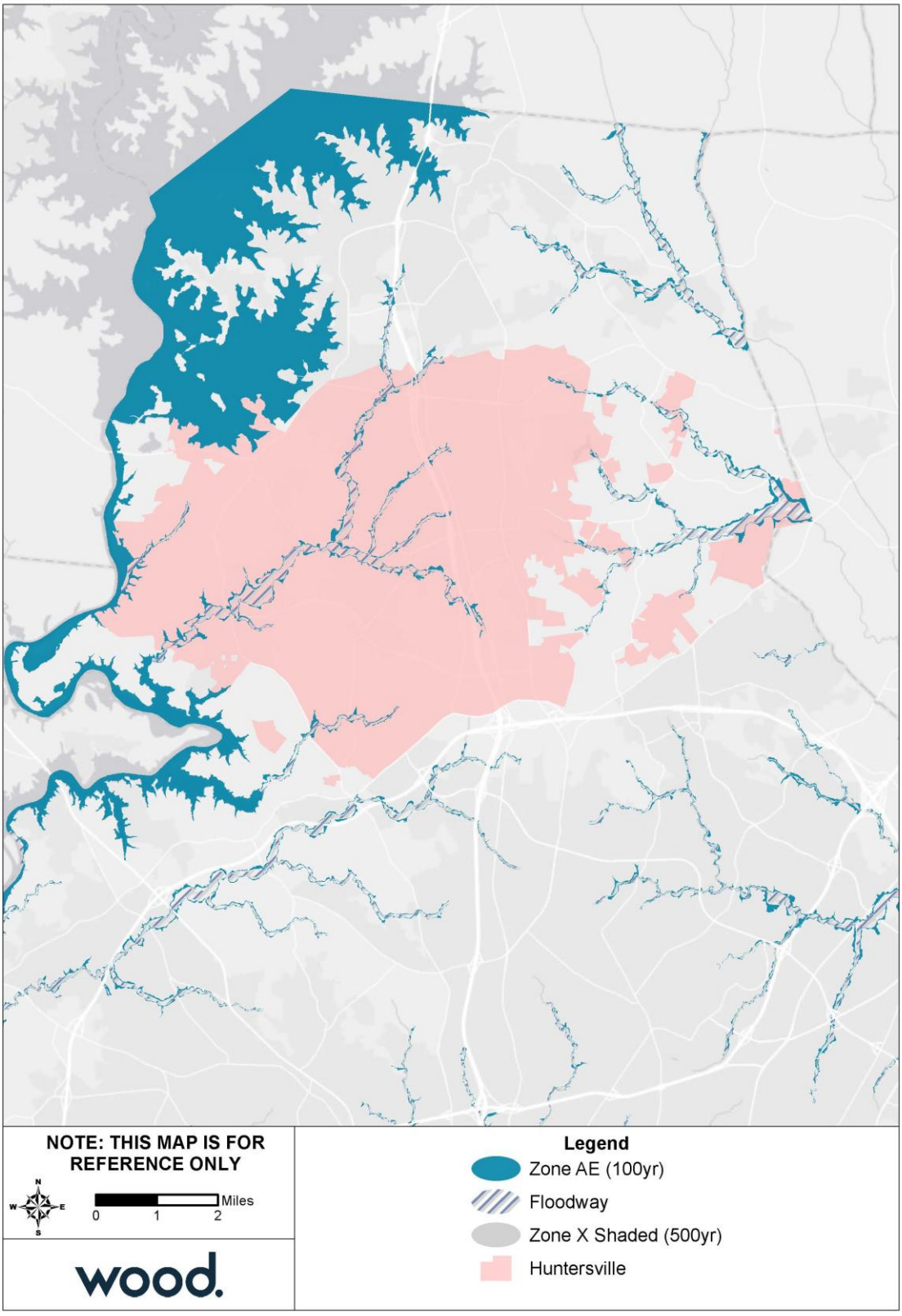
Figure E.2 reflects the effective mapped flood hazard zones for the Town of Huntersville, and Figure E.3 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

Table E.11 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector and flood event in the City of Charlotte. There are no High Potential Loss Properties at risk to damage from flooding in the Town of Huntersville.

Table E.11 – Critical Facilities Exposed to Flooding, Town of Huntersville

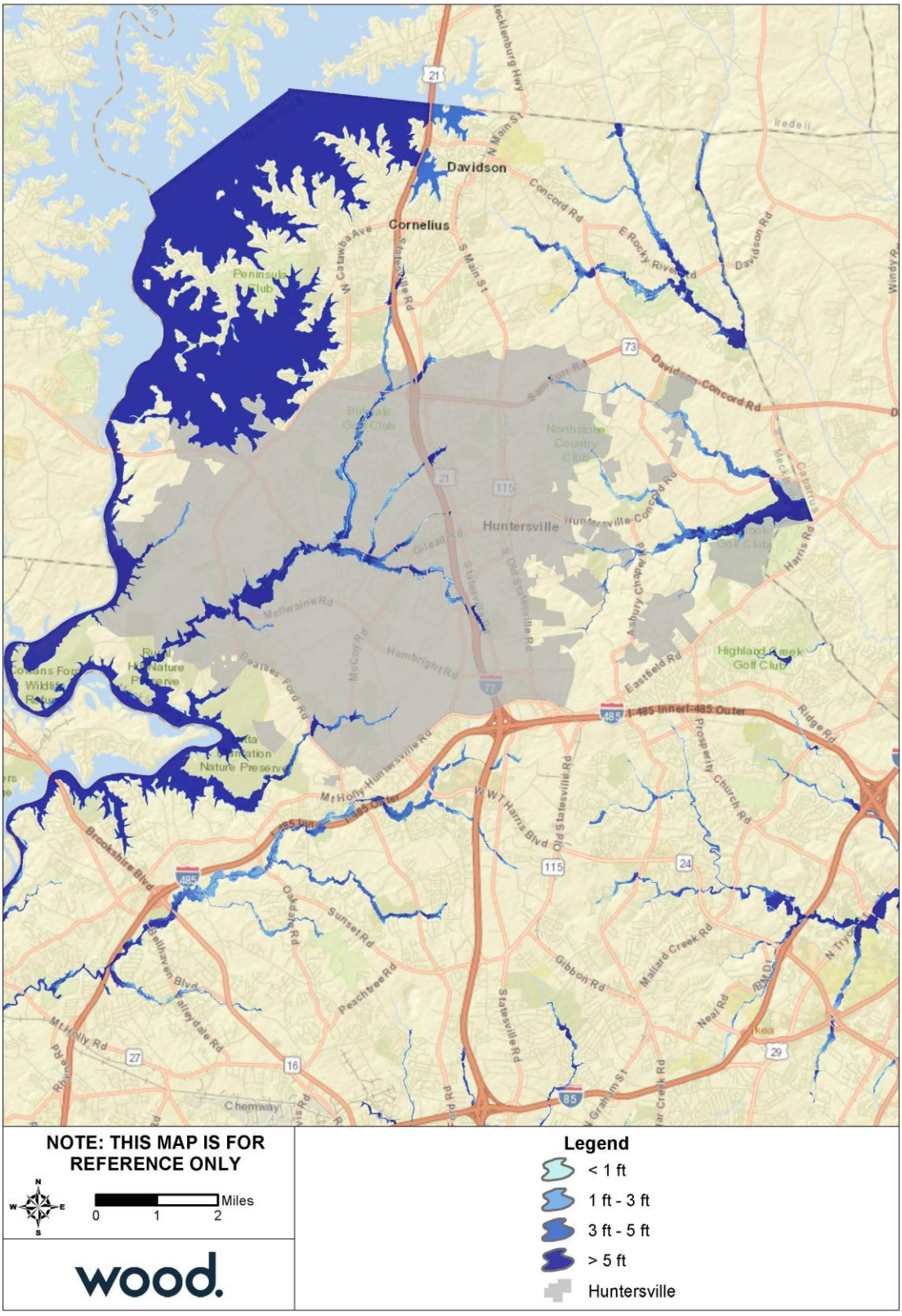
Sector	Event	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	500 Year	1	$1,119
All Categories	**500 Year**	**1**	**$1,119**

Figure E.2 – FEMA Flood Hazard Areas, Town of Huntersville



Source: FEMA Effective DFIRM

Figure E.3 – Flood Depth, 1%-Annual-Chance Floodplain, Town of Huntersville



Source: FEMA Effective DFIRM

E.3.3 Wildfire

Table E.12 summarizes the acreage in the Town of Huntersville 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 8 percent of the Town of Huntersville is not included in the WUI.

Table E.12 – Wildland Urban Interface Acreage, Town of Huntersville

	Housing Density	Total Acreage	Percent of Total Acreage
	Not in WUI	2,257.95	8.6%
	LT 1hs/40ac	1,908.80	7.3%
	1hs/40ac to 1hs/20ac	2,415.98	9.2%
	1hs/20ac to 1hs/10ac	3,168.22	12.1%
	1hs/10ac to 1hs/5ac	2,382.27	9.1%
	1hs/5ac to 1hs/2ac	9,661.85	37.0%
	1hs/2ac to 3hs/1ac	3,332.01	12.8%
	GT 3hs/1ac	997.13	3.8%
	Total	26,124.21	

Source: Southern Wildfire Risk Assessment

Figure A.4 depicts the WUI for all incorporated areas in Mecklenburg County, including the Town of Huntersville. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure A.5 depicts Burn Probability for all of Mecklenburg County based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Figure E.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 Huntersville. There are small clusters of moderate (Class 3) and high (Class 4) potential fire intensity throughout Huntersville, particularly in the western half of the Town. Overall, these clusters only comprise 13.2% and 1.9% of the Town's total area, respectively.

Table E.13 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table E.14 provides counts and estimated damages for High Potential Loss Properties in the Town of Huntersville.

Table E.13 – Critical Facilities Exposed to Wildfire, Town of Huntersville

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	8	$3,088,112
Commercial Facilities	142	$277,059,787
Critical Manufacturing	14	$8,664,262
Energy	2	$35,490
Government Facilities	37	$118,653,720
Healthcare and Public Health	19	$48,692,032
Transportation Systems	39	$69,596,214
All Categories	**261**	**$525,789,617**

Source: NCEM Risk Management Tool

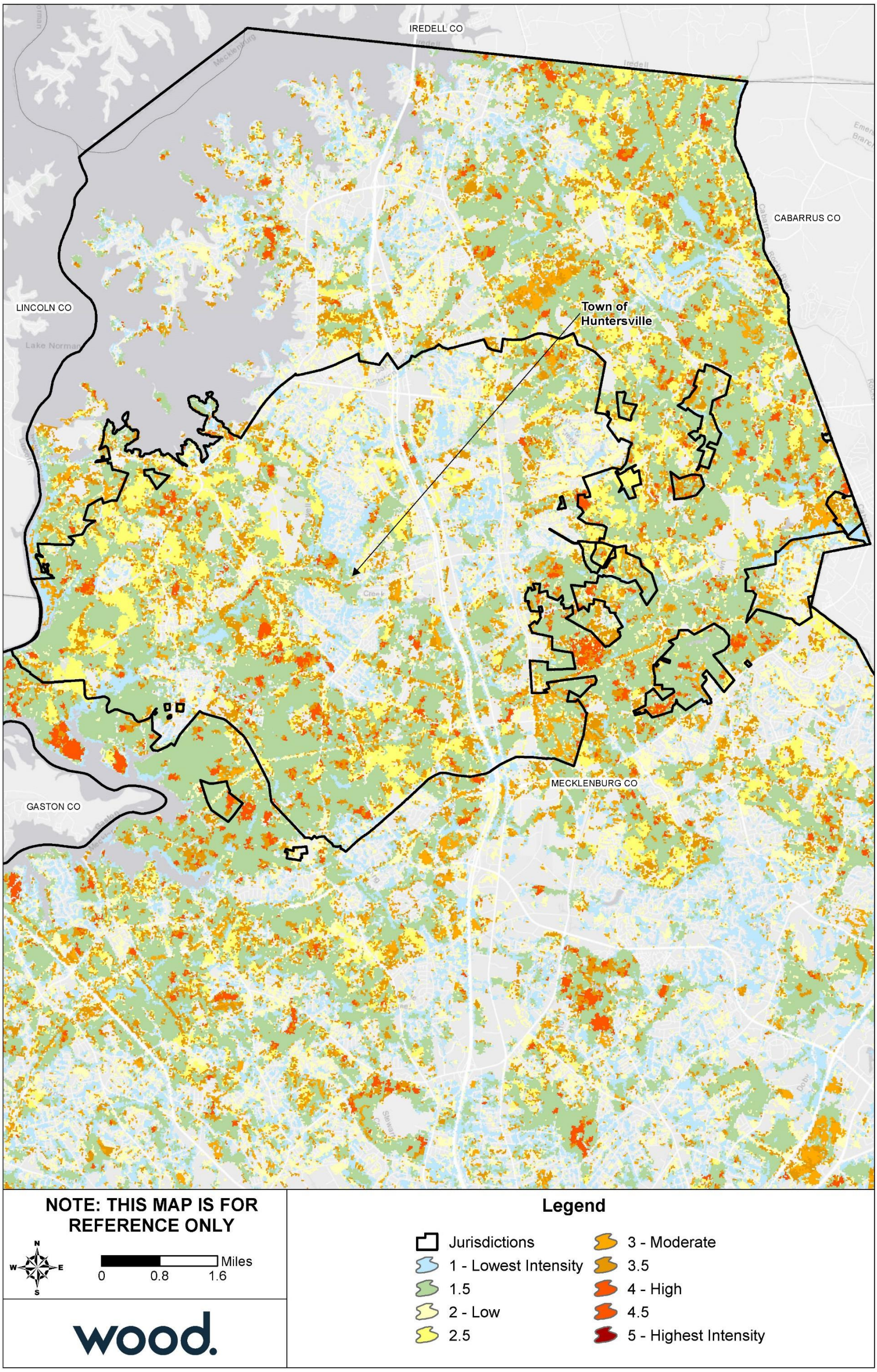
Table E.14 – High Potential Loss Properties Exposed to Wildfire, Town of Huntersville

Category	Number of Buildings at Risk	Estimated Damages
Commercial	69	$266,026,869
Government	16	$114,058,838

Category	Number of Buildings at Risk	Estimated Damages
Industrial	2	$3,655,647
Religious	10	$61,966,956
Residential	19	$77,993,150
All Categories	**116**	**$523,701,460**

Source: NCEM Risk Management Tool

Figure E.4 – Fire Intensity Scale, Town of Huntersville



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 Huntersville are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Huntersville has a moderate overall capability rating. The Town has strong planning and regulatory capability by relying on the County for certain regulatory functions. The Town could further improve these capabilities with the development of a Flood Damage Prevention Ordinance and an evacuation plan. Huntersville has strong fiscal capability, moderate administrative capability, and limited outreach and structural mitigation capability.

E.4.2 Floodplain Management

The Town of Huntersville joined the NFIP through emergency entry in 1995 and has been a regular participant since February 2004. 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.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	149	$56,381	$44,549,700	1	$4,857.81
2-4 Family	1	$368	$269,200	0	$0.00
All Other Residential	2	$583	$408,000	0	$0.00
Non-Residential	6	$7,406	$2,560,000	0	$0.00
Total	158	$64,738	$47,786,900	1	$4,857.81

Source: FEMA Community Information System, accessed May 2020

Table E.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	15	$8,205	$4,696,900	0	$0.00
B, C & X Zone					
Standard	6	$3,537	$2,100,000	0	$0.00
Preferred	137	$52,996	$40,990,000	1	$4,857.81
Total	158	$64,738	$47,786,900	1	$4,857.81

Source: FEMA Community Information System, accessed May 2020

Table E.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	11	$5,348	$3,087,500	0	$0.00
B, C & X Zone	75	$30,784	$24,467,000	1	$4,857.81
Standard	5	$2,944	$1,750,000	0	$0.00
Preferred	70	$27,840	$22,717,000	1	$4,857.81
Total	86	$36,132	$27,554,500	1	$4,857.81

Source: FEMA Community Information System, accessed May 2020

Table E.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	4	$2,857	$1,609,400	0	$0.00
B, C & X Zone	68	$25,749	$18,623,000	0	$0.00
Standard	1	$593	$350,000	0	$0.00
Preferred	67	$25,156	$18,273,000	0	$0.00
Total	72	$28,606	$20,232,400	0	$0.00

Source: FEMA Community Information System, accessed May 2020

E.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Huntersville-1	Seek grant 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	1.3	Moderate	Property Protection	Town of Huntersville	To be Determined on a case-by-case basis	Local, State Grants, UHMA Grants, other federal grants	2020-2025	Carry Forward	No actions were needed in the last five years due to other priorities. The Town will continue to seek funding to equip new and/or existing Town-owned facilities with materials and technology that will improve resilience to hazards.
Huntersville-2	Implement storm water mitigation projects, including the grading of ditches and replacing failing/potentially failing storm water structures	Flood	1.2	High	Structural Projects	Town of Huntersville Public Works Department	To be determined	CMSWS funds	2020-2025	New	
Huntersville 3	Conduct an annual tabletop exercise addressing potential hazards faced by Town. This exercise would bring together representatives from all Town departments that would work together creating and implementing a plan to effectively deal with the hazard.	All Hazards	3.1	High	Emergency Services	Huntersville Police Department	$0	N/A	2020-2025	New	
Huntersville 4	Coordinate with Cher-Meck EM to relay critical information on the Towns Social Media Sites regarding potential hazards, localized emergencies, preparedness, and property protection options.	All Hazards	2.1	High	Public Education & Awareness	Town of Huntersville /HPD PIO	$0	N/A	2020-2025	New	
Huntersville 5	Provide and maintain NIMS training for town employees and government officials likely to be involved with hazard mitigation or emergency response. .	All Hazards	3.1	Moderate	Emergency Services	Town of Huntersville	$0	N/A	2020-2025	New	

Annex F Town of Matthews

F.1 PLANNING PROCESS

The table below lists the HMPC members who represented the Town of Matthews.

Table F.1 – HMPC Members

Representative	Agency/Department
Rob Kinniburgh	Fire Department
Clark Pennington	Police Department
CJ O'Neil	Public Works

F.2 COMMUNITY PROFILE

Geography

The Town of Matthews is located in southeastern Mecklenburg County. It is neighbored by Charlotte to the west, Mint Hill to the northeast, and Union County to the southeast. Matthews is part of the Charlotte-Concord-Gastonia, NC-SC Metropolitan Statistical Area. The Town comprises a total land area of 17.1 square miles.

According to data from the U.S. Fish and Wildlife Service's National Wetlands Inventory, there are approximately 313 acres of wetlands in Matthews.

Population and Demographics

Table F.2 provides population counts and growth estimates for the Town of Matthews as compared to Mecklenburg County. Table F.3 provides demographic information for Matthews as compared to the county and the state.

Table F.2 – Population Counts, Matthews, 2010-2018

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
Town of Matthews	22,127	27,198	31,400	4,202	15.4%
Mecklenburg County	**695,454**	**919,628**	**1,054,314**	**134,686**	**14.6%**

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, Matthews, 2018

Demographic & Social Characteristics	Matthews	Mecklenburg County	North Carolina
Median Age	41.8	35	38.6
% of Population Under 5 years old	5.9%	6.8%	5.9%
% of population Over 65 years old	16.4%	10.6%	15.5%
% of Population Over 25 with high school diploma	94.8%	90.10%	87.4%
% of Population Over 25 with bachelor's degree or higher	53.8%	44.80%	30.5%
% with Disability	8.1%	8.4%	13.6%
% Speak English less than "very well"	4.7%	8.9%	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 Matthews compared to the County and State overall.

Table F.4 – Housing Statistics, Matthews, 2010-2018

Housing Characteristics	Matthews	Mecklenburg County	North Carolina
Housing Units (2010)	11,021	398,510	4,327,528
Housing Units (2018)	12,265	435,795	4,573,066
Housing Units Percent Change (2010-2018)	11.29%	9.36%	5.67%
Housing Occupancy Rate	95.6%	92.6%	85.70%
% Owner-Occupied	73.2%	56.5%	65%
Average Household Size	2.56	2.56	2.52
% of Housing Units with no Vehicles Available	3%	5.9%	5.9%
% of Housing Units that are mobile homes	1.5%	1.4%	13.0%
Median Home Value	$249,200	$219,800	$165,900

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 Matthews as compared to the county and the state.

Table F.5 – Economic Statistics, Matthews, 2018

Demographic & Social Characteristics	Matthews	Mecklenburg County	North Carolina
Median Household Income	$78,971	$64,312	$52,413
Per Capita Income	$39,379	$37,298	$29,456
Unemployment Rate	3.4	5.8%	6.3%
% of Individuals Below Poverty Level	6.2	12.7	15.4
% Without Health Insurance	7.4	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: Dam Failure, Flood and Wildfire.

Asset Inventory

The following tables summarize the asset inventory for Matthews in order to estimate the total physical exposure to hazards in this area. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted and displayed. Due to the high volume of CIKR facilities, a map of these buildings is not provided. However, maps of CIKR impacted by specific hazards are provided where applicable in Section 4 of this plan. Building counts provided Table F.8 are from 2018. Because the Town has experienced growth and development since then, these numbers may underestimate actual risk.

Table F.6 – Critical Infrastructure & Key Resources by Type

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	EM	Government Facilities	Healthcare	Transportation Systems	Energy	Emergency Services	Water	Total
Town of Matthews	0	12	0	435	0	130	0	59	34	138	0	0	0	**808**

Source: NCEM Risk Management Tool

Table F.7 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Town of Matthews	47	122	36	14	0	28	0	**247**

Source: NCEM Risk Management Tool

Table F.8 – IRISK Inventory of Building Counts and Values

Jurisdiction	Building Count	Building Value
Town of Matthews	10,030	$2,976,296,682

F.3.1 Dam Failure

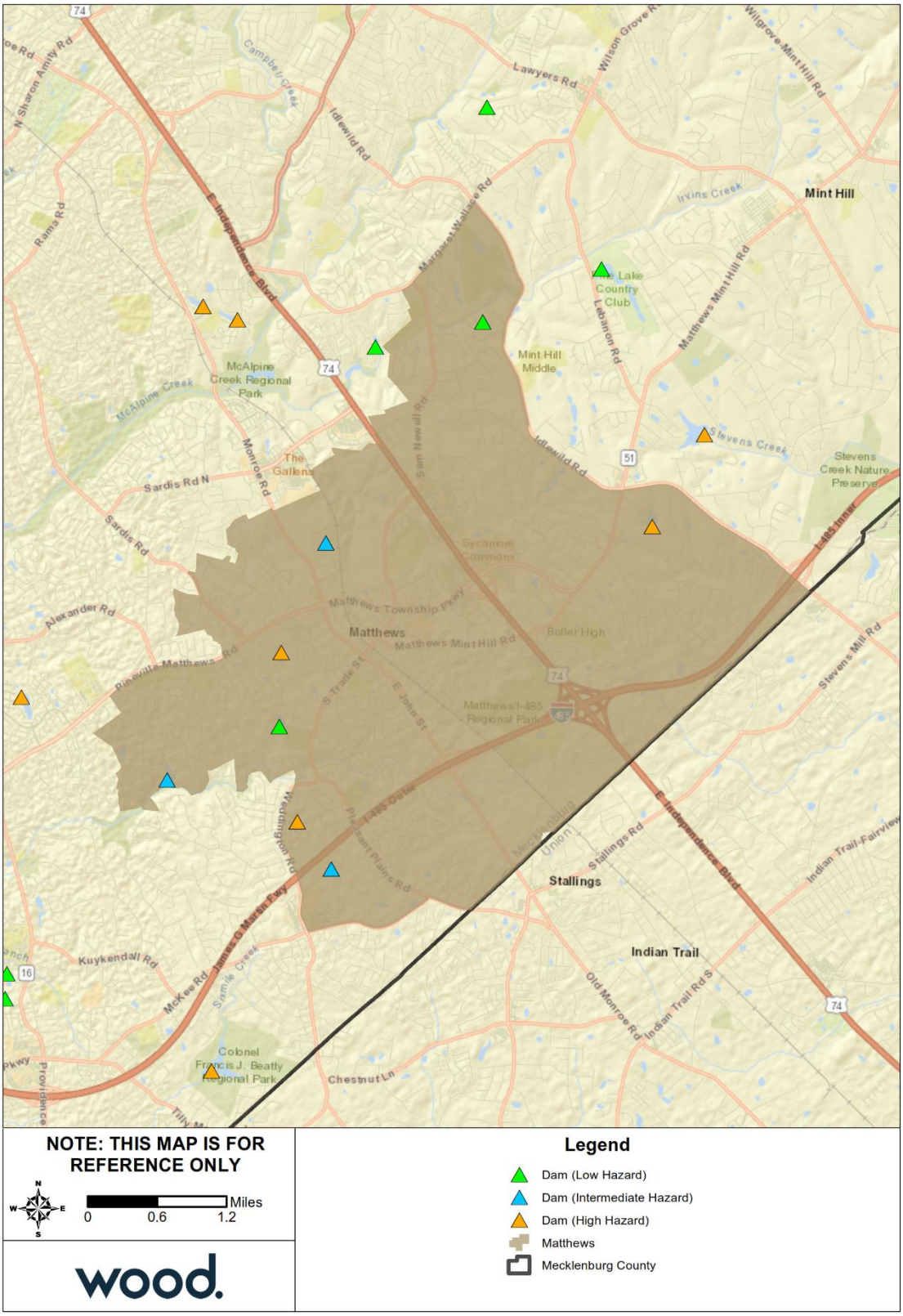
Table F.9 lists details the high hazard dam in the Town of Matthews identified by the North Carolina Dam Inventory as of July 2018. All dam locations throughout Matthews are shown in Figure F.1. Note that Matthews is the nearest downstream location to the Quail Acres Dam located in Charlotte. The condition of this dam was rated as fair at the time of its last inspection.

Table F.9 – High Hazard Dams in Town of Matthews

Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
Windrow Dam	NC03484	Fair	17	Matthews
Winterbrooke Dam	NC03488	Fair	19.6	Matthews
Landtec Pond Dam	NC06177	Fair	5	Matthews

Source: NC Dam Inventory, July 2018

Figure F.1 – Dam Locations, Town of Matthews



Source: NC Dam Inventory, July 2018

F.3.2 Flood

Table F.10 details the acreage of the Town of Matthews by flood zone on the effective DFIRM. Per this assessment, 2 percent of Matthews falls within the mapped 1%-annual-chance floodplains.

Table F.10 – Flood Zone Acreage in the Town of Matthews

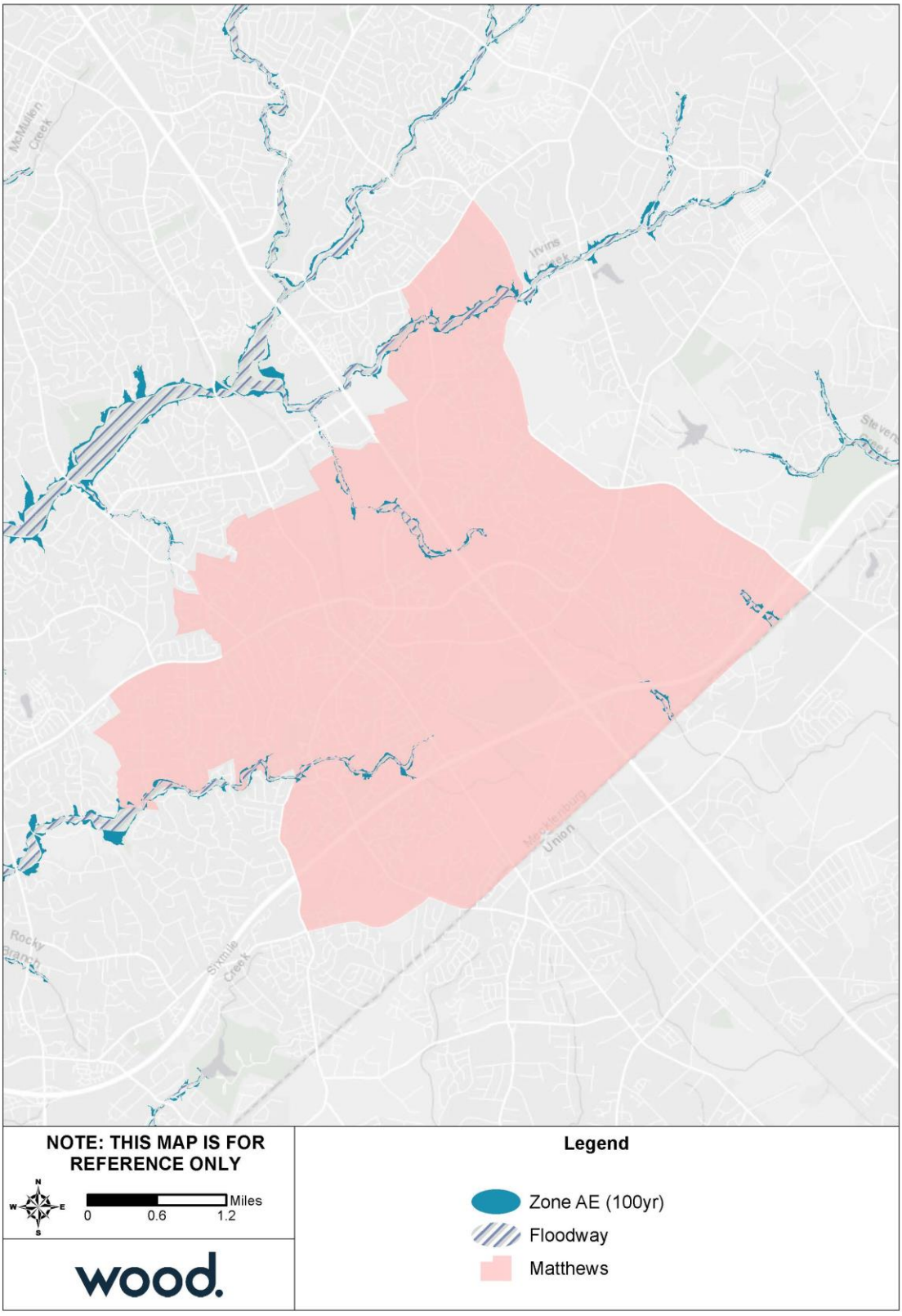
Flood Zone	Acreage	Percent of Total (%)
Zone AE	220.39	2.01%
Zone X (500-year)	0.00	0.00%
Zone X Unshaded	10,756.46	97.99%
Total	**10,976.85**	--

Source: FEMA Effective DFIRM

Figure F.2 reflects the effective mapped flood hazard zones for the Town of Matthews, and Figure F.3 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

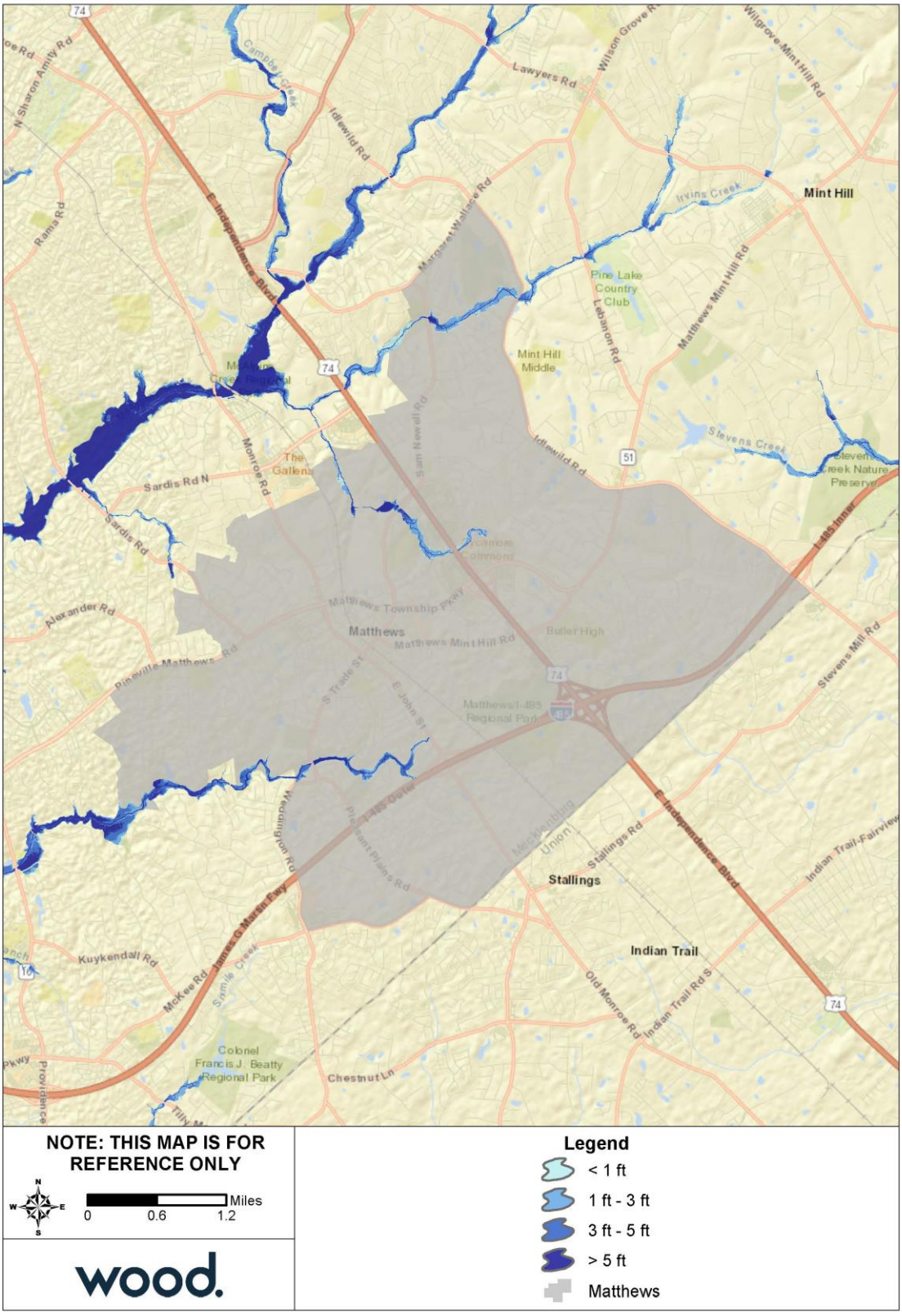
There are no critical facilities or high potential loss properties with estimated flood damages in the Town of Matthews.

Figure F.2 – FEMA Flood Hazard Areas, Town of Matthews



Source: FEMA Effective DFIRM

Figure F.3 – Flood Depth, 1%-Annual-Chance Floodplain, Town of Matthews



Source: FEMA Effective DFIRM

F.3.3 Wildfire

Table F.11 summarizes the acreage in the Town of Matthews 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 10 percent of the Town of Matthews is not included in the WUI.

Table F.11 – Wildland Urban Interface Acreage, Town of Matthews

	Housing Density	Total Acreage	Percent of Total Acreage
	Not in WUI	1,149.19	10.5%
	LT 1hs/40ac	463.54	4.2%
	1hs/40ac to 1hs/20ac	233.34	2.1%
	1hs/20ac to 1hs/10ac	432.11	3.9%
	1hs/10ac to 1hs/5ac	543.05	4.95
	1hs/5ac to 1hs/2ac	1,137.35	10.4%
	1hs/2ac to 3hs/1ac	6,690.17	61.0%
	GT 3hs/1ac	322.81	2.9%
	Total	10,971.57	

Source: Southern Wildfire Risk Assessment

Figure A.4 depicts the WUI for all incorporated areas in Mecklenburg County, including the Town of Matthews. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure A.5 depicts Burn Probability for all of Mecklenburg County based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Figure F.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 Matthews. There are areas of moderate to high potential fire intensity spread throughout the Town, particularly in the north and along the eastern edges of the Town. Overall, 6.6% of the Town has a Class 3 fire intensity and less than 1 percent has a Class 4 fire intensity.

Table F.12 and Table F.13 provide building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings and High Potential Loss Properties at risk to wildfire.

Table F.12 – Critical Facilities Exposed to Wildfire, Town of Matthews

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	1	$572,633
Commercial Facilities	63	$77,842,874
Critical Manufacturing	12	$6,125,345
Government Facilities	12	$126,719,129
Healthcare and Public Health	5	$13,268,649
Transportation Systems	15	$11,186,466
All Categories	**108**	**$235,715,096**

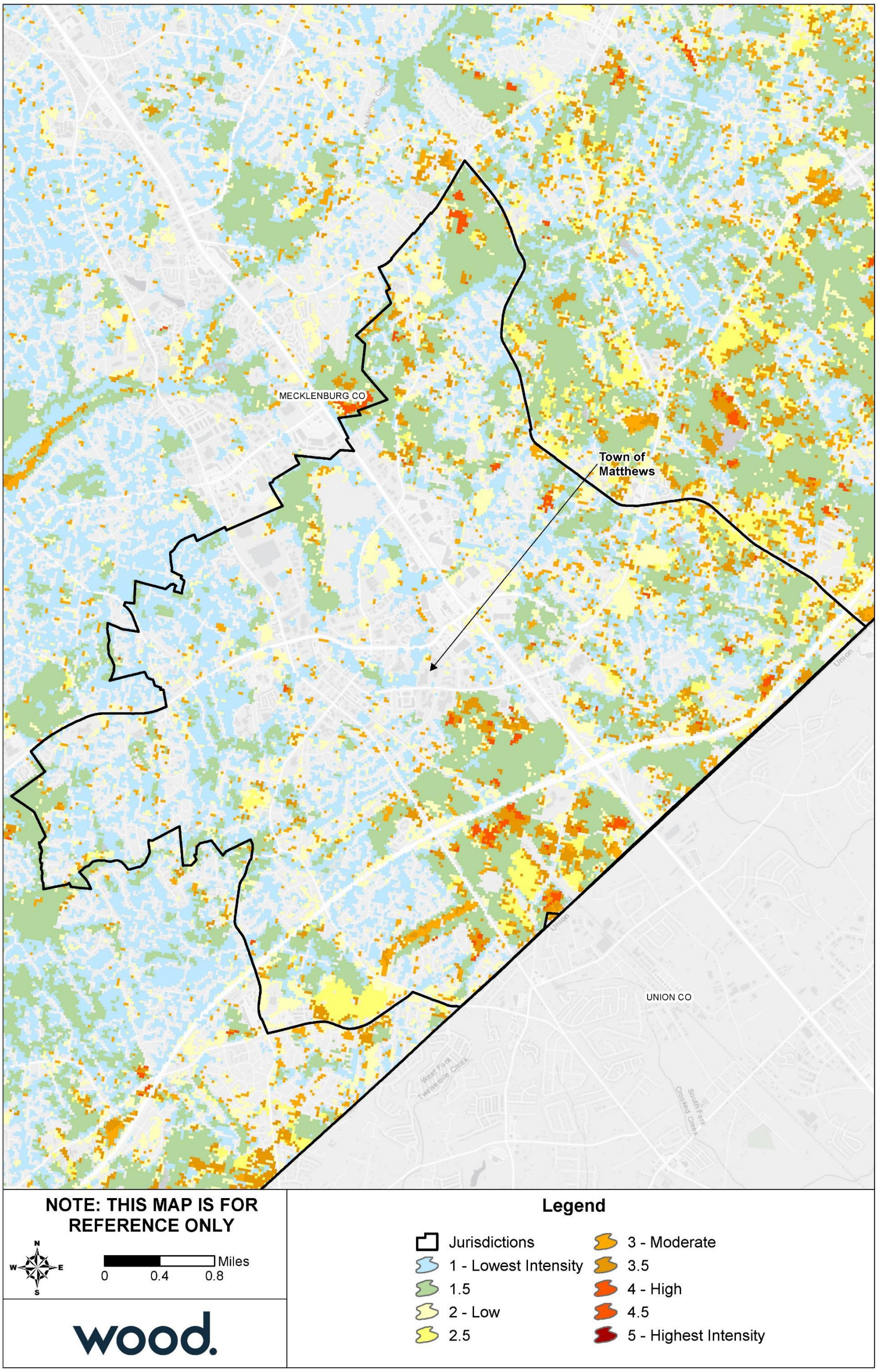
Source: NCEM Risk Management Tool

Table F.13 – High Potential Loss Properties Exposed to Wildfire, Town of Matthews

Category	Number of Buildings at Risk	Estimated Damages
Commercial	15	$56,126,085
Government	7	$125,868,075
Industrial	1	$1,639,960
Religious	11	$29,468,891
All Categories	**34**	**$213,103,011**

Source: NCEM Risk Management Tool

Figure F.4 – Fire Intensity Scale, Town of Matthews



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 Matthews are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Matthews has a moderate overall capability rating. The Town has some regulatory and planning capability, but also relies on Mecklenburg County for further regulatory and planning support. Matthews could improve its regulatory capability to enhance resilience by developing and implementing a Post Disaster Recovery Plan paired with a Post-Disaster Redevelopment Ordinance, as well as an evacuation plan and a continuity of operations plan. The Town has strong administrative capability, moderate fiscal and outreach capability, and limited structural mitigation experience.

F.4.2 Floodplain Management

The Town of Matthews joined the NFIP through emergency entry in 1995 and has been a regular participant since February 2004. The following tables reflect NFIP policy and claims data for the Town categorized by structure type, flood zone, Pre-FIRM and Post-FIRM.

Table F.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	64	$25,804	$18,986,000	13	$140,214.64
2-4 Family	3	$970	$770,000	0	$0.00
All Other Residential	1	$75	$20,000	0	$0.00
Non-Residential	4	$9,664	$3,100,000	0	$0.00
Total	72	$36,513	$22,876,000	13	$140,214.64

Source: FEMA Community Information System, accessed May 2020

Table F.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	3	$2,734	$464,000	1	$0.00
B, C & X Zone					
Standard	3	$1,413	$980,000	0	$0.00
Preferred	66	$32,366	$21,432,000	12	$140,214.64
Total	72	$36,513	$22,876,000	13	$140,214.64

Source: FEMA Community Information System, accessed May 2020

Table F.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	3	$2,734	$464,000	1	$0.00
B, C & X Zone	54	$24,438	$17,227,000	5	$31,333.06
Standard	2	$883	$630,000	0	$0.00
Preferred	52	$23,555	$16,597,000	5	$31,333.06
Total	57	$27,172	$17,691,000	6	$31,333.06

Source: FEMA Community Information System, accessed May 2020

Table F.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
B, C & X Zone	15	$9,341	$5,185,000	7	$108,881.58
Standard	1	$530	$350,000	0	$0.00
Preferred	14	$8,811	$4,835,000	7	$108,881.58
Total	15	$9,341	$5,185,000	7	$108,881.58

Source: FEMA Community Information System, accessed May 2020

F.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Matthews-1	Develop a second full-function Emergency Operations Center (EOC) at the Fire Department as a backup to the current EOC at the Police Department.	All Hazards	1.3	Moderate	Emergency Services	Matthews Police and Fire	$16,000	Town Funds, FEMA	5 years	Carry Forward	Backup police communication ability available at Fire Station 1, looking at moving the EOC to Police HQ
Matthews-2	Prepare and maintain a map of areas that flood frequently, particularly those areas outside of FEMA floodplains. Digitize and add to County GIS on the Internet.	Flood	2.1	High	Prevention	Public Works in coordination with Planning GIS	$10,000	Town Storm Water Fees	1 year	Carry Forward	Continual update, mapping reviewed annually and updated as new data is available.
Matthews-3	Paint the bonnets on all fire hydrants in the Town Limits to match the NFPA flow color so that all arriving units will be able to visually see the tested flow of the hydrant.	Wildfire	3.1	High	Emergency Services	Fire Department	$1,000 material, labor in house staff time	General Funds	5 years	Carry Forward	In process as time and resources allow. Not a priority since GIS Mapping provides same capability to identify flow.
Matthews-4	Seek grant 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	1.3	Moderate	Property Protection	Town of Matthews Public Works Department	TBD case by case	Local, State Grants, UHMA Grants, other federal grants	5 years	Carry Forward	Resiliency will be assessed and retrofit will be evaluated as renovations take place and funding is made available.
Matthews-5	Seek grant funding to install backup generators or quick connect hook ups for mobile generators on any newly constructed county/town critical facilities.	All Hazards	1.3	Moderate	Property Protection	Town of Matthews Public Works Department	TBD case by case	Local, State Grants, UHMA Grants, other federal grants	5 years	Carry Forward	Critical facilities, PD, Fire, and PW now have generators. The need for emergency generators will be assessed as new town facilities are constructed.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Matthews-6	Maintain continued compliance with the National Flood Insurance Program (NFIP) through implementation and periodic evaluation of the following higher regulatory standards (in addition to basic required compliance actions): a) Development standards linked to Community Floodplain (Future Conditions) b) Require critical facilities protection to 500-year flood levels c) Require parking lots to be elevated (no more than six inches deep in any parking space during Community Flood event) d) Require dry land access for new or substantially improved buildings (above Community Flood BFE) e) Levee restrictions f) Cumulative substantial damage improvement provision g) Prohibit basements below flood level on filled lots	Flood	4.1	High	Prevention	Public Works in coordination with CMSWS	Local staff time	N/A	3-5 years	Carry Forward	Partially Completed/In Progress. Continued compliance through planning ordinance; will continue to enforce. (See Section 7.)
Matthews-7	Coordinate with Mecklenburg County Storm Water Services to consider applying for and joining FEMA's Community Rating System (CRS).	Flood	4.1	Moderate	Prevention	Public Works in coordination with CMSWS	Local staff time	N/A	3-5 years	Carry Forward	Deferred. Intended to be a result of this 2020 Hazard Mitigation Plan update.
Matthews-8	Mitigate localized flooding caused by existing road and railroad structures by means of increasing the dimensions of drainage culverts in problem areas.	Flood, Severe Winter Storm	1.2	Moderate	Structural Projects	Public Works	$500,000+	Bonds, power bill revenues, Army Corps project funding, Watershed Protection & flood protection funds, etc.	3-5 years	Carry Forward	Partially Completed/In Progress. The Town has worked with CSX to have CSX complete an upgrade of the culvert under the railroad that caused flooding on Tank Town Road on a regular basis. VERY FEW FLOODING EVENTS SINCE CULVERT UPGRADE. The revised culvert is designed to handle the 50-year flood event. Now working with NCDOT to replace the Sam Newell Road culvert with bridge as part of the U-2509 widening project on US74. Construction scheduled to start 2024.
Matthews-10	Provide and maintain NIMS training for all department supervisors and appropriate line employees. Review and revise the Town Emergency operating Plan as necessary. Exercise the plan annually.	All Hazards	3.1	High	Emergency Services	Matthews Fire & EMS	$1,000 annually	General Fund	More than 5 years	Carry Forward	Completed and ongoing. Annual exercise of Town EOP and refresher NIMS training.
Matthews-11	Routinely inspect the functioning of fire hydrants and report findings to CMU for repair.	Wildfire	3.1	High	Prevention	Fire Department	Staff time and resources	N/A	More than 5 years	Carry Forward	Ongoing annual hydrant maintenance program. All hydrants have been inspected and maintained annually. Flow testing every five years to comply with ISO.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Matthews-12	Train staff to educate themselves and the public regarding hazards and the steps that can be taken to reduce their impact.	All Hazards	3.1	Moderate	Public Education & Awareness	Matthews PIO Office and Mecklenburg County	$10,000	General tax revenues, FEMA Emergency Management Institute courses, FEMA and American Red Cross materials are free of charge, Hazard Mitigation Grant Program (HMGP), Department of Homeland Security—Citizenship Education and Training	1 year	Carry Forward	Training has been conducted with staff using County and online resources. FireCorps Volunteers conducted basic CERT program every other year.
Matthews-13	Relocate Town EOC to Police Department	All Hazards	1.3	Moderate	Emergency Services	Matthews Police / Matthews Emergency Management	$10,000	General fund	1 year	New	Install additional phone and computer connections, install large display monitors to track incident status, weather, CAD, and resources. Provide breakout rooms for critical decision making, analysis, and planning. Provide for a greater degree of security. Fire Dept HQ will serve as an Operations Center and back-up for Police Communications Center.
Matthews-14	Provide Information and Educate the Public about strategies for and actions to promote self-reliance during weather-related events. Provide timely information to the public via social media. Provide education to citizens based on the Community Emergency Response Training.	All Hazards	2.3	High	Public Education & Awareness	Matthews Communications Director, Fire & EMS / Fire Corps	$5,000 annually	General fund	2-3 years	New	
Matthews-15	Increase Public Works Debris Removal Capability - Increase debris collection and removal capability by purchasing a grapple attachment for backhoe & skidsteer. The equipment could be used proactively to prevent storm drainage-related flooding, as well aid in as post-event clean-up.	Flood, Hurricane & Tropical Storm, Severe Winter Storm, Severe Weather, Tornado	3.1	High	Prevention	Matthews Public Works	$150,000	Capital Improvement Funds / Storm water funds	3-5 years	New	Grapple attachments for backhoe and skidsteer have been purchased and implemented.
Matthews-16	"South Towns" PSAP: Explore the benefits and costs associated with moving the 'South Towns' (Mint Hill, Matthews, Pineville) PSAP to Pineville Police Dept, with Matthews serving as the back-up PSAP.	All Hazards	3.1	High	Emergency Services	Town of Matthews, Department TBD	TBD	TBD	3-5 years	New	

Annex G Town of Mint Hill

G.1 PLANNING PROCESS

The table below lists the HMPC members who represented the Town of Mint Hill.

Table G.1 – HMPC Members

Representative	Agency/Department
David Leath	Mint Hill Fire
John Rowell	Mint Hill Police

G.2 COMMUNITY PROFILE

Geography

The Town of Mint Hill is located in southeastern Mecklenburg County. It is neighbored by Charlotte to the northwest, Matthews to the southwest, and Stallings and Union County to the southeast. The Town is part of the Charlotte-Concord-Gastonia, NC-SC Metropolitan Statistical Area. Mint Hill comprises a total land area of 23.9 square miles.

According to data from the U.S. Fish and Wildlife Service's National Wetlands Inventory, there are approximately 487 acres of wetlands in Mint Hill.

Population and Demographics

Table G.2 provides population counts and growth estimates for the Town of Mint Hill as compared to Mecklenburg County. Table G.3 provides demographic information for Mint Hill as compared to the county and the state.

Table G.2 – Population Counts, Mint Hill, 2010-2018

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
Town of Mint Hill	14,922	22,722	26,168	3,446	15.2%
Mecklenburg County	**695,454**	**919,628**	**1,054,314**	**134,686**	**14.6%**

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, Mint Hill, 2018

Demographic & Social Characteristics	Mint Hill	Mecklenburg County	North Carolina
Median Age	43.7	35	38.6
% of Population Under 5 years old	5.7%	6.8%	5.9%
% of population Over 65 years old	19%	10.6%	15.5%
% of Population Over 25 with high school diploma	94.4%	90.10%	87.4%
% of Population Over 25 with bachelor's degree or higher	39.6%	44.80%	30.5%
% with Disability	10%	8.4%	13.6%
% Speak English less than "very well"	3.8%	8.9%	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 Mint Hill as compared to the County and State overall.

Table G.4 – Housing Statistics, Mint Hill, 2010-2018

Housing Characteristics	Mint Hill	Mecklenburg County	North Carolina
Housing Units (2010)	9,149	398,510	4,327,528
Housing Units (2018)	9,736	435,795	4,573,066
Housing Units Percent Change (2010-2018)	6.42%	9.36%	5.67%
Housing Occupancy Rate	96.20%	92.6%	85.70%
% Owner-Occupied	77.80%	56.5%	65%
Average Household Size	2.8	2.56	2.52
% of Housing Units with no Vehicles Available	2%	5.9%	5.9%
% of Housing Units that are mobile homes	1.5%	1.4%	13.0%
Median Home Value	$252,800	$219,800	$165,900

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 Mint Hill as compared to the county and the state.

Table G.5 – Economic Statistics, Mint Hill, 2018

Demographic & Social Characteristics	Mint Hill	Mecklenburg County	North Carolina
Median Household Income	$70,425	$64,312	$52,413
Per Capita Income	$32,588	$37,298	$29,456
Unemployment Rate	3.7	5.8%	6.3%
% of Individuals Below Poverty Level	10	12.7	15.4
% Without Health Insurance	8.9	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 Matthews in order to estimate the total physical exposure to hazards in this area. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted and displayed. Due to the high volume of CIKR facilities, a map of these buildings is not provided. However, maps of CIKR impacted by specific hazards are provided where applicable in Section 4 of this plan. Building counts provided Table G.8 are from 2018. Because the Town has experienced growth and development since then, these numbers may underestimate actual risk.

Table G.6 – Critical Infrastructure & Key Resources by Type

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	EM	Government Facilities	Healthcare	Transportation Systems	Energy	Emergency Services	Water	Total
Town of Mint Hill	0	9	0	283	0	73	0	48	17	82	0	0	0	**512**

Source: NCEM Risk Management Tool

Table G.7 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Town of Mint Hill	8	62	13	10	0	14	0	**107**

Source: NCEM Risk Management Tool

Table G.8 – IRISK Inventory of Building Counts and Values

Jurisdiction	Building Count	Building Value
Town of Mint Hill	9,883	$1,961,562,978

Source: NCEM Risk Management Tool

G.3.1 Dam Failure

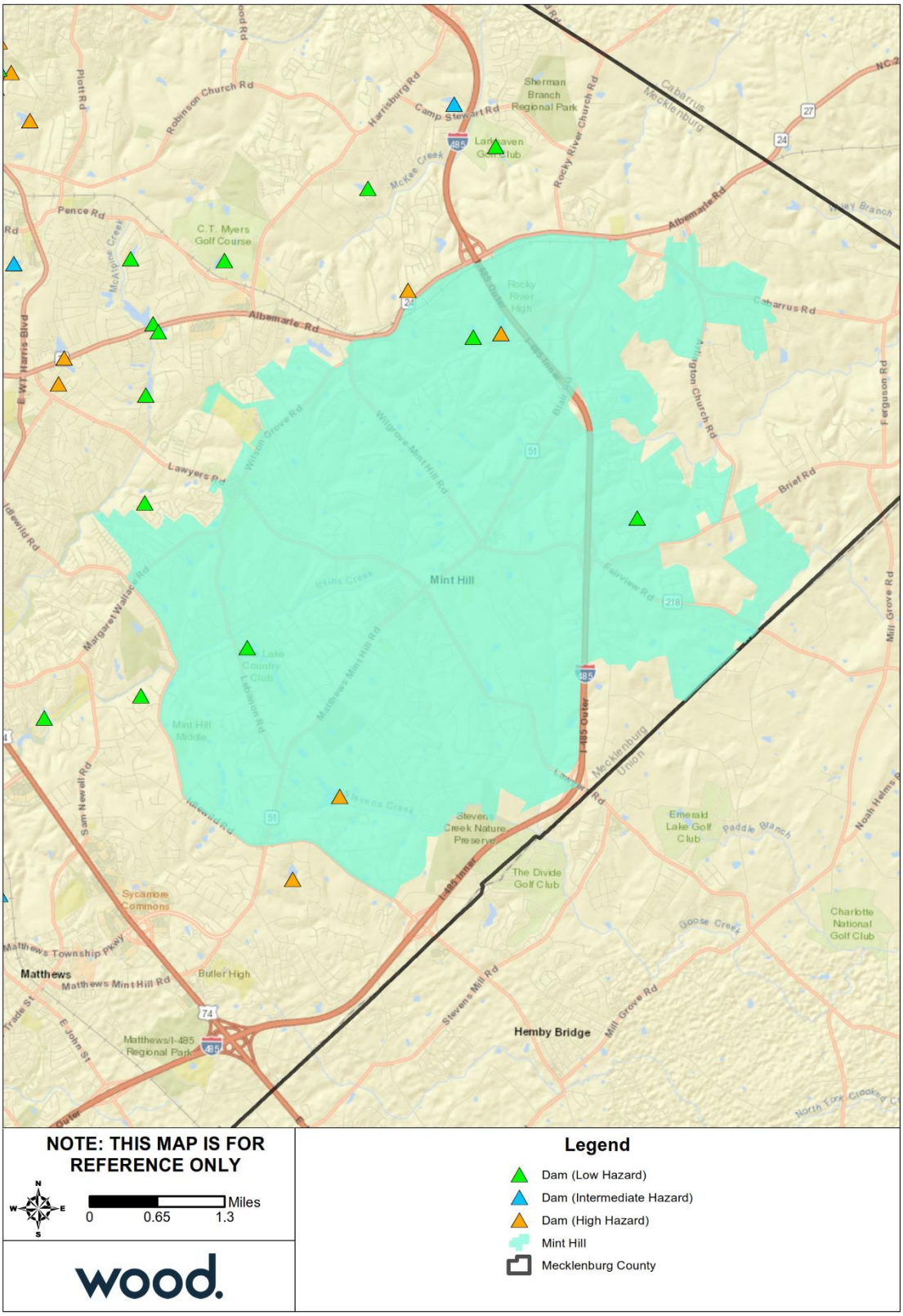
Table G.9 lists details the high hazard dams in the Town of Mint Hill identified by the North Carolina Dam Inventory as of July 2018. All dam locations throughout Mint Hill are shown in Figure G.1.

Table G.9 – High Hazard Dams in Town of Matthews

Dam Name	NID ID	Condition as of Last Inspection	Max Capacity (Ac-Ft)	Nearest Downstream Location
Cornwell Dam	NC00328	Fair	358	Fairview
Woodrow Allen Dam	NC03483	Poor	36	Mint Hill

Source: NC Dam Inventory, July 2018

Figure G.1 – Dam Locations, Town of Mint Hill



Source: NC Dam Inventory, July 2018

G.3.2 Flood

Table G.10 details the acreage of the Town of Mint Hill by flood zone on the effective DFIRM. Per this assessment, just under 2 percent of Mint Hill falls within the mapped 1%-annual-chance floodplains.

Table G.10 – Flood Zone Acreage in the Town of Mint Hill

Flood Zone	Acreage	Percent of Total (%)
Zone AE	306.16	1.96%
Zone X (500-year)	0.00	0.00%
Zone X Unshaded	15,297.71	98.04%
Total	**15,603.87**	--

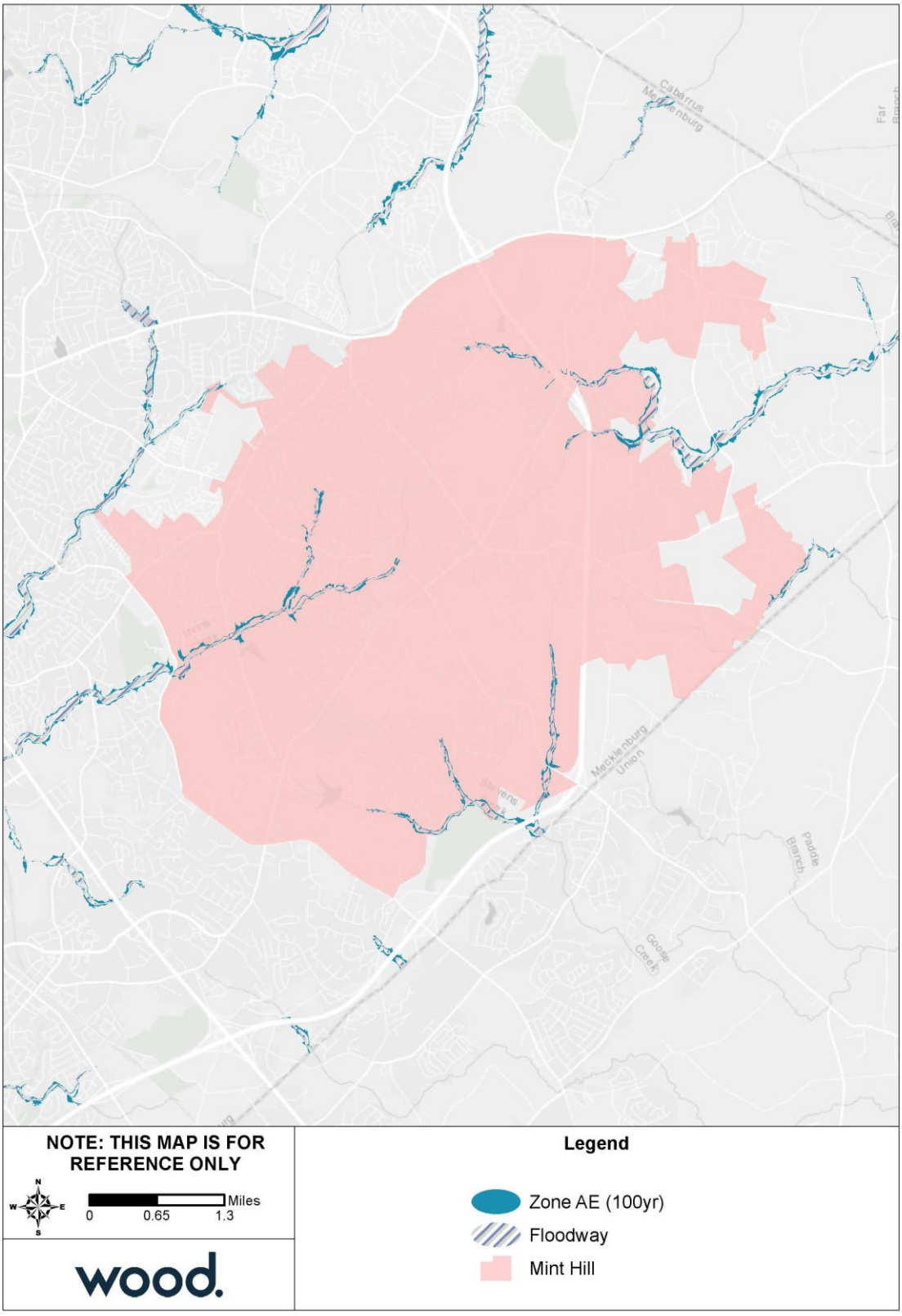
Source: FEMA Effective DFIRM

There are no critical facilities or high potential loss properties with estimated flood damages in the Town of Mint Hill.

Figure G.2 reflects the effective mapped flood hazard zones for the Town of Mint Hill, and Figure G.3 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

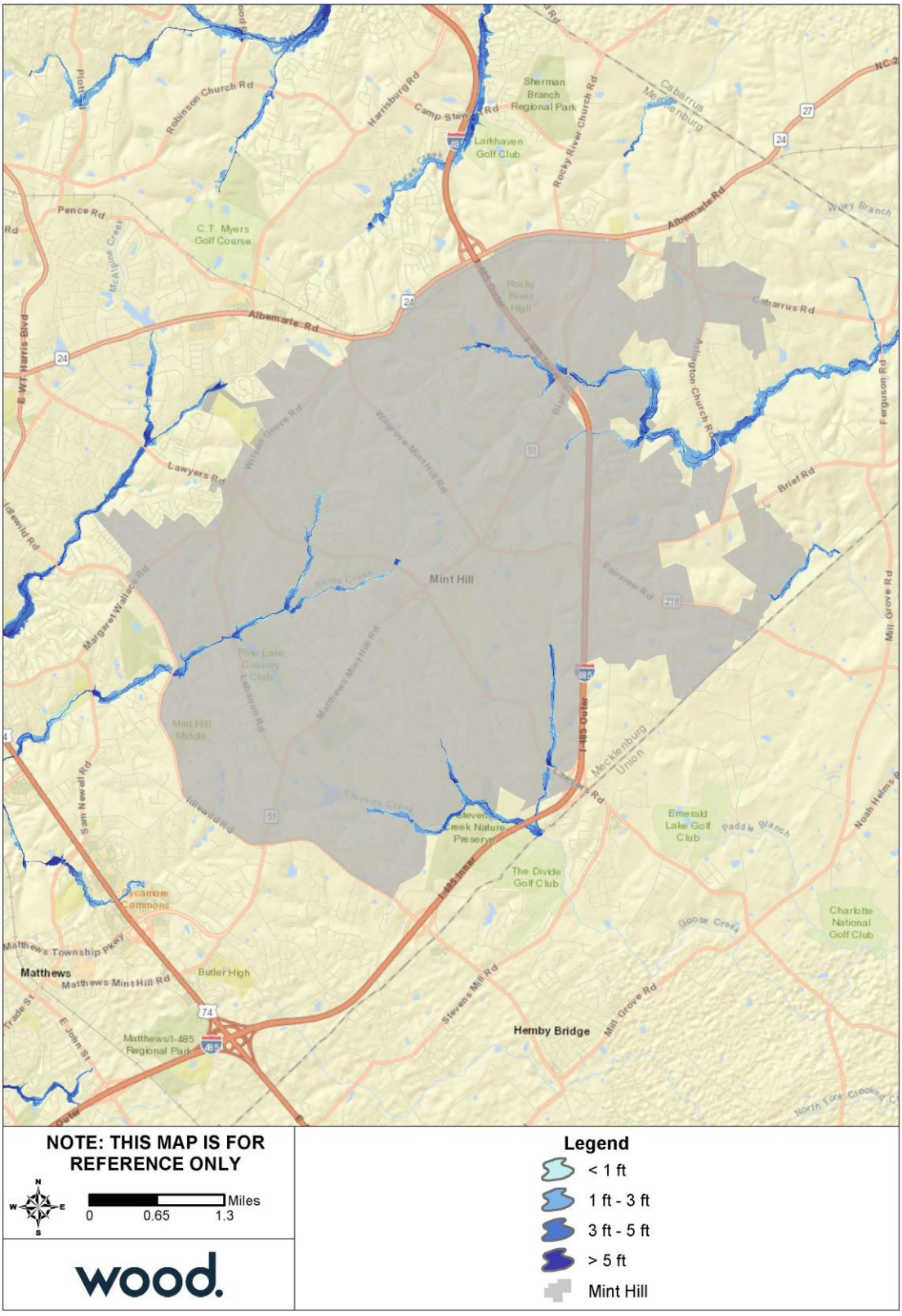
There are no critical facilities or high potential loss properties with estimated flood damages in the Town of Mint Hill.

Figure G.2 – FEMA Flood Hazard Areas, Town of Mint Hill



Source: FEMA Effective DFIRM

Figure G.3 – Flood Depth, 1%-Annual-Chance Floodplain, Town of Mint Hill



Source: FEMA Effective DFIRM

G.3.3 Wildfire

Table G.11 summarizes the acreage in the Town of Mint 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 4 percent of the Town of Mint Hill is not included in the WUI.

Table G.11 – Wildland Urban Interface Acreage, Town of Mint Hill

	Housing Density	Total Acreage	Percent of Total Acreage
	Not in WUI	701.09	4.5%
	LT 1hs/40ac	522.12	3.3%
	1hs/40ac to 1hs/20ac	395.48	2.5%
	1hs/20ac to 1hs/10ac	948.16	6.1%
	1hs/10ac to 1hs/5ac	1,813.62	11.6%
	1hs/5ac to 1hs/2ac	4,022.25	25.8%
	1hs/2ac to 3hs/1ac	7,100.61	45.5%
	GT 3hs/1ac	99.65	0.6%
	Total	15,602.98	

Source: Southern Wildfire Risk Assessment

Figure A.4 depicts the WUI for all incorporated areas in Mecklenburg County, including the Town of Mint Hill. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure A.5 depicts Burn Probability for all of Mecklenburg 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 Mint Hill. There are pockets of moderate to high potential fire intensity throughout the Town, especially in eastern Mint Hill. Overall, just over one percent of the Town has a Class 4 (high) fire intensity rating and an additional 13 percent has a Class 3 fire intensity rating.

Table G.12 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table G.13 provides counts and estimated damages for High Potential Loss Properties in the Town of Mint Hill.

Table G.12 – Critical Facilities Exposed to Wildfire, Town of Mint Hill

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	6	$5,853,203
Commercial Facilities	120	$105,304,882
Critical Manufacturing	33	$20,881,966
Government Facilities	14	$21,784,233
Healthcare and Public Health	7	$4,347,713
Transportation Systems	38	$27,380,152
All Categories	**218**	**$185,552,149**

Source: NCEM Risk Management Tool

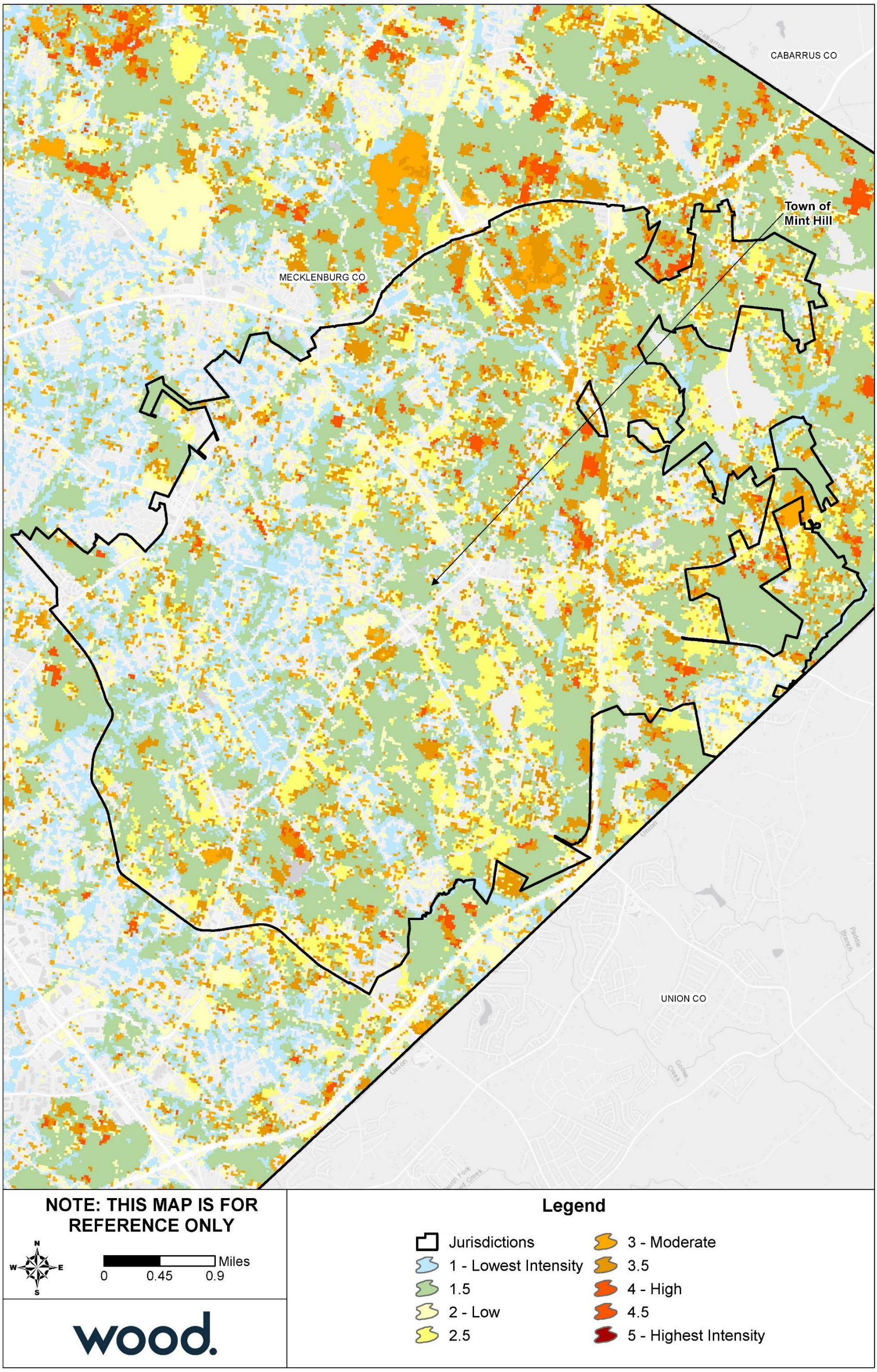
Table G.13 – High Potential Loss Properties Exposed to Wildfire, Town of Mint Hill

Category	Number of Buildings at Risk	Estimated Damages
Commercial	37	$69,309,126
Government	3	$20,910,471
Industrial	8	$14,810,656
Religious	10	$25,192,567

Category	Number of Buildings at Risk	Estimated Damages
Residential	2	$14,066,145
All Categories	**60**	**$144,288,965**

Source: NCEM Risk Management Tool

Figure G.4 – Fire Intensity Scale, Town of Mint Hill



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 Mint Hill are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Mint Hill has a moderate overall capability rating. The Town has moderate planning and regulatory capability, relying on Mecklenburg County to help fill in the gaps. They are currently developing an open space management plan, economic development plan, and historic preservation plan to further this capability. The Town has limited administrative, fiscal, and outreach capability and no structural mitigation experience.

G.4.2 Floodplain Management

The Town of Mint Hill joined the NFIP through regular entry in December 2007. 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.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	55	$24,122	$16,432,800	3	$27,461.18
Total	**55**	**$24,122**	**$16,432,800**	**3**	**$27,461.18**

Source: FEMA Community Information System, accessed May 2020

Table G.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	16	$9,054	$4,477,800	1	$0.00
B, C & X Zone					
Standard	2	$1,443	$475,000	0	$0.00
Preferred	37	$13,625	$11,480,000	2	$27,461.18
Total	**55**	**$24,122**	**$16,432,800**	**3**	**$27,461.18**

Source: FEMA Community Information System, accessed May 2020

Table G.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	14	$8,487	$3,977,800	1	$0.00
B, C & X Zone	26	$10,030	$7,545,000	1	$18,104.82
Standard	2	$1,443	$475,000	0	$0.00
Preferred	24	$8,587	$7,070,000	1	$18,104.82
Total	**40**	**$18,517**	**$11,522,800**	**2**	**$18,104.82**

Source: FEMA Community Information System, accessed May 2020

Table G.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	2	$567	$500,000	0	$0.00
B, C & X Zone	13	$5,038	$4,410,000	1	$9,356.36
Standard	0	$0	$0	0	$0.00
Preferred	13	$5,038	$4,410,000	1	$9,356.36
Total	**15**	**$5,605**	**$4,910,000**	**1**	**$9,356.36**

Source: FEMA Community Information System, accessed May 2020

G.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Mint Hill-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	1.3	Moderate	Property Protection	Mecklenburg County Buildings and Inspections Department; Town of Mint Hill Emergency Services	To be determined on a case by case basis	Local, State Grants, UHMA grants, other federal grants	2025	Carried Forward	No progress made due to funding limitations. Resiliency will be assessed and retrofits will be evaluated as renovations take place and funding is made available.
Mint Hill-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	1.3	Moderate	Property Protection	Mecklenburg County Buildings and Inspections Department; Town of Mint Hill Emergency Services	To be determined on a case by case basis	Local, State Grants, UHMA grants, other federal grants	2025	Carried Forward	Critical facilities, PD, Fire, PW and Town Hall now have generators. The need for more emergency generators will be assessed as new town Facilities are constructed.
Mint Hill-3	Maintain continued compliance with the National Flood Insurance Program (NFIP) through implementation and periodic evaluation of the following higher regulatory standards (in addition to basic required compliance actions): a) Development standards linked to Community Floodplain (Future Conditions) b) Require critical facilities protection to 500-year flood levels c) Require parking lots to be elevated (no more than six inches deep in any parking space during Community Flood event) d) Require dry land access for new or substantially improved buildings (above Community Flood BFE) e) Levee restrictions f) Cumulative substantial damage improvement provision g) Prohibit basements below flood level on filled lots	Flood	4.1	High	Prevention	Town of Mint Hill in coordination with CMSWS	Local staff time	Local	2020-2025	Carried Forward	The Town has maintained compliance with NFIP.
Mint Hill-4	Prepare and conduct a survey for critical facilities to help identify structural and/or non-structural deficiencies that may lead to increased vulnerability to natural hazards. Include recommended corrective actions in local capital improvements program.	All Hazards	1.3	Moderate	Prevention	Town of Mint Hill Public Works Department	$20,000	Local	2025	Carried Forward	Critical facilities have been reevaluated on a yearly basis to identify any deficiencies.
Mint Hill-5	Prepare and maintain a map of areas that flood frequently, particularly those areas outside of FEMA floodplains.	Flood	2.1	Moderate	Prevention	In coordination with CMSWS	$5,000	N/A	2025	Carried Forward	Mapping review completed annually. Updated as new data is available.
Mint Hill-6	Coordinate with the North Carolina Division of Forest Resources (NCDFR) to prepare Community Wildfire Protection Plans (CWWPs) for identified high risk communities.	Wildfire	4.1	Moderate	Prevention	Town of Mint Hill Voluntary Fire Department; in coordination with NCFS	$5,000	NCDFR grants; FEMA PDM or HMGP	2025	Carried Forward	This action is the responsibility of the NCFS. The Town of Mint Hill will continue to assist with this action as needed, however it is being monitored and maintained by NCFS.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Mint Hill-7	On an annual basis, coordinate with Charlotte-Mecklenburg Emergency Management on a widespread public outreach activity to provide information on all natural hazards facing the area to local residents, including methods for mitigating and preventing damages from hazardous conditions and how to respond when an imminent hazard threatens.	All Hazards	2.1	Moderate	Public Education & Awareness	Town of Mint Hill in coordination with CMEMO (Lead)	Local staff time and resources	Local	2020-2025	Carried Forward	No progress made due to limited staff and competing priorities.
Mint Hill-8	On an annual basis, coordinate with Charlotte-Mecklenburg Emergency Management to provide information on all natural hazards facing the area to local planning staff and elected officials. This should be combined with an annual progress report on the status of local mitigation actions as identified in the Multi-jurisdictional Hazard Mitigation Plan.	All Hazards	3.1	Moderate	Public Education & Awareness	Town of Mint Hill in coordination with CMEMO (Lead)	Local staff time and resources	Local	2020-2025	Carried Forward	No progress made due to limited staff and competing priorities.
Mint Hill-9	Improve growth management procedures in identified flood hazard areas.	Flood	4.1	High	Prevention	Town of Mint Hill Planning Department	Staff time and resources	Local	2025	Carried Forward	No specific procedure changes made due to competing priorities, but this is an ongoing procedure with constant evaluation and improvements.

Annex H Town of Pineville

H.1 PLANNING PROCESS

The table below lists the HMPC members who represented the Town of Pineville.

Table H.1 – HMPC Members

Representative	Agency/Department
Brian Elgort	Planning
Chip Hill	Code Enforcement
Randy Smith	Citizen
Gerelyn Garcia	Citizen
Jack Edwards	Mayor

H.2 COMMUNITY PROFILE

Geography

The Town of Pineville is located in southern Mecklenburg County. It is neighbored by Charlotte to the north and east and by Lancaster and York Counties to the southwest. The Town is part of the Charlotte-Concord-Gastonia, NC-SC Metropolitan Statistical Area. Pineville comprises a total land area of 6.6 square miles.

According to data from the U.S. Fish and Wildlife Service's National Wetlands Inventory, there are approximately 44 acres of wetlands in Pineville.

Population and Demographics

Table H.2 provides population counts and growth estimates for the Town of Pineville as compared to Mecklenburg County. Table H.3 provides demographic information for Pineville as compared to the county and the state.

Table H.2 – Population Counts, Pineville, 2010-2018

Jurisdiction	2000 Census Population	2010 Census Population	2018 ACS Population Estimate	Total Change 2010-2018	% Change 2010-2018
Town of Pineville	3,449	7,479	8,574	1,095	14.6%
Mecklenburg County	**695,454**	**919,628**	**1,054,314**	**134,686**	**14.6%**

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, Pineville, 2018

Demographic & Social Characteristics	Town of Pineville	Mecklenburg County	North Carolina
Median Age	35.1	35	38.6
% of Population Under 5 years old	8.9%	6.8%	5.9%
% of population Over 65 years old	18.9%	10.6%	15.5%
% of Population Over 25 with high school diploma	95%	90.10%	87.4%
% of Population Over 25 with bachelor's degree or higher	43.9%	44.80%	30.5%
% with Disability	15%	8.4%	13.6%
% Speak English less than "very well"	7.1%	8.9%	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 Pineville as compared to the County and State overall.

Table H.4 – Housing Statistics, Pineville, 2010-2018

Housing Characteristics	Pineville	Mecklenburg County	North Carolina
Housing Units (2010)	4,051	398,510	4,327,528
Housing Units (2018)	4,183	435,795	4,573,066
Housing Units Percent Change (2010-2018)	3.26%	9.36%	5.67%
Housing Occupancy Rate	93.2%	92.6%	85.70%
% Owner-Occupied	32.4%	56.5%	65%
Average Household Size	2.2	2.56	2.52
% of Housing Units with no Vehicles Available	14.9%	5.9%	5.9%
% of Housing Units that are mobile homes	0%	1.4%	13.0%
Median Home Value	$208,300	$219,800	$165,900

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 Pineville as compared to the county and the state.

Table H.5 – Economic Statistics, Pineville, 2018

Demographic & Social Characteristics	Pineville	Mecklenburg County	North Carolina
Median Household Income	$48,324	$64,312	$52,413
Per Capita Income	$31,290	$37,298	$29,456
Unemployment Rate	4.1%	5.8%	6.3%
% of Individuals Below Poverty Level	9.1	12.7	15.4
% Without Health Insurance	10.7	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: Dam Failure, Flood and Wildfire.

Asset Inventory

The following tables summarize the asset inventory for Pineville in order to estimate the total physical exposure to hazards in this area. Note that the CIKR counts are by building; where a critical facility comprises a cluster of buildings, each building is counted and displayed. Due to the high volume of CIKR facilities, a map of these buildings is not provided. However, maps of CIKR impacted by specific hazards are provided where applicable in Section 4 of this plan. Building counts provided Table D.8 are from 2018. Because the Town has experienced some growth and development since then, these numbers may underestimate actual risk.

Table H.6 – Critical Infrastructure & Key Resources by Type

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	EM	Government Facilities	Healthcare	Transportation Systems	Energy	Emergency Services	Water	Total
Town of Pineville	0	4	0	335	0	136	0	23	23	69	0	0	0	**590**

Source: NCEM Risk Management Tool

Table H.7 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Town of Pineville	81	90	42	3	0	5	0	**221**

Source: NCEM Risk Management Tool

Table H.8 – IRISK Inventory of Building Counts and Values

Jurisdiction	Building Count	Building Value
Town of Pineville	2,731	$1,454,204,073

Source: NCEM Risk Management Tool

H.3.1 Dam Failure

According to the North Carolina Dam Inventory as of July 2018, the Town of Pineville is the nearest downstream location to two high hazard dams located in the City of Charlotte. The Arrowood Quarry Dam was in fair condition at the time of its last inspection; however, the Windermere Dam was not rated, and risk is unknown.

H.3.2 Flood

Table H.9 details the acreage of the Town of Pineville by flood zone on the effective DFIRM. Per this assessment, over 20 percent of Pineville falls within the mapped 1%-annual-chance floodplains.

Table H.9 – FEMA Flood Hazard Areas, Town of Pineville

Flood Zone	Acreage	Percent of Total (%)
Zone AE	861.87	20.30%
Zone X (500-year)	0.00	0.00%
Zone X Unshaded	3,384.41	79.70%
Total	**4,246.28**	--

Source: FEMA Effective DFIRM

Figure H.1 reflects the effective mapped flood hazard zones for the Town of Pineville, and Figure H.2 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

Table H.10 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector and flood event in the Town of Pineville. Table H.11 provides building counts and estimated damages for high potential loss facilities exposed to flooding by category and event.

Table H.10 – Critical Facilities Exposed to Flooding, Town of Pineville

Sector	Event	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	10 Year	2	$42,262
	25 Year	3	$82,759
	50 Year	14	$200,480
	100 Year	16	$556,252
	500 Year	25	$2,683,709
Critical Manufacturing	10 Year	4	$87,970
	25 Year	5	$159,124
	50 Year	6	$308,471
	100 Year	7	$409,745
	500 Year	9	$587,199
Government Facilities	500 Year	22	$1,614,256
Healthcare and Public Health	10 Year	2	$88,968
	25 Year	2	$106,238
	50 Year	2	$130,080
	100 Year	2	$135,367
	500 Year	3	$173,625
Transportation Systems	10 Year	3	$190,497
	25 Year	4	$211,818
	50 Year	7	$380,746
	100 Year	9	$436,199
	500 Year	10	$596,326
All Categories	**10 Year**	**11**	**$409,697**
	25 Year	**14**	**$559,939**
	50 Year	**29**	**$1,019,777**
	100 Year	**34**	**$1,537,563**
	500 Year	**49**	**$4,047,736**

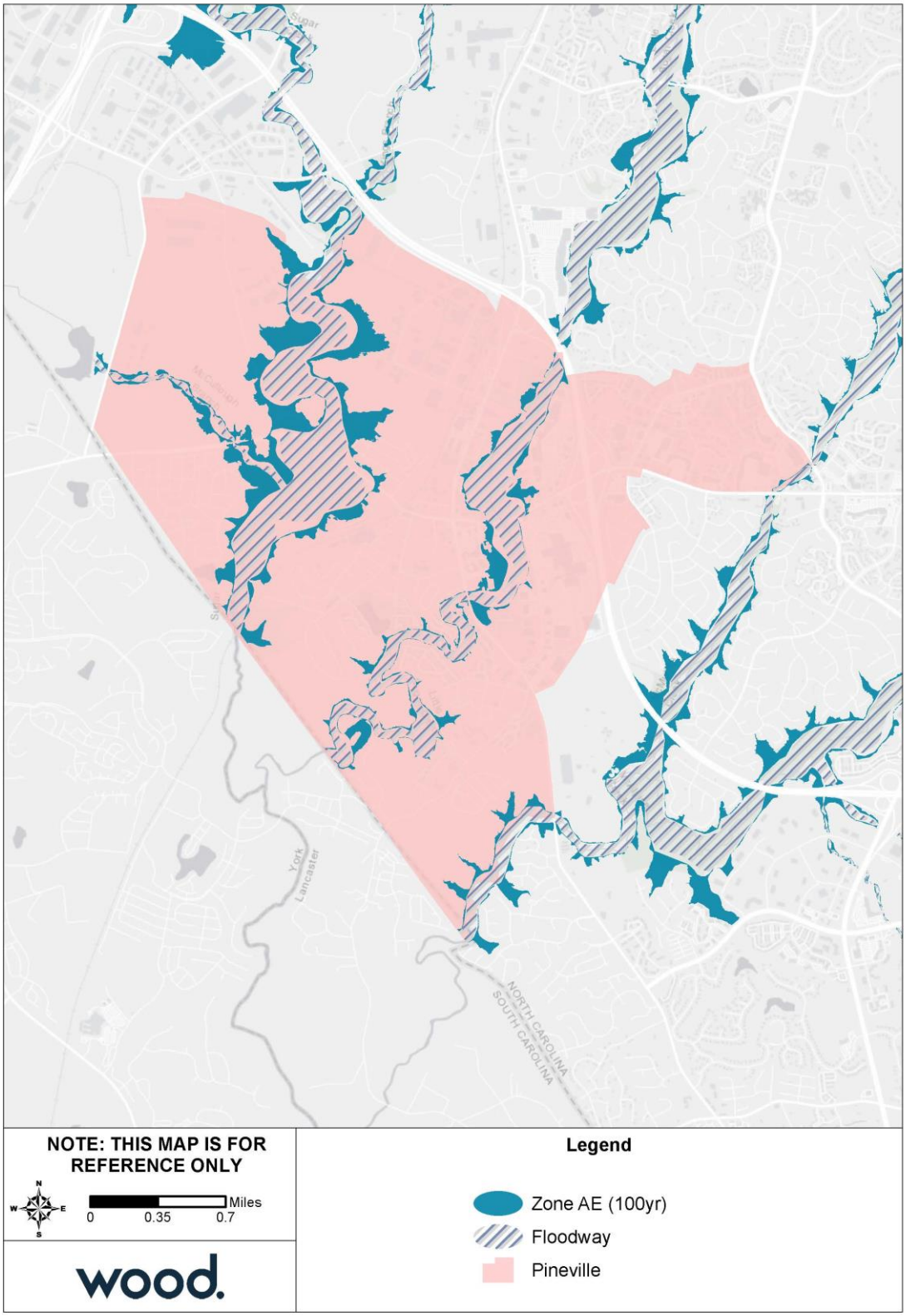
Source: NCEM Risk Management Tool

Table H.11 – High Potential Loss Properties Exposed to Flooding, Town of Pineville

Category	Event	Number of Buildings at Risk	Estimated Damages
Commercial	100 Year	12	$5,168,111
	500 Year	23	$16,910,785
Residential	10 Year	1	$8,338
	25 Year	1	$264,573
	50 Year	1	$417,778
	100 Year	1	$493,730
	500 Year	1	$683,596
All Categories	**10 Year**	**1**	**$8,338**
	25 Year	**1**	**$264,573**
	50 Year	**1**	**$417,778**
	100 Year	**3**	**$746,653**
	500 Year	**5**	**$2,512,834**

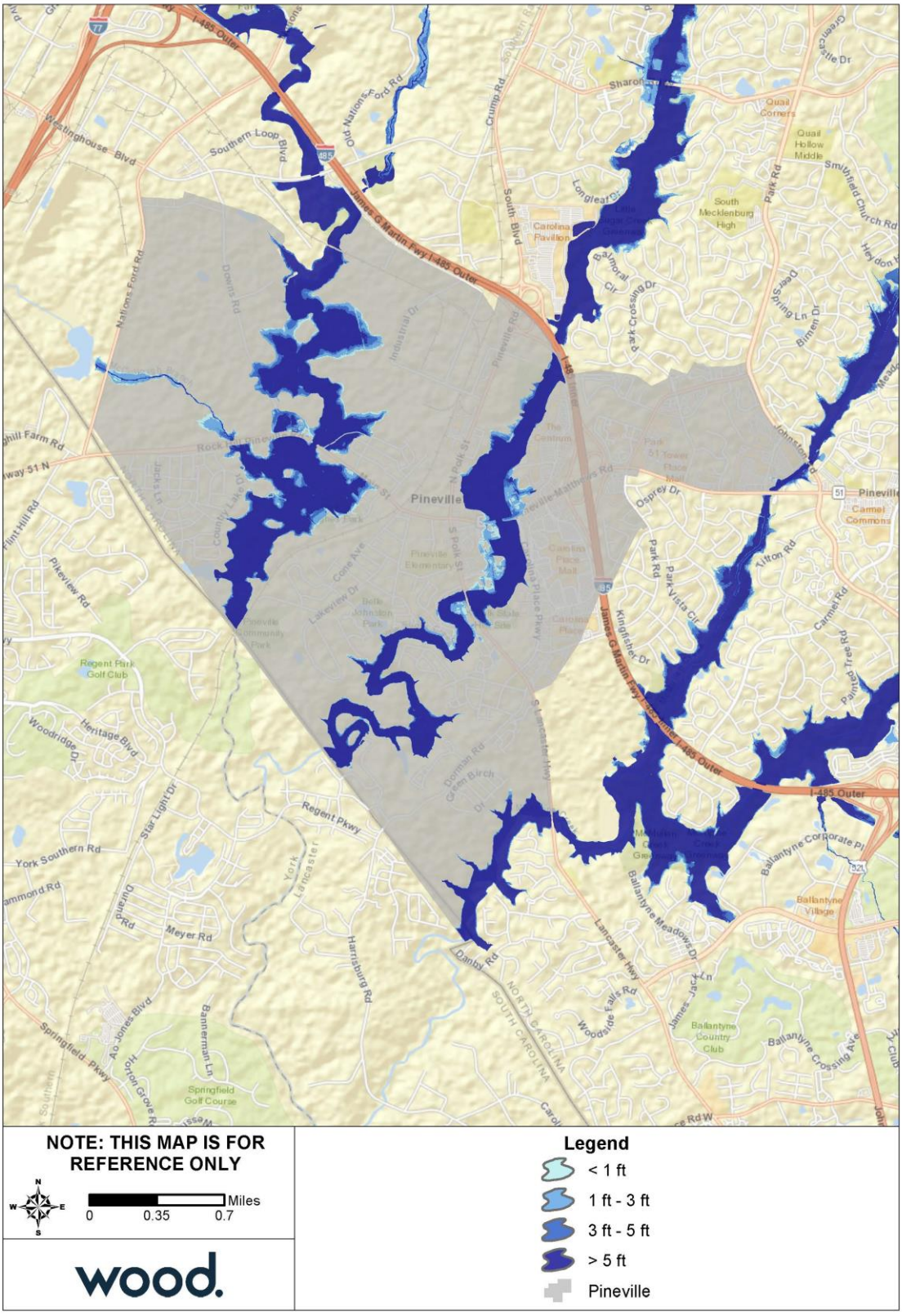
Source: NCEM Risk Management Tool

Figure H.1 – FEMA Flood Hazard Areas, Town of Pineville



Source: FEMA Effective DFIRM

Figure H.2 – Flood Depth, 1%-Annual-Chance Floodplain, Town of Pineville



Source: FEMA Effective DFIRM

H.3.3 Wildfire

Table H.12 summarizes the acreage in the Town of Pineville 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. Approximately 30 percent of the Town of Pineville is not included in the WUI.

Table H.12 – Wildland Urban Interface Acreage, Town of Pineville

	Housing Density	Total Acreage	Percent of Total Acreage
	Not in WUI	1,279.11	30.1%
	LT 1hs/40ac	477.40	11.2%
	1hs/40ac to 1hs/20ac	247.91	5.8%
	1hs/20ac to 1hs/10ac	285.39	6.7%
	1hs/10ac to 1hs/5ac	321.88	7.6%
	1hs/5ac to 1hs/2ac	363.44	8.5%
	1hs/2ac to 3hs/1ac	881.44	20.7%
	GT 3hs/1ac	397.22	9.3%
	Total	4,253.79	

Source: Southern Wildfire Risk Assessment

Figure A.4 depicts the WUI for all incorporated areas in Mecklenburg County, including the Town of Pineville. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure A.5 depicts Burn Probability for all of Mecklenburg County based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Figure H.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 Pineville. Moderate to high potential fire intensity is spread throughout the Town, especially in the western area. Overall, areas of Class 3 fire intensity comprise 7.3% of the Town's total area and areas of Class 4 potential fire intensity make up less than one percent of 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 Pineville.

Table H.13 – Critical Facilities Exposed to Wildfire, Town of Pineville

Sector	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	31	$27,934,696
Critical Manufacturing	13	$11,135,572
Healthcare and Public Health	1	$2,821,194
All Categories	**45**	**$41,891,462**

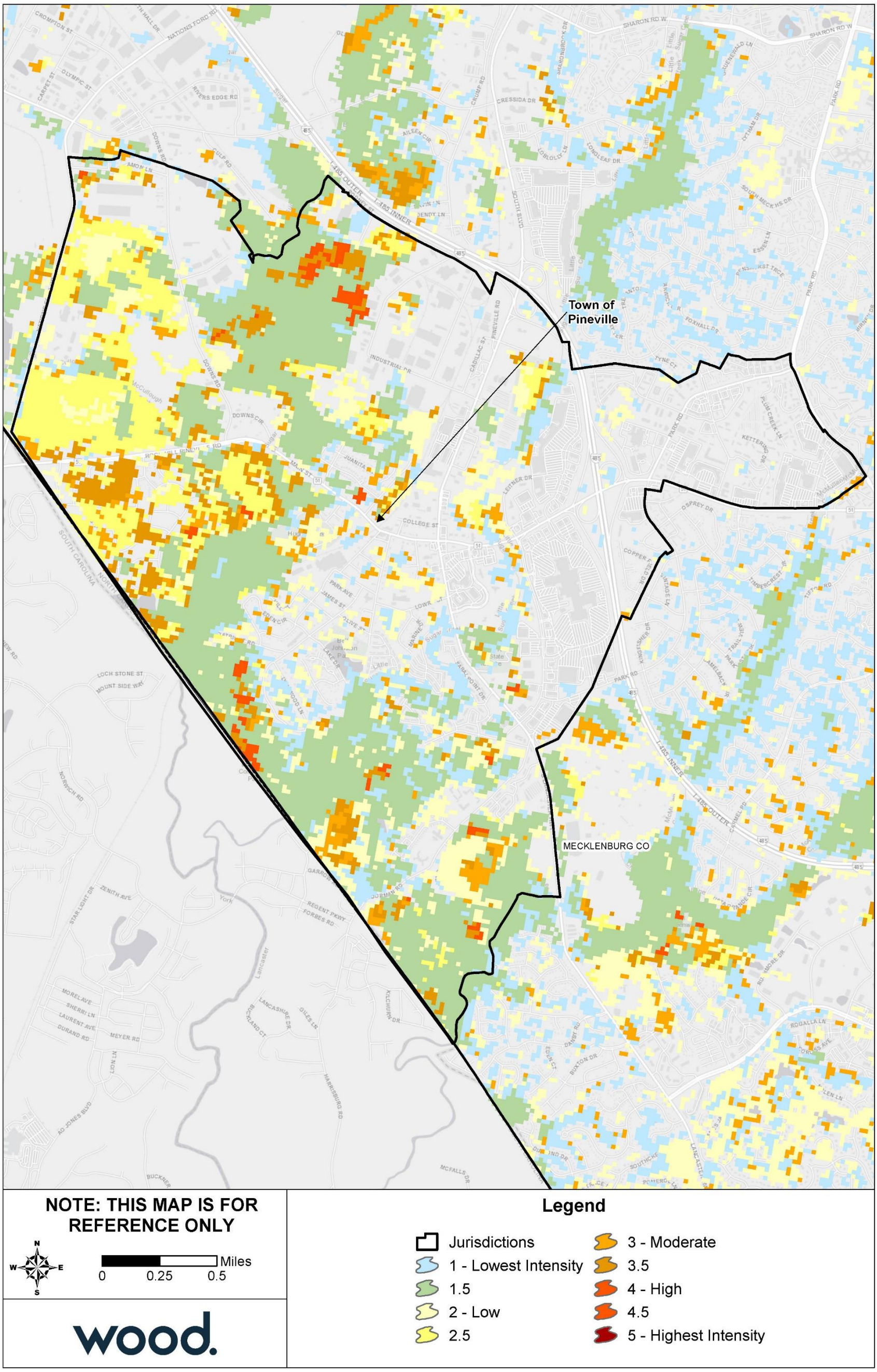
Source: NCEM Risk Management Tool

Table H.14 – High Potential Loss Properties Exposed to Wildfire, Town of Pineville

Category	Number of Buildings at Risk	Estimated Damages
Commercial	9	$15,859,188
Industrial	2	$6,502,974
Religious	1	$3,351,878
All Categories	**12**	**$25,714,040**

Source: NCEM Risk Management Tool

Figure H.3 – Fire Intensity Scale, Town of Pineville



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 Pineville are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Ossipee has a moderate overall capability rating. The Town has sufficient planning and regulatory capability bolstered by participation in County initiatives. The Town could further increase this capability through development of a Flood Damage Prevention Ordinance or a Post-Disaster Redevelopment Ordinance. Pineville has strong fiscal capability, moderate administrative capabilities, limited outreach capabilities, and limited structural mitigation experience.

H.4.2 Floodplain Management

The Town of Pineville joined the NFIP through emergency in 1975 and have been a regular participant since March 1987. The following tables reflect NFIP policy and claims data for the Town categorized by structure type, flood zone, Pre-FIRM and Post-FIRM.

Table H.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	25	$14,086	$5,814,300	3	$1,718.13
2-4 Family	4	$1,014	$659,900	0	$0.00
All Other Residential	5	$951	$562,200	0	$0.00
Non-Residential	26	$47,639	$9,560,000	2	$18,000.00
Total	**60**	**$63,690**	**$16,596,400**	**5**	**$19,718.13**

Source: FEMA Community Information System, accessed May 2020

Table H.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	35	$45,407	$9,181,400	4	$19,718.13
B, C & X Zone					
Standard	6	$8,130	$1,965,000	0	$0.00
Preferred	19	$10,153	$5,450,000	1	$0.00
Total	**60**	**$63,690**	**$16,596,400**	**5**	**$19,718.13**

Source: FEMA Community Information System, accessed May 2020

Table H.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	14	$26,501	$1,797,300	4	$19,718.13
B, C & X Zone	9	$10,607	$3,058,000	0	$0.00
Standard	5	$7,712	$1,790,000	0	$0.00
Preferred	4	$2,895	$1,268,000	0	$0.00
Total	**23**	**$37,108**	**$4,855,300**	**4**	**$19,718.13**

Source: FEMA Community Information System, accessed May 2020

Table H.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	21	$18,906	$7,384,100	0	$0.00
B, C & X Zone	16	$7,676	$4,357,000	1	$0.00
Standard	1	$418	$175,000	0	$0.00
Preferred	15	$7,258	$4,182,000	1	$0.00
Total	**37**	**$26,582**	**$11,741,100**	**1**	**$0.00**

Source: FEMA Community Information System, accessed May 2020

H.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Pineville-1	Seek grant 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	1.3	Moderate	Property Protection	Town of Pineville	Determined on case-by-case basis	Local, State Grants, UHMA Grants, other federal grants	2020-2025	Carry Forward	In progress: Mecklenburg County retroFIT flood hazard mitigation grant program rolled out in FY16 project to identify and partially fund various mitigation projects using techniques such as floodproofing.
Pineville-2	Seek grant funding to install backup generators or quick connect hook ups for mobile generators on any newly constructed county/town critical facilities.	All Hazards	1.3	Moderate	Property Protection	Town of Pineville	Determined on case-by-case basis	Local, State Grants, UHMA Grants, other federal grants	2020-2025	Carry Forward	In Progress. Grants have not yet been applied for, but staff have been gathering information and quotes to be able to apply for a grant when we find one that is suitable.
Pineville-3	Maintain continued compliance with the National Flood Insurance Program (NFIP) through implementation and periodic evaluation of the following higher regulatory standard (in addition to basic required compliance actions): a) Development standards linked to Community Floodplain (Future Conditions) b) Require critical facilities protection to 500-year flood levels c) Require parking lots to be elevated (no more than six inches deep in any parking space during Community Flood event) d) Require dry land access for new or substantially improved buildings (above Community Flood BFE) e) Levee restrictions f) Cumulative substantial damage improvement provision g) Prohibit basements below flood level on filled lots	Flood	4.1	High	Prevention	Town of Pineville in coordination with CMSWS	Local staff time	N/A	2020-2025	Carry Forward	In Progress: Municipal Ordinance Updates to City, County, and town floodplain ordinances completed as Flood Insurance Rate Map revisions become effective. Staff participated in FEMA/NCDEM training E273 “Managing Floodplain Development through the National Flood Insurance Program”.
Pineville-4	In coordination with CMSWS, continue participation in the NFIP Community Rating System (CRS) with the goal of increasing CRS credit points to become a Class 5 community of better within five years.	Flood	4.1	High	Prevention	Town of Pineville in coordination with CMSWS	Local staff time	N/A	2025	Carry Forward	In Progress: Maintained programs to remain Class 6. Researched 2017 CRS manual to prepare for upcoming Annual CRS recertification.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Pineville-5	Advertise and promote the availability of flood insurance.	Flood	2.3	High	Public Education & Awareness	Town of Pineville	No extra cost - the Town of Pineville maintains a bi-monthly newsletter that can be used to support this action	Local budget	2020-2025	Carry Forward	In Progress: Annual "Floodplain Flash" newsletter distributed by USPS in May 2015, 2016 & 2018
Pineville-6	Preserve lands subject to repetitive flooding.	Flood	1.2	Moderate	Prevention	Town of Pineville	Unknown - value of land	Land Trust, Pre-Disaster Mitigation (PDM) program, Hazard Mitigation Grant Program (HMGP), Clean Water Management Trust Fund	2020-2025	Carry Forward	In Progress. The Mecklenburg County Flood Risk Assessment and Risk Reduction Tool (RARRT) is now used to guide local mitigation program actions. Flood risk scores, mitigation priority scores and planning level mitigation techniques were developed for all buildings with property touching the floodplain with updated floodplain maps. This data is now used to develop and prioritize local mitigation efforts.
Pineville-7	Continue to limit future development in identified flood hazard areas and prohibit new critical facilities from being located with the 500-year floodplain as required in the Town's flood damage prevention ordinance.	Flood	4.1	Moderate	Prevention	Planning and Zoning/Mecklenburg County LUESA	Staff time and resources	N/A	2020-2025	Carry Forward	In Progress. Town maintains Zoning and Subdivision Ordinances to attain this goal. In process of developing a new Comprehensive Plan and updating the Zoning Ordinance. Expected to be completed in next two years.
Pineville-8	Conduct cumulative impact analysis/studies for multiple development projects within the same watershed.	Flood	4.1	Moderate	Prevention	Mecklenburg County Storm Water Services, Public Works, GIS Department	Staff time and resources	NRCS—Watershed Protection and Flood Prevention Program, NRCS—Watershed Surveys and Planning, USACE—Floodplain Management Services, HMGP	2020-2025	Carry Forward	In Progress: Staff continues to require extensive studies for development projects within watersheds.
Pineville-9	Continue to coordinate with CMEMO on enhancements to the Town's early warning system and procedures for imminent hazard events.	All Hazards	3.2	High	Emergency Services	Police and Town Manager	TBD	FEMA—All Hazards Operational Planning, HMGP	2020-2025	Carry Forward	In Progress: Continue to coordinate with CMEMO on an ongoing basis.
Pineville-10	On an annual basis, coordinate with Charlotte-Mecklenburg Emergency Management on a widespread public outreach activity to provide information on all natural hazards facing the area to local residents, including methods for preventing damages from hazardous conditions and how to respond when an imminent hazard threatens.	All Hazards	2.1	Moderate	Public Education & Awareness	In coordination with CMEMO (Lead)	Staff time and resources	N/A	2020-2025	Carry Forward	In Progress: Through the Town of Pineville website and social media platforms provide notifications and links to preventing damage during hazardous conditions and also how to respond to imminent hazards as they arise.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Mitigation Category	Lead Agency / Department	Cost Estimate	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Pineville-11	On an annual basis, coordinate with Charlotte-Mecklenburg Emergency Management to provide information on all natural hazards facing the area to local planning staff and elected officials. This should be combined with an annual progress report on the status of local mitigation actions as identified in the Multi-jurisdictional Hazard Mitigation Plan.	All Hazards	3.1	Moderate	Public Education & Awareness	In coordination with CMEMO (Lead)	Staff time and resources	N/A	2020-2025	Carry Forward	In Progress: CMEMO hosted April 2017 planning committee meeting CMSWS hosts May 2018 planning meeting for participating CRS jurisdictions. EM still responsible for hosting 2018 planning committee meetings for all jurisdictions.
Pineville-12	Acquire safe sites for public facilities, including schools, police and fire stations, etc.	All Hazards	1.3	High	Prevention	Town Manager	Dependent on land values, existing ownership of property	Town budget	2020-2025	Carry Forward	Achieved/Ongoing. Belle Johnston Community Center can function as a safe site and any other current or future public facilities that qualify.
Pineville-13	Develop early warning system for hazard events.	All Hazards	3.2	High	Emergency Services	Police and Town Manager	$100,000	FEMA—All Hazards Operational Planning, HMGP	2020-2025	Carry Forward	In progress: Additional stream stage sensors will be installed to provide more stream height data to be used in H&H model calibration and automated real-time flood inundation mapping.
Pineville-14	Develop traffic response plan addressing how to deal with traffic in a commercial area for ingress/egress in the event of a disaster or emergency.	All Hazards	3.3	Moderate	Prevention	Police Department/NCDOT	Staff time and resources	N/A	2020-2025	Carry Forward	Completed/Ongoing. The Police Department has traffic control measures in place. The Town is currently working on re-aligning a traffic light for better and more efficient traffic flow.

Appendix A Plan Review Tool

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APPENDIX A:
LOCAL MITIGATION PLAN REVIEW TOOL

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA's evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of the each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

Jurisdiction: **Mecklenburg County, NC**	**Title of Plan:** **Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan**	**Date of Plan:** **July 2020**
Local Point of Contact: **David Stroud**		**Address:** **4021 Stirrup Creek Drive, Suite 100** **Durham, NC 27703**
Title: **Hazard Mitigation Planning & Emergency Lead**		
Agency:		
Phone Number: **919-856-6485**		**E-Mail:** **david.stroud@woodplc.com**

State Reviewer:	**Title:**	**Date:**
Carl Baker	**Hazard Mitigation Planner**	**August 6, 2020** **August 13, 2020**

FEMA Reviewer: **Edwardine S. Marrone** **Carl Mickalonis**	**Title:** **NC-FIT-Mitigation Planner** **HM Planning Lead**	**October 30, 2020**
Date Received in FEMA Region RIV	**08-14-20**	
Plan Not Approved		
Plan Approvable Pending Adoption		
Plan Approved	**11-23-20**	

✓ Denotes FEMA Reviewer concurs with State Reviewers notations.

SECTION 1:
REGULATION CHECKLIST

INSTRUCTIONS: The Regulation Checklist must be completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been 'Met' or 'Not Met.' The 'Required Revisions' summary at the bottom of each Element must be completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is 'Not Met.' Sub-elements should be referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable. Requirements for each Element and sub-element are described in detail in this *Plan Review Guide* in Section 4, Regulation Checklist.

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan (section and/or page number)**	**Met**	**Not Met**
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1)) **QC concurs.**	a. d. e. Section 2 (p. 4-24)✓ b. P2 c. P9-11 Appendix B includes meeting agenda, minutes, sign-in sheets	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. 7-8, 14); Appendix B✓ a. P14 b. c. Appendix B included outreach documentation, meeting sign-in sheets, stakeholders invitation & list .	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. 12-13); Appendix B a.&b. P12-14 Appendix B included public survey & survey results.	X	
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3)) **QC concurs**	a. & b. Section 2 (p. 7-8) ✓	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. 250-251)✓	X	

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
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. 247-251) a.-d. P247-250	X	
ELEMENT A: REQUIRED REVISIONS NCEM 1st Review: A1: The town of Davidson is only documented at the first meeting. Please provide a participation or proxy statement for the remainder of the planning meetings. Participation statement added. A2: No revisions required. A3: No revisions required. A4: No revisions required. A5: No revisions required. A6: No revisions required. NCEM 2nd Review: No revisions required. A1: Attendance rosters located in Appendix B.			
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. 53-206; Hazard Description, Location, Extent, Hazard Summary by Jurisdiction), Annexes A-H a. & b. P43-44 a.-d. 56, 59, 65-66, 83, 90-93, 109, 112, 128-129, 131-135, 143-144, 155 168, 170,	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. 53-206; Past Occurrences, Probability of Future Occurrence, Hazard Summary by Jurisdiction), a.-c. 60-61, 66-67, 69, 84-85, 94-97, 111-114, 129-131, 135, 144-147, 154-157, 171-174,	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)) **QC Concurs**	Section 4.5 (p. 53-206; Vulnerability Assessment, Hazard Summary by Jurisdiction), Annexes A-H a.&b. 60-63, 67-69, 86-87, 94-105, 113-120, 131-142, 144-147, 156-164, 171, 174-178	X	

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii)) **QC concurs**	Section 4.5.5 (p.106)✓	X	
ELEMENT B: REQUIRED REVISIONS NCEM 1st Review: B1: No revisions required. B2: No revisions required. B3: No revisions required. B4: No revisions required. NCEM 2nd Review: 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)) **QC concurs**	Section 5 (p. 207-222)✓	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. 212-214) P97 (participation) P228, 230, 235, 236, 238, 239, 242, 244 (continued compliance)	X	
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i)) **QC concurs**	Section 6 (p.223-225)✓	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. 223-226), a.-c. Section 7 (p. 227-246) ✓	X	
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))	a.&b. Section 6 (p. 223-226),✓ Section 7 (p. 227-246)	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.247-251) a.&c. P 247-250 b.d.&e. P 207-222	X	

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT C: REQUIRED REVISIONS NCEM 1st Review: C1: No revisions required. C2: No revisions required. C3: No revisions required. C4: The following revisions to mitigation actions: • Mecklenburg-8: Add "critical facilities" to action description. Added • Charlotte: Change the following to All Hazard category: Charlotte Actions # 1, 2, 5, 6, and 7. Changed • Pineville-14: Add "for ingress/egress in the event of a disaster or emergency" to the action description. Added C5: No revisions required. C6: No revisions required. NCEM 2nd Review: No revisions required.			
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Section 3 (p. 25-39), Section 4 (p. 40-206; Asset Inventory, Vulnerability Assessment), Annexes A-H ✓	X	
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3)) **QC concur**	a. Section 2 (p. 14-24)✓, Section 5 (p.207-222) P. 227-246	X	
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3)) **QC concur.**	Section 6 (p. 223-226), Section 7 (p. 227-246)✓ Page 6, 8, 41 & 43-44	X	
ELEMENT D: REQUIRED REVISIONS NCEM 1st Review: D1: No revisions required. D2: Status updates listed on Mitigation Action Plans, Section7. D3: No revisions required. NCEM 2nd Review: No revisions required.			
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 State approval; 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
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 State approval; Adoption resolutions will be added to Section 9		X

ELEMENT E: REQUIRED REVISIONS

FEMA REQUIRED REVISIONS:

Adoption documentation has not been provided by any of the participating jurisdictions.

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 adoption documentation was provided by: Town of Matthews
12-3-20 Town of Pineville provided adoption documentation.
12-8-20 Mecklenburg Co provided adoption documentation.
01-04-21 Town of Huntersville provided adoption documentation.
01-21-21 Town of Cornelius provided adoption documentation.
2-1-21 Town of Davidson provided adoption documentation.
2-23-2021 City of Charlotte provided adoption documentation.
3-5-2021 Mint Hill provided adoption documentation

ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)			
F1.			
F2.			

ELEMENT F: 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. Plan Strengths and Opportunities for Improvement

This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

Element A: Planning Process

Plan Strengths

- Committee members included city/county officials, representatives from various departments including Fire, Public Works, Stormwater, Planning, FMO, Police, Emergency Management, UNC Charlotte, Davidson College, and private citizens.
- Invited stakeholders included representatives from non-profit organizations, educational institutions, surrounding municipalities, federal government, state government and the business community. Example of some invitees are American Red Cross, United Way, Habitat for Humanity, UNC Charlotte, Gaston County, FEMA, NC NFIP Coordinator, and Charlotte Mecklenburg Black Chamber of Commerce. The full list is in Appendix B: Planning Process Documentation.
- A high-level public survey summary and analysis is provided in Section 2. The full public survey is in Appendix B: Planning Process Documentation.

Element B: Hazard Identification and Risk Assessment

Plan Strengths

- Table 4.4 Hazard Evaluation Results provides an explanation for the hazards included or not included in the risk assessment.
- Probability and the priority risk index ratings used are described prior to individual hazard risk assessments.

Element C: Mitigation Strategy

Plan Strengths

- A robust capability assessment is conducted to develop the mitigation strategies. The capability assessment identifies strengths that may further the successful implementation of the mitigation strategies along with weaknesses that are identified actions in the mitigation action plan.
- The mitigation strategies will be incorporated into other county and municipality plans in the future. Inclusion of the mitigation strategies in other plans will ensure the communities are focused on being resilient communities.
- 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 resilient communities.
- The proposed mitigation projects are very specific, actionable, and it is clear the actions were evaluated and re-prioritized.

Element D: Plan Update, Evaluation, and Implementation (*Plan Updates Only*)

Plan Strengths

The monitor and evaluate process is documented. Specific parameters have been set for meetings and the responsible parties of the mitigation strategies will provide a status report.

Opportunities for Improvement

Suggestion for future plan updates; tie the growth management maps to meet Element D1 more easily and would enhance the documentation of development since the last plan update.

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	Mecklenburg County	County					Y	Y	Y	Y	Y	
2	Charlotte	City					Y	Y	Y	Y	Y	
3	Cornelius	Town					Y	Y	Y	Y	Y	
4	Davidson	Town					Y	Y	Y	Y	Y	
5	Huntersville	Town					Y	Y	Y	Y	Y	
6	Matthews	Town					Y	Y	Y	Y	Y	
7	Mint Hill	Town					Y	Y	Y	Y	Y	
8	Pineville	Town					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.	January 24, 2019 3 p.m.	Charlotte Fire Department HQ, 500 Dalton Avenue, Charlotte, NC
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	March 13, 2019 2 p.m.	Charlotte Fire Department HQ, 500 Dalton Avenue, Charlotte, NC
HMPC Mtg. #3	1) Review Draft Hazard Identification & Risk Assessment (HIRA) 2) Draft objectives and Mitigation Action Plans	July 31, 2019 2 p.m.	Charlotte Fire Department HQ, 500 Dalton Avenue, Charlotte, NC
HMPC Mtg. #4	1) Review the Draft Hazard Mitigation Plan 2) Solicit comments and feedback	July 22, 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: January 24, 2019

Charlotte-Mecklenburg Multi-Jurisdictional Hazard Mitigation Plan Update

Meeting 1: Hazard Mitigation Planning Committee Project Kick-Off Meeting
Time & Date: Thursday, January 24, 2019, 3:00-4:30 p.m.
Location: Charlotte Fire Department Headquarters, 500 Dalton Avenue, Charlotte

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. Next Steps
    a. Capability Assessment
    b. Mitigation Action Status Updates
    c. Mitigation Goals Update
6. Questions
7. Adjourn

Page **1** of **1**

Charlotte-Mecklenburg Multi-Jurisdictional Hazard Mitigation Plan Update

Meeting 1: Hazard Mitigation Planning Committee Project Kick-Off Meeting
Date & Time: Thursday, January 24, 2019, 3:00-4:30 p.m.
Location: Charlotte Fire Department Headquarters, 500 Dalton Avenue, Charlotte

Introductions

Chief Wike Graham, Deputy Director of Char-Meck Emergency Management, kicked off the meeting by welcoming everyone in attendance and providing a brief overview of the importance of hazard mitigation and its role in emergency management. He discussed Char-Meck Emergency's Management's relationship with North Carolina Emergency Management (NCEM) and the role NCEM has played in facilitating this plan update process. Chief Graham noted that Anthony Bateman, Emergency Management Planner, will be the main point of contact from Char-Meck Emergency Management. He then introduced David Stroud and Abby Moore, consultants from Wood, who will be leading the County and jurisdictions through the planning process, to facilitate the rest of the meeting. David began by providing the meeting agenda and had everyone in attendance introduce themselves. There were 37 people in attendance and recorded on the sign-in sheet, including representatives from all eight of the jurisdictions participating in the plan update.

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.

Trends in Disasters

Trends are resulting in increases costs for disaster response and recovery. There has been an increase in population and community growth in recent years, especially in Mecklenburg County, which means that more people are living in hazardous areas and there is greater exposure to hazard risk. 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 more hazards, with recognition of technological and human-caused hazards. 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 14 costliest natural disasters by NOAA estimates. All of them occurred within the last 30 years, and 4 of the top 5 occurred within the last 14 years. These figures did not include Hurricanes Florence and Michael because it is still too early to estimate the full costs of these disasters. David also noted that these costs are general damage estimates, but that the actual cost of disasters to state and local governments, businesses, insurance companies, homeowners, and others is much higher.

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. The HMPC needs to finalize a list of stakeholders for involvement and ensure that committee membership includes equal representation from local officials and citizens or stakeholders. Mr. Stroud recommended considering North Carolina Emergency Management, FEMA Region IV, NOAA, other adjoining communities, citizens, schools, businesses, and others in brainstorming this citizen and stakeholder list.

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). The HMPC agreed on profiling the following hazards: Flooding, Hurricane, Severe Winter Weather, Extreme Heat, Earthquake, Wildfire, Dam Failure, Levee Failure, Drought, Severe Thunderstorm, Tornado, Landslide, Sinkhole, Hazardous Materials Incident, and Radiological Emergency. There was discussion regarding the inclusion of additional technological and man-made hazards, including Terrorism, Infectious Disease, Cyber Threat, Electromagnetic Pulse, and Solar Events. It was decided that while these threats may exist and may be significant to the planning area, they are generally not addressed through mitigation but rather through emergency operations and continuity of operations planning. Therefore, unless vulnerability information can be found and the HMPC decides that realistic mitigation strategies can be developed, the plan will only identify these threats and hazards and will confirm where and how they are being addressed elsewhere.

The vulnerability assessment will use County parcel data, FEMA Hazus analysis, and/or NCEM IRISK data. Hazards will be prioritized using the Priority Risk Index. A concern was raised regarding the level of risk that can be assessed for certain hazards, such as flood, and whether a threshold of the typical 100-year floodplain would be sufficient for planning. It was noted that risk data for flood is also available and will be included for the 500-year flood.

Each community will self-assess capability to determine what mitigation activities can be undertaken 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.

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.
- Natural 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 discussed North Carolina Emergency Management's new tool for mitigation planning, which will be used in this effort. NCEM 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 October 2019 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 October 2020.

The next meeting will be held in late March or early April.

Plan Website

Abby presented the website for the planning process, which will be a tool for HMPC coordination and public outreach. The website is www.mecknc HMP.com. The site contains upcoming meetings announcements, meeting

agendas and minutes, the public survey, draft documents of the plan update, information on the identified hazards, and opportunities to provide feedback. All communities are encouraged to place a link to this website on their local community pages to encourage more public involvement.

Next Steps

Community representatives need to complete the capability assessment and return it to Abby at abigail.moore@woodplc.com by March 1st. Representatives should come to the next meeting prepared to discuss the mitigation goals and past actions. It was noted that more substantial information than "ongoing" must be provided for continuing actions and that all actions must relate to a mitigation goal. Details on completed actions may be provided in the status and/or may be relevant to include in the capability assessment. Abby will send the capability assessment and past actions to all HMPC members for review and completion. These items will also be made available on the plan website.

Meeting Adjourned

Mecklenburg County, NC
Hazard Mitigation Planning Committee Kick-Off Meeting

Thursday, January 24th, 3:00 PM

	Name	Organization	Phone	E-Mail
1.	Abby Moore	Wood	919-768-9927	abigail.moore@woodplc.com
2.	DAVID STROUD	WOOD	919-325-6497	david.stroud@woodplc.com
3.	CHRIS FERGUSON	STATE NCEM	919-825-2569	christopher.ferguson@ncdps.gov
4.	Jacazza Jones	NCEM Mitigation	919 825 2592	jacazza.jones@ncdps.gov
5.	John Mello	NCEM Mitigation	919-825-2334	John.Mello@ncdps.gov
6.	Tammy Wendelgass	CLT Water	980-308-3675	Thomas.Wendelgass@charlotteNC.GOV
7.	Brian Elgort	Town of Pineville	704-889-0504	belgort@pinevillenc.gov
8.	ANDY GORETTI	MECK. CO. GIS	704-621-7987	ANDY.GORETTI@MECKNC.GOV
9.	Clark Pennington	Matthews PD	704 841 6731	cpennington@matthewsNC.gov
10.	Randy Smith	SWAC	7042319020	randyj74@icloud.com
11.	Gary Fournier	Town of Cornelius	704-896-2461	gfournier@cornelius.org
12.	Andrew Bridges	Meck EMO	704-534-6970	andrew.bridges@meckNC.gov
13.	Matthew Bixler	Meck EMO	980-722-3831	matthew.bixler@meckNC.gov
14.	STEVE ROBBINS	HUNTERSVILLE PUBLIC WKS	704-746-6605	SROBBINS@HUNTERSVILLE.ORG
15.	Matt Gustis	Charlotte Stormwater	704-336-6183	mgustis@charlottenc.gov
16.	Andy Babson	City of Charlotte ERPM	704 336 4333	abobson@ci.charlotte.nc.us
17.	David Love	Meck Cnty SWS	980-314-3229	david.love@mecklenburgcountync.gov
18.	Gerelyn garcia	Pineville	201-403-5444	gerelyngarcia@gmail.com
19.	Robert Kinnebrough	MATTHEWS	704 708 1200	rkinnebrough@matthewsnc.gov
20.	John McCulloch	Meck Co. Stormwater	980-721-3760	jdmcculloch@mecklenburgcountync.gov

Mecklenburg County, NC
Hazard Mitigation Planning Committee Kick-Off Meeting

Thursday, January 24th, 3:00 PM

21.	Kevin Martin	UNC Charlotte	704. 687. 8890	kevin.martin@uncc.edu
22.	Josh Runfola	UNC Charlotte.	704 687 8890	Jrunfola@uncc.edu
23.	Shawn Kiley	UNC Charlotte	704-687-8876	SKiley@uncc.edu
24.	DAVID KROENING	County Storm Water	704-360-1794	David.Kroening@meckNC.gov
25.	Robert Graham	CMEMS	828-329-8554	rgraham@charlottenc.gov
26.	TIM HARTSELL	CHARLOTTE FIR	704-778-7796	THARTSELL@CHARLOTTENC.GOV
27.	Tony Bateman	CMEMO	980-214-7195	
28.	Jesse Bouk	Town of Davidson PW	704-437-6060	Jbouk e townofdavidson.org
29.	ANDREW DECRISTOFARO	CMSWS	980-721-3565	andrew.decristofaro@mecknc.gov
30.	TRAVIS CRYAN	DUKE EMERGY	704 <34 9450	TRAVIS.CRYAN@DUKE-ENERGY.COM
31.	Daryl Hammock	City Storm Water	704-336-2167	dhammock@charlottenc.gov.
32.	Tim Trautman	County Storm Water	980-314-3224	tim.trautman@mecklenburgcountync.gov
33.	Alex Alcorn	City Manager's office-ELT	612-868-4323	alex.alcorn@charlottenc.gov
34.	David Leath	Mint Hill	980-721-4342	dleath@fire.minthill.com
35.	C.J. O'Neill	Town of Matthews	(704) 708-1242	cjoneille matthewsnc.gov
36.	DAN BOONE	HUNTERSVILLE	704-948-1685	DBOONE@HUNTERSVILLE.ORG
37.	KEVIN JOHNSTON	Huntersville P.D.	704 309-9081	kjohnston@huntersville.org
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HMPC Meeting 2: March 13, 2019

Charlotte-Mecklenburg Multi-Jurisdictional Hazard Mitigation Plan Update

Meeting 2: Hazard Mitigation Planning Committee Meeting
Time & Date: Wednesday, March 13, 2019, 2:00-4:00 p.m.
Location: Charlotte Fire Department Headquarters, 500 Dalton Avenue, Charlotte

Agenda

1. Goals and Objectives
    a. Review and Update Goals from the 2015 plan
    b. Create Objectives for each goal
2. Create a Vision Statement
3. Review Existing Mitigation Projects
    a. Reporting on Actions to be Carried Forward
4. Finalize Community Capability Self-Assessments
5. Next Steps
6. Questions
7. Adjourn

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Charlotte-Mecklenburg Multi-Jurisdictional Hazard Mitigation Plan Update

Meeting 2: Hazard Mitigation Planning Committee Meeting
Date & Time: Wednesday, March 13, 2019, 2:00-4:00 p.m.
Location: Charlotte Fire Department Headquarters, 500 Dalton Avenue, Charlotte

Introduction and Announcements

Chief Wike Graham, Deputy Director of Char-Meck Emergency Management, welcomed everyone in attendance and reiterated the importance of hazard mitigation and its role in emergency management. He also announced that the base plan for the Emergency Operations Plan just went through review and is routing to communities for signature and adoption. He also noted that an active shooter emergency management symposium was held recently. Another announcement was made regarding an upcoming Diversity, Equity, and Inclusion in Public Safety conference. Anthony Bateman, Emergency Management Planner, gave a brief review of the planning process so far, including the information that HMPC representatives have been asked to provide so far. He then introduced David Stroud and Abby Moore, consultants from Wood, who are leading the County and jurisdictions through the planning process, to facilitate the rest of the meeting. David provided the meeting agenda. There were 31 people in attendance and recorded on the sign-in sheet, including representatives from six of the eight jurisdictions participating in the plan update.

Review and Update Mitigation Goals

David reviewed the goals from the 2015 Mecklenburg County 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 to each of the goals. The proposed goals are as follows:

#1	Identify and implement hazard mitigation projects designed to reduce the impact of future hazard events on existing critical facilities and infrastructure as well as public and private property.
#2	Conduct education and outreach activities intended to better inform people about hazards and encourage personal responsibility for preparedness and mitigation.
#3	Improve emergency preparedness and response capabilities.
#4	Enact planning and policy measures to reduce the impacts of identified hazards and make future development more resilient to hazards.

One HMPC representative commented that while the revised Goal 4 targets hazard mitigation and development management in known hazard areas, it is also important to consider hazard mitigation outside of these areas, because the effects of development may be felt elsewhere, as is the case with stormwater management.

Another question was raised about what needs to be developed on a region/planning-area level and what must be developed by each jurisdictions. The clarification provided was as follows: Goals will be created on the regional level and agreed upon by the entire HMPC. Objectives will also be created on the regional level by the entire HMPC. However, it is possible that not all objectives will end up being pursued by all jurisdictions. Mitigation projects must be developed by each jurisdiction. It is possible to create multi-jurisdictional actions where multiple jurisdictions collaborate and pursue the same project; however, all jurisdictions must develop projects of their own.

Create Objectives

Following the discussion of goals, David presented a set of objectives developed by Wood as a starting point for the HMPC to begin developing objectives within each goal. Objectives should be more specific than goals but less specific than mitigation projects. No specific comments were provided on the objectives during the meeting, but

the HMPC can review the list of objectives and provide comments via email. These objectives may be used and/or additional objectives may be proposed. Wood's recommended objectives are as follows:

#1-1	Retrofit buildings and infrastructure to protect against damage from hazards.
#1-2	Implement structural projects to avert hazards and reduce vulnerability.
#1-3	Ensure critical facilities can maintain operations during hazard events.
#2-1	Conduct awareness activities in person and via web and social media.
#2-2	Assist vulnerable populations through targeted outreach.
#2-3	Promote and incentivize private mitigation activities.
#3-1	Conduct training and exercises intended to better prepare government officials to respond to, mitigate against and recover from emergencies and disasters.
#3-2	Improve ability to warn people of impending hazards and disasters.
#3-3	Establish traffic control procedures intended to reduce injuries and the loss of life before, during and after emergencies and disasters.
#4-1	Adopt development regulations to limit or prevent development in hazard areas.
#4-2	Enforce building codes and development regulations.

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 Mecklenburg County will look like in five years. With these guiding questions, the group developed the following list of vision concepts:

- Staff education: educating and training staff to improve capabilities
- Public education: even as the area grows, citizens understand their responsibilities through a strong public education program
- Managing growth:
  - Regulating development to avert hazards
  - Informed, intentional, planned decisions
  - More infrastructure and improved maintenance of existing infrastructure
- Implementation:
  - Taking responsibility to implement projects and make measurable progress
  - Plan and projects will be sustainable
- Resilience: When an event occurs there are minimal damages and we can recover quickly
- Coordination: locally and across jurisdictions
- Funding: successfully leveraging funding and not missing opportunities

During this process there was an extensive discussion on mitigation funding resources, including FEMA grants, Community Development Block Grant-Disaster Resistant grants, and other sources. David recommended contact the Mitigation Plans Manager, Chris Crew at John.Crew@ncdps.gov with any specific questions concerning mitigation funding availability.

Review Existing Mitigation Projects

Abby discussed the mitigation project reporting that each jurisdiction must complete. The consultant team had asked that each jurisdiction review their previous projects and bring status updates and any questions to this meeting. Abby announced that following the formal presentation the group would have time 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. Additionally, Abby presented a mitigation action reporting worksheet. A worksheet will need to be completed for every action that will be carried forward into the plan update. HMPC members only need to report on existing actions at this time. New actions will be discussed later in the planning process.

Finalize Community Capability Self-Assessments

Abby reviewed the Capability Self-Assessments which were due on March 1st. Two jurisdictions still need to submit their information. The group discussed shared capabilities developed by the County, and it was clarified that the Emergency Operations Plan and Solid Waste planning are County Developed activities. HMPC members were given until Friday, March 15th to update their capability information and resubmit it to Abby if needed.

Next Steps

Abby will send out the draft Vision Statement to the HMPC for review within the next week. HMPC members will then have time 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 and completed mitigation forms for actions to be carried forward to Abby at abigail.moore@woodplc.com by Friday, May 10th.

Meeting Adjourned

Mecklenburg County, NC
Hazard Mitigation Planning Committee – Meeting #2

Wednesday, March 13th, 2:00 PM

	Name	Organization	Phone	E-Mail
1.	Abby Moore	Wood.	919-768-9927	abigail.moore@woodplc.com
2.	Jennifer Thompson	Cornelius PD	704.214.7541	jthompson@corneliuspd.org
3.	Gary Fournier	Town of Cornelius	704-896-2461	gfournier@cornelius.org
4.	Rob Kinniburgh	Town of MATTHEWS	704 708 1200	rkinniburgh@matthewsnc.gov
5.	Randy Smith	Citizen	7042319020	randyj74@icloud.com
6.	Derrell Clark	Duke Energy	980-313-6788	derrellclark@duke-energy.com
7.	Joshua Runfola	UNLL OEM	719-314-9151	jrunfola@unlc.edu
8.	Shawn Kiley	UNCC OEM	704-687-8876	SKiley@uncc.edu
9.	Michael Tobin	CLT EM	704-608-4936	michael.tobin@cltairport.com
10.	KEN CHAPMAN	CATS S&S	704-517-5541	kchapman@CHARLOTTENC.gov
11.	Chad Hagans	CATS S+S	704-432-5032	chad.hagans@charlottenc.gov
12.	Matt Quales	CATS S&S	980.579.7175	matthew.quales@charlottenc.gov
13.	Matt Bixler	Meck. Co. FMO	980-722-3831	matthew.bixler@mecknc.gov
14.	Tim Trautman	MECK Co Storm Water	980-[redacted]-3224	tim.trautman@mecknc.gov
15.	Matt Gustis	City of Charlotte E&PM	(704)336-6183	mgustis@charlottenc.gov
16.	Alex Alum	City of CLT		
17.	KATHY CORNETT	PLANNING	704.336.4845	KCORNETT@
18.	Robert Graham	CMEMO	828-329-8554	rgraham@charlottenc.gov
19.	Jimmy Rhyne	CDOT	704-336-3905	jrhyne@charlottenc.gov
20.	Salih Iddrisu	Mecklenburg County	704-314-3207	Salih.Iddrisu@MeckNC.gov.

Mecklenburg County, NC
Hazard Mitigation Planning Committee – Meeting #2

Wednesday, March 13th, 2:00 PM

21.	Mae Bryant	E & PM Engineering & Property Mgmt	704.622.9823	mbryant@charlottenc.gov
22.	Tommy Wendelgass	CLT Water	980.308.3765	Thomas.wendelgass@charlottenc.gov
23.	ELLEN PRICE	CITY SOLID WASTE SERVICES	704-353-1183	eprice@charlottenc.gov
24.	DAVID KROENING	Meck County Storm Water	704.560.1794	David.Kroening@mecknc.gov
25.	Tonya Arrington	CMPD	704.200.8927	tarrington@cmpd.org
26.	DAN BOONE	H'ville Commissioner	704-948-1685	D.Boone@Huntersville.org
27.	John Rowell	Mint Hill PD	704 326-6805	jrowell@police.minthill.com
28.	Elaney Katsafanas	CMEMO	980-505-3215	elaney.katsafanas@charlottenc.gov
29.	Hannah Sanborn	CMEMO	704-661-1405	hannah.panicco@charlottenc.gov
30.	Cameron Niedermayer	COUNTY MGRS OFFICE	980 314 2883	cameron.niedermayer@mecknc.gov
31.	Derrick Ramos	COUNTY MGRS OFFICE	980 314 2881	derrick.ramos@mecknc.gov
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HMPC Meeting 3: July 31, 2019

Charlotte-Mecklenburg Multi-Jurisdictional Hazard Mitigation Plan Update

Meeting 3: Hazard Mitigation Planning Committee Meeting
Time & Date: Wednesday, July 31, 2019, 2:00-4:00 p.m.
Location: Charlotte Fire Department Headquarters, 500 Dalton Avenue, Charlotte

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. Review Organization of Jurisdictional Annexes
4. Review of Goals & Objectives
    a. Discuss Mitigation Action Plan Requirements
5. Next Steps
6. Questions
7. Adjourn

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Charlotte-Mecklenburg Multi-Jurisdictional Hazard Mitigation Plan Update

Meeting 3: Hazard Mitigation Planning Committee Meeting
Date & Time: Wednesday, July 31, 2019, 2:00-4:00 p.m.
Location: Charlotte Fire Department Headquarters, 500 Dalton Avenue, Charlotte

Introduction and Announcements

Chief Wike Graham, Deputy Director of Char-Meck Emergency Management, welcomed everyone in attendance. He discussed the recent flood event from June 9-10th and emphasized the importance of mitigation.

Following discussion on the flood event, David Stroud and Abby Moore, consultants from Wood, facilitated the meeting. There were 19 people in attendance and recorded on the sign-in sheet. David began by providing 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 and the 2015 Mecklenburg County 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 & Levee Failure
- Drought
- Earthquake
- Extreme Heat
- Flood
- Hurricane & Tropical Storm
- Landslide
- Severe Weather (Thunderstorm Wind, Lightning, and Hail)
- Severe Winter Storm
- Sinkhole
- Tornado
- Wildfire
- Cyber Threat
- Hazardous Materials Incident
- Radiological Incident
- Electromagnetic Pulse

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 what additional flood data will be presented in the plan and how it will compare to the County's own flood risk information. Wood can incorporate any flood risk data from the County in addition to the data that will be provided from the State's IRISK database so that the HMP will be consistent with the County's other plans.
- Wood noted that the data currently shown in the HIRA is from the State's 2010 IRISK database which is what was provided in the Risk Management Tool. Wood has recently discovered that there is a 2018 update to that database and has requested that the State make this data available for the plan. This may delay the planning timeline. For now, the draft risk assessment will be posted with the 2010 data.

In summary, the high priority hazards are: extreme heat, severe winter storm, flood, hazardous materials incident, EMP, radiological emergency, tornado, drought, and, severe weather. The moderate priority hazards are: hurricane & tropical storm, dam & levee failure, cyber attack, and wildfire. Earthquake, sinkhole, and landslide are low priority hazards and do not need to be prioritized for mitigation.

Public Survey Results

There were 33 responses to the public survey. The highest priority hazards according to the public are: extreme heat and severe weather.

Annex Summary

Abby provided a brief summary of the organization of the jurisdictional annexes to the plan. Each annex will contain the following sections: planning process, community profile, risk assessment, capability assessment, and mitigation strategy. The annexes will not repeat regional information but rather will provide jurisdiction-specific information.

Plan Vision, Goals & Objectives

Recommended changes to the plan vision were provided for HMPC discussion and final revision and approval. Only minor changes were made to the goals and objectives; they were provided for the HMPC to consider while developing new mitigation actions.

Mitigation Action Plan Requirements

Each participating jurisdiction must have two actions for every high and moderate priority hazard. An all hazards action will 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.

Next Steps

The draft HIRA will be posted on the plan website by Friday, August 2nd. The HMPC should review the HIRA and submit comments by Friday, August 16th. 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, August 30th.

Meeting Adjourned

Mecklenburg County, NC
Hazard Mitigation Planning Committee – Meeting #3

Wednesday, July 31st, 2:00 PM

	Name	Organization	Phone	E-Mail
1.	Gary Fournier	Cornelius Planning	704-896-2461	gfournier@cornelius.org
2.	David Leath	Mint Hill	980-721-4342	dleath@fire.minthill.com
3.	Brian Elgort	Pineville Planning	704-889-0504	belgort@pinevillenc.gov
4.	DAN BOONE	Huntersville Commissioner	704-948-1685	Dboone@huntersville.net
5.	Jennifer Thompson	Cornelius PD	704.214.7541	jthompson@corneliuspd.org
6.	Randy Smith	Pineville Resident	704 231-9020	randyj74@icloud.com
7.	Joshua Runfola	UNC Charlotte	719-314-9151	jrunfola@uncc.edu
8.	Kevin Martin	UNC Charlotte	704 687 8890	kevin.martin@uncc.edu
9.	Rob Kinniburgh	MATTHEWS	704 708 1200	rkinniburgh@matthewsnc.gov
10.	Tyler Vanhoy	Charlotte-Meck Storm water Services	980-721-3825	seth.vanhoy@mecklnc.gov
11.	ANDREW DECRISTOFARO	LUESA - CHAR-MECK STORM WATER	980-721-3565	
12.	Dave Canaan	LUESA - SWW	980-314-3209	dave.canaan@mecklnc.gov
13.	Kevin Johnston	Huntersville PD	704 309 9081	kjohnston@huntersville.org
14.	STEVE ROBBINS	HUNTERSVILLE PUBLIC WORKS	704-746-6605	SROBBINS@HUNTERSVILLE.ORG
15.	Tim Trautman	STORMWATER SERVICES	704-959-4013	tim.trautman@mecklnc.gov
16.	Alex Alcorn	City of CLT	704 562 6754	alex.alcorn@charlottenc.gov
17.	TED PANAGIOTOPOULOS	COUNTY FIRE MARSHAL	980-722-3821	TED.PANAGIOTOPOULOS@MECKLENBURGCOUNTYNC.COM
18.	DAVID STROUD	WOOD	919-325-6497	david.stroud@woodplc.com
19.	Abby Moore	Wood	919-768-9927	abigail.moore@woodplc.com
20.				

HMPC Meeting 4: July 22, 2020

Charlotte-Mecklenburg Multi-Jurisdictional Hazard Mitigation Plan Update

Hazard Mitigation Planning Committee, Meeting #4
Time & Date: Wednesday, July 22, 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.

- Updates to the HIRA: Abby summarized the hazards included in the plan and how they scored on the Priority Risk Index. The PRI rankings did not change from the prior HIRA review meeting, but Wood addressed the HMPC's concerns regarding flood data and out of date iRisk data in the current iteration of the HIRA.
- Mitigation Action Plans: The mitigation actions plans are coming together, thanks to the HMPCs quick responses on the data needed to complete the plans. The iteration of the plan on the plan website reflects the data available at the time of publishing and will be updated as comments come back and those edits are made. The HMPC should continue to send Abby comments on mitigation actions.
- HMPC's role in implementation and maintenance of the plan: It was noted that while plan updates are required every 5 years, and FEMA recommends annual reporting on the status of the plan – primarily mitigation actions – CRS recommends reviewing the plan Quarterly. There was an interest from the HMPC to pursue quarterly meetings to review actions and maintain public involvement. It would be the responsibility of the HMPC to convene and facilitate these meetings.
- 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 integrated this 2020 plan update with other local planning efforts. Charlotte Water intends to integrate the findings from the HMP update into the department's Emergency Operation's Plan. Abby noted that communities that are currently going through Comprehensive Plan updates should also consider integration. The HMPC was asked to email any plan integration efforts to Abby to be included in the plan.
- Public Engagement: The HMPC noted the low number of survey responses (35) and concern that residents don't know where to get information regarding disasters. They were especially concerned that they were

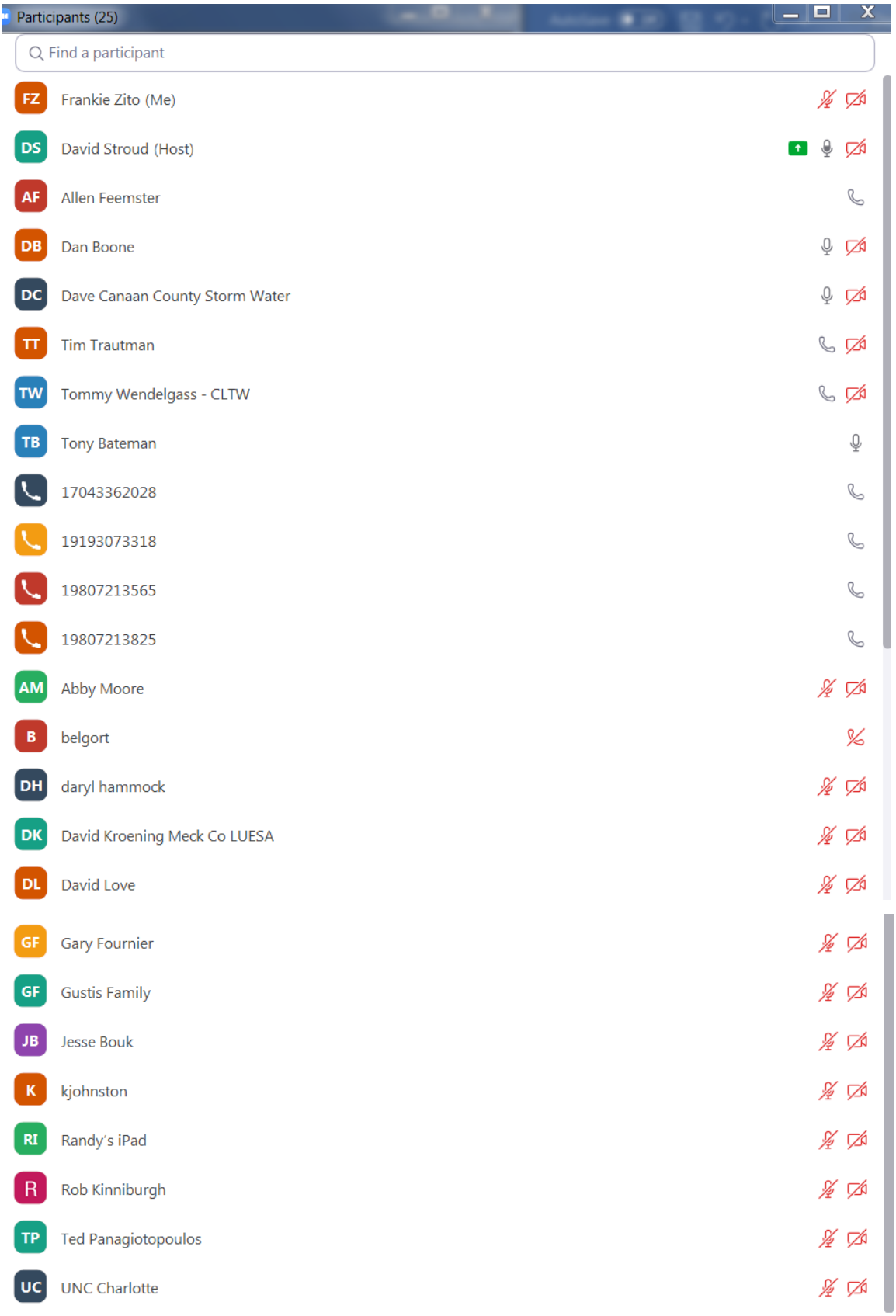
missing a big opportunity and the point of this plan update if they did not find new and creative ways to get the community involved. David noted that Charlotte has a PPI as part of the CRS program and might use some of the creative outreach opportunities in that plan to also share the Hazard Mitigation Plan. Abby shared that most of the communities have identified public education activities in their mitigation action plans. The HMPC agreed that it was essential to ensure stronger public outreach and would incorporate this into their quarterly meetings.

- Plan Adoption was discussed. Abby and David explained that communities can adopt the plan at any time following approval from the state prior to FEMA approval to ensure adoption prior to expiration. This eliminates the need for an Adoption Pending Approval letter from FEMA. Instead, once *all jurisdictions* adopt the plan, FEMA will send final approval letters. At this point, the plan in its final version will be uploaded to the website. Communities are encouraged to download the final plan for their own records, as the plan website will not be accessible indefinitely.
- The final public meeting will be held on Wednesday, July 22nd at 5pm via Zoom. The public interest has been larger than expected (15-20 responses). Communities were asked to publicize this meeting leading up to it, with CRS communities required to publicize it at least three different ways, such as via Facebook, Twitter, or social media, on a community website or event calendar, via a newsletter, or otherwise to ensure credits.

Next Steps

Review mitigation action plans and the full draft plan provide any updates or comments by Wednesday, July 29th. Wood will incorporate comments and feedback and submit the plan to the state for review ASAP following receipt of comments.

Meeting Adjourned


Participants (25)
Find a participant
FZ Frankie Zito (Me)
DS David Stroud (Host)
AF Allen Feemster
DB Dan Boone
DC Dave Canaan County Storm Water
TT Tim Trautman
TW Tommy Wendelgass - CLTW
TB Tony Bateman
17043362028
19193073318
19807213565
19807213825
AM Abby Moore
B belgort
DH daryl hammock
DK David Kroening Meck Co LUESA
DL David Love
GF Gary Fournier
GF Gustis Family
JB Jesse Bouk
K kjohnston
RI Randy's iPad
R Rob Kinniburgh
TP Ted Panagiotopoulos
UC UNC Charlotte

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.	January 24, 2019 5:30 p.m.	Charlotte Fire Department HQ, 500 Dalton Avenue, Charlotte, NC
Public Meeting #2	1) Review "Draft" Hazard Mitigation Plan 2) Solicit comments and feedback	July 22, 2020 5 p.m.	Zoom Video Conference Call

Public Meeting Agendas, Minutes, Sign-in Sheets, and Announcements

Public Meeting 1: January 24, 2019

Charlotte-Mecklenburg Multi-Jurisdictional Hazard Mitigation Plan Update

Meeting 1: Hazard Mitigation Planning Project Public Meeting
Date & Time: Thursday, January 24, 2019, 5:30 p.m.
Location: Charlotte Fire Department Headquarters, 500 Dalton Avenue, Charlotte

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. Next Steps
6. Questions
7. Adjourn

Page **1** of **1**

Charlotte-Mecklenburg Multi-Jurisdictional Hazard Mitigation Plan Update

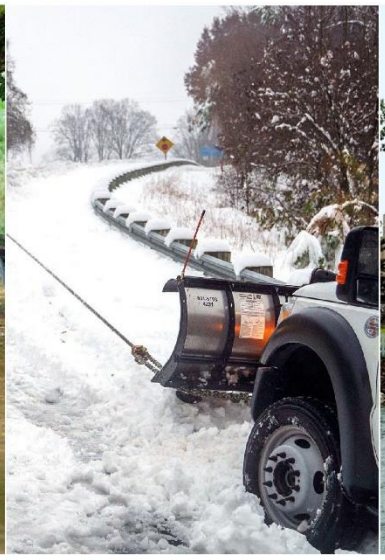
Meeting 1: Hazard Mitigation Planning Project Public Meeting
Date & Time: Thursday, January 24, 2019, 5:30 p.m.
Location: Charlotte Fire Department Headquarters, 500 Dalton Avenue, Charlotte

Summary

Tony Bateman, Char-Meck Emergency Management Planner; Chief Wike Graham, Deputy Director of Char-Meck Emergency Management; and David Stroud and Abby Moore from Wood were on-site to present information and answer questions about the plan update process. However, there were no attendees from the public.

The meeting was adjourned at 6:30 p.m.

Interested members of the public will be able to get involved in the project and take the public survey via the plan update website at www.mecklenburgHMP.com.


PUBLIC MEETING
HAZARD MITIGATION PLAN UPDATE

Know Your Risks. Share Your Input.

Mecklenburg County and its local jurisdictions are updating the Charlotte-Mecklenburg Multi-Jurisdictional Hazard Mitigation Plan to assess and minimize risk to natural hazards. Your participation in this process is important to us!

What concerns you about severe weather? Do you have ideas for helping our community better prepare for hazard events? Come learn about the update process and share your input with us!

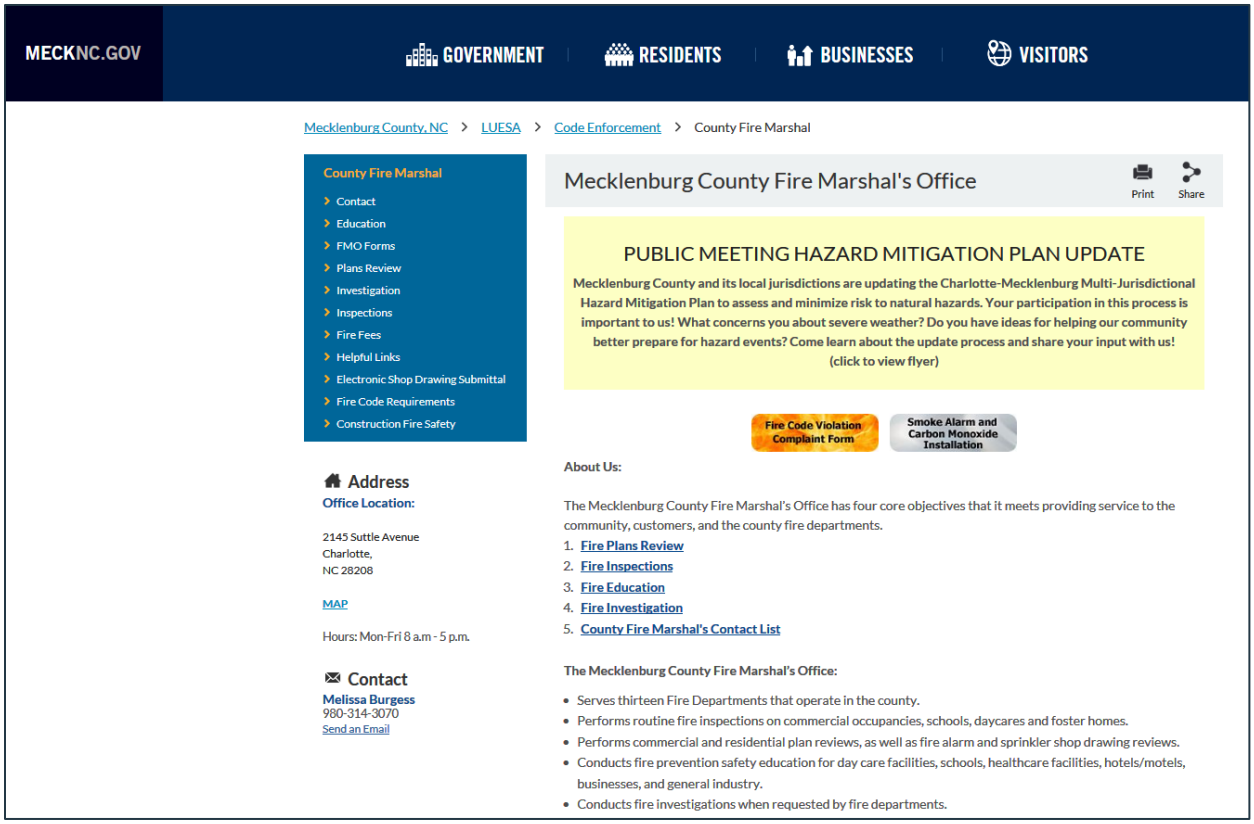
DATE: THURSDAY, JANUARY 24TH

TIME: 5:30 PM

LOCATION: CHARLOTTE FIRE DEPT. HQ
500 DALTON AVE.
CHARLOTTE, NC 28216

Visit our website for more information and to take our public survey:

www.meckncchmp.com



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- Helpful Links
- Electronic Shop Drawing Submittal
- Fire Code Requirements
- Construction Fire Safety

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Office Location:

2145 Suttle Avenue
Charlotte,
NC 28208

MAP

Hours: Mon-Fri 8 a.m - 5 p.m.

Contact

Melissa Burgess
980-314-3070
Send an Email

Mecklenburg County Fire Marshal's Office

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PUBLIC MEETING HAZARD MITIGATION PLAN UPDATE

Mecklenburg County and its local jurisdictions are updating the Charlotte-Mecklenburg Multi-Jurisdictional Hazard Mitigation Plan to assess and minimize risk to natural hazards. Your participation in this process is important to us! What concerns you about severe weather? Do you have ideas for helping our community better prepare for hazard events? Come learn about the update process and share your input with us!
(click to view flyer)

Fire Code Violation Complaint Form | Smoke Alarm and Carbon Monoxide Installation

About Us:

The Mecklenburg County Fire Marshal's Office has four core objectives that it meets providing service to the community, customers, and the county fire departments.

1. Fire Plans Review
2. Fire Inspections
3. Fire Education
4. Fire Investigation
5. County Fire Marshal's Contact List

The Mecklenburg County Fire Marshal's Office:

- Serves thirteen Fire Departments that operate in the county.
- Performs routine fire inspections on commercial occupancies, schools, daycares and foster homes.
- Performs commercial and residential plan reviews, as well as fire alarm and sprinkler shop drawing reviews.
- Conducts fire prevention safety education for day care facilities, schools, healthcare facilities, hotels/motels, businesses, and general industry.
- Conducts fire investigations when requested by fire departments.

Public Meeting 2: July 22, 2020

Charlotte-Mecklenburg Multi-Jurisdictional Hazard Mitigation Plan Update

Meeting 1: Hazard Mitigation Planning Project Public Meeting
Date & Time: Wednesday, July 22, 2020, 5:00 p.m.
Location: Zoom Video Conference Call

Summary

Tony Bateman, Char-Meck Emergency Management Planner and David Stroud and Abby Moore from Wood were on the call to present information about the plan update and answer questions about the plan update process and the current draft plan.

There were 15 people in attendance on the call. After a brief welcome from Tony, David began the meeting by asking participants to introduce themselves. Participants included community members, boy scouts working on merit badges, and representatives of local nonprofits and government organizations.

The remainder of the meeting followed the agenda below:

David and Abby presented the meeting slides according to the following agenda:

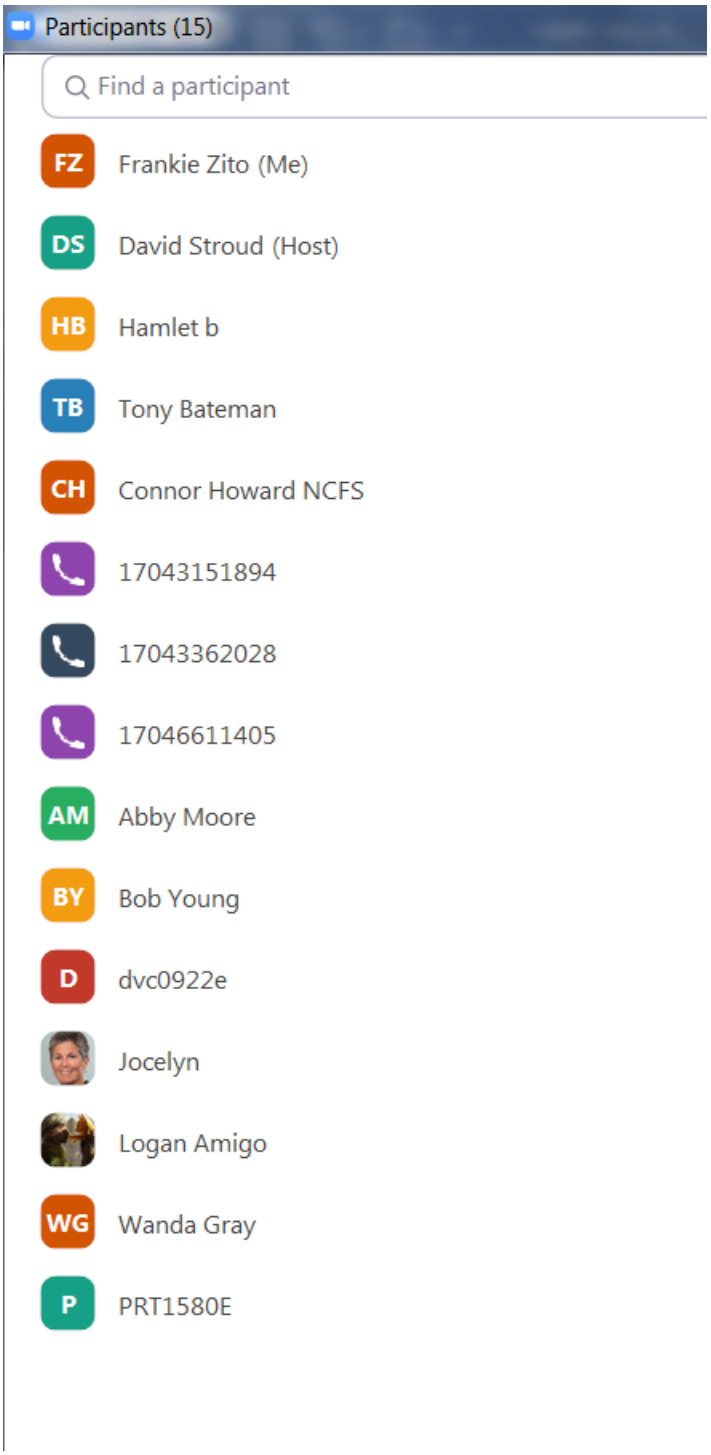
1. Where we are in the planning process
    a. Review of Hazard Mitigation Planning legislation
    b. Planning Step 7 & Planning Step 8
    c. Structure of the Plan
2. Review of Key Plan Components
    a. Hazards & Priority Risk Index
        i. Updates to the HIRA
    b. Goals & Objectives Review
    c. Mitigation Actions Discussion
    d. Plan Implementation & Maintenance
        i. Responsibilities of the HMPC
3. Plan Website
4. Next Steps and Questions

Meeting Discussion

Following the presentation from David and Abby, the meeting was open for question and comment. One resident spoke up asking about how much input Duke Energy had in the planning process given their intensive use of the Catawba River. While Duke Energy was not involved in this plan update process, Tony Bateman noted that he would reach out to them regarding involvement in future plan maintenance and update efforts. There were no other comments from the community.

Next Steps

The community members present were encouraged to visit the plan website to review the available documents and the full draft plan and submit any comments to Abby (abigail.moore@woodplc.com) or using the "Contact Us" button on the website by Wednesday July 29th.


Participants (15)
Find a participant
FZ
Frankie Zito (Me)
DS
David Stroud (Host)
HB
Hamlet b
TB
Tony Bateman
CH
Connor Howard NCFS
17043151894
17043362028
17046611405
AM
Abby Moore
BY
Bob Young
D
dvc0922e
Jocelyn
Logan Amigo
WG
Wanda Gray
P
PRT1580E

Town of Cornelius
Posted by Cornelius Town
Just now ·

PSA: Mecklenburg County has updated its Hazard Mitigation Plan and is seeking public input on the draft plan.

A virtual public meeting is scheduled for tomorrow, Wednesday, July 22, at 5 pm to be held via Zoom.

To attend this meeting, please email abigail.moore@woodplc.com to request an email invitation.

To review the draft plan and provide feedback, visit mecknchmp.com.

http://www.mecknchmp.com/draftDocuments.html

MECKNCHMP.COM
Mecklenburg County Hazard Mitigation Plan

Town of Matthews North Carolina

ABOUT RESIDENTS BUSINESS GOVERNMENT DEPARTMENTS HOW DO I?

I'm looking for...

- Agenda and Minutes
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- Citizen Involvement
- Report a Concern

Mecklenburg County Hazard Mitigation Plan Citizen Input Opportunity

Posted on Friday July 17, 2020

Charlotte, Mecklenburg County, and the County's six towns are working on the County's Hazardous Mitigation Plan. Citizens are now invited to provide input on the draft plan

Charlotte, Mecklenburg County, and the County's six towns have begun work on the County's Hazardous Mitigation Plan. Implemented in 2000, Communities are required by FEMA to update their hazard mitigation plans every 5 years to remain eligible for federal disaster funding. Any federally declared disaster in State of North Carolina means Mecklenburg County is eligible to apply for plan-identified mitigation project funding. Having an updated plan ensures that the County will be ready with mitigation project ideas whenever funding becomes available.

Matthews residents were invited to participate in the planning effort by completing a brief hazard and preparedness awareness survey in March 2019.

Citizens are now invited to provide input on the draft plan: Click here to review the draft plan.

For more information, please visit: http://www.mecknchmp.com/Agendas_Minutes.html

McCullough Neighborhood - Meck 2020 Haz Mitigation update plan, public meeting

McCullough Residents,

We are very fortunate to have neighbors who volunteer their time and expertise outside of McCullough but which nevertheless, have an impact on our lives. One of these volunteers is Randy Smith who participated in the planning process for the 2020 Mecklenburg County Hazard Mitigation Plan. In particular, Randy shared this with us:

- Mecklenburg County has updated its Hazard Mitigation Plan and is seeking public input on the draft plan. A virtual public meeting is scheduled for Wednesday, July 22nd at 5 pm to be held via Zoom. To attend this meeting, please email abigail.moore@woodplc.com to request an email invitation. To review the draft plan and provide feedback, visit http://www.mecknchmp.com/draftDocuments.html.

McCullough Neighborhood Association

Board of Directors

HOME – TOWN NEWS

Posted on: July 16, 2020

FINAL PUBLIC MEETING FOR UPDATED MECKLENBURG COUNTY HAZARD MITIGATION PLAN JULY 22 AT 5 P.M.

Mecklenburg County has updated its Hazard Mitigation Plan and is seeking public input on the draft plan. A virtual public meeting is scheduled for Wednesday, July 22nd at 5 pm to be held via Zoom. To attend this meeting, please email abigail.moore@woodplc.com to request an email invitation. To review the draft plan and provide feedback, visit http://www.mecknchmp.com/draftDocuments.html.

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Governor Provides Guidance for Schools and Extends Phase 2 Order Until At Least August 7th

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Charlotte-Mecklenburg Emergency Management
July 20 ·

The Charlotte-Mecklenburg Hazard Mitigation Plan has been updated & we are seeking public input on the draft. A virtual public meeting is scheduled for Wed, July 22 at 5pm via Zoom. To attend this meeting, please email abigail.moore@woodplc.com to request an email invitation. To review the draft plan and provide feedback, visit http://www.meckncchmp.com/draftDocuments.html.

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Mecklenburg County, North Carolina
Multi-Jurisdictional
Hazard Mitigation Plan
1
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Public Outreach Flyer

MECKLENBURG COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

What Is a Hazard Mitigation Plan? Why is it Important to Me?

A Hazard Mitigation Plan is the result of a planning process to identify natural hazards, develop strategies to reduce or eliminate the loss of life and property damage resulting from these hazards, and educate community members about these hazards and loss reduction strategies. This planning process is structured around the four phases of the Disaster Mitigation Act of 2000, which the Region's planning consultant has aligned with the ten steps of the Community Rating System (CRS). Having an adopted Hazard Mitigation Plan ensures a community is eligible for federal disaster funding. It is important for citizens to become involved in mitigation planning in their community. The planning team, together with the community, has identified priority hazards, developed goals, and developed potential mitigation actions and now needs your input.

What is the Community Rating System?

The CRS is a national program developed by the Federal Emergency Management Agency (FEMA) to encourage communities to reduce their risk to flood-related hazards. The CRS rewards the efforts communities take to go above and beyond the minimum requirements of the National Flood Insurance Program (NFIP) by providing discounts on flood insurance premiums. Specifically, the CRS encourages communities to reduce flood damage to existing buildings, manage development, protect new buildings, preserve and/or restore natural floodplain functions, help insurance agents obtain flood data, and help individuals obtain flood insurance.

What Hazards are Included in the Plan?

The planning committee has included the following hazards in the Mecklenburg County Multi-Jurisdictional Hazard Mitigation Plan and prioritized them as follows:

High Risk (> 2.4)	Extreme Heat Severe Winter Storm Flood Hazardous Materials Incident EMP	Radiological Emergency Tornado Drought Severe Weather
Moderate Risk (2.0 – 2.4)	Hurricane & Tropical Storm Dam & Levee Failure Cyber Attack Wildfire	
Low Risk (< 2.0)	Earthquake Sinkhole Landslide	

Goals

The planning committee has identified the following mitigation goals to reduce vulnerability to identified hazards.

#1 **Identify and implement hazard mitigation projects designed to reduce the impact of future hazard events on existing critical facilities and infrastructure as well as public and private property.**

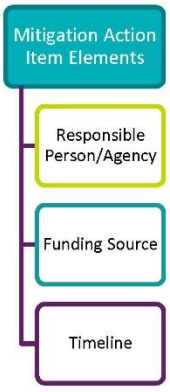
#2 **Conduct education and outreach activities intended to better inform people about hazards and encourage personal responsibility for preparedness and mitigation.**

#3 **Improve emergency preparedness and response capabilities.**

#4 **Enact planning and policy measures to reduce the impacts of identified hazards and make future development more resilient to hazards.**

What Is a Mitigation Action Plan?

After setting goals and objectives for specific, quantifiable results, the planning committee has developed mitigation actions—specific, individual steps that can be taken to meet those goals and objectives. The mitigation action plan prioritizes each action, assigns a responsible person or group, identifies funding, and sets a timeline for implementing the action.



Why is it Important to Me?

The mitigation actions and the action plan for implementation will be the framework for real progress towards risk reduction and hazard mitigation in Mecklenburg County. It is important for residents, business owners, property owners, and other community stakeholders to become involved in this process to ensure that mitigation actions will be feasible, effective, and supported by the community. The planning team needs your input on the feasibility of these actions to prevent or lessen the impacts of hazards.

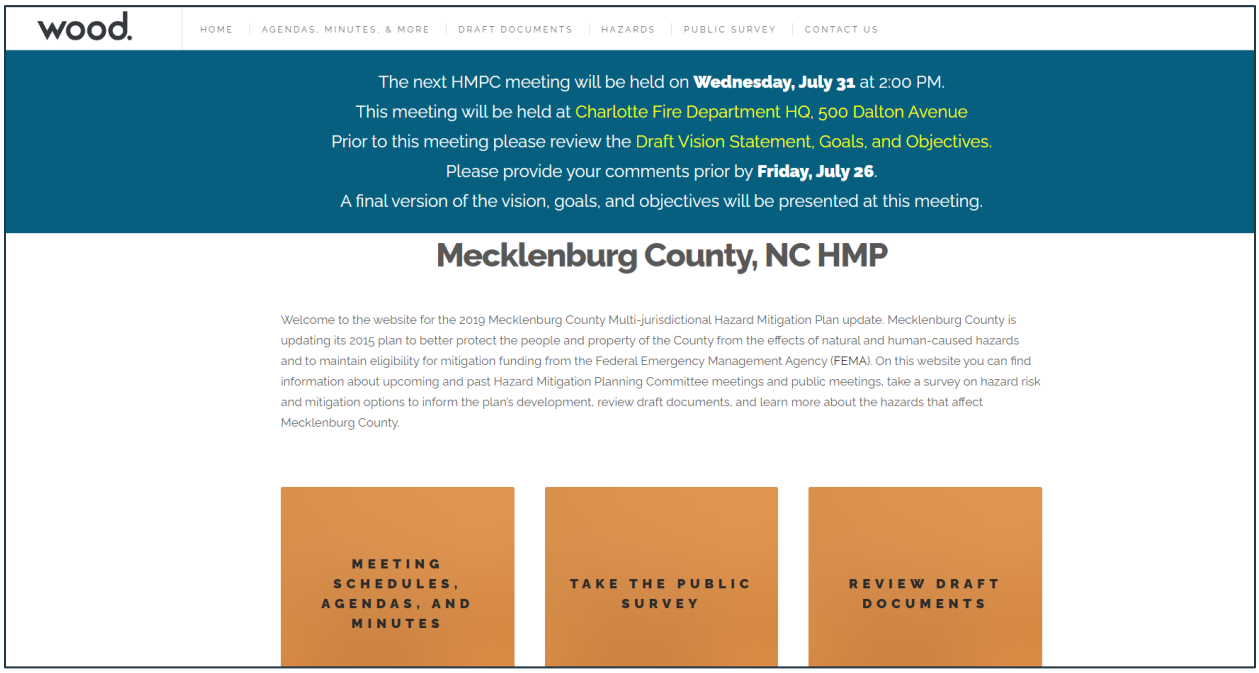
WE NEED YOUR INPUT

What Can I Do to Participate?

Visit the website. Get more information and follow the planning process at MeckNCHMP.com. The website contains announcements for upcoming meetings, minutes and presentations from past planning meetings, information on the identified hazards, draft planning documents for review, and more.

Send us information or comments. If you have information to share for inclusion in the plan, you can contact the planning consultants at david.stroud@woodplc.com and abigail.moore@woodplc.com. Additionally, prior to being submitted to FEMA, the draft plan will be available for public review. You can provide comments on draft documents via the plan website.

Plan Website and Outreach

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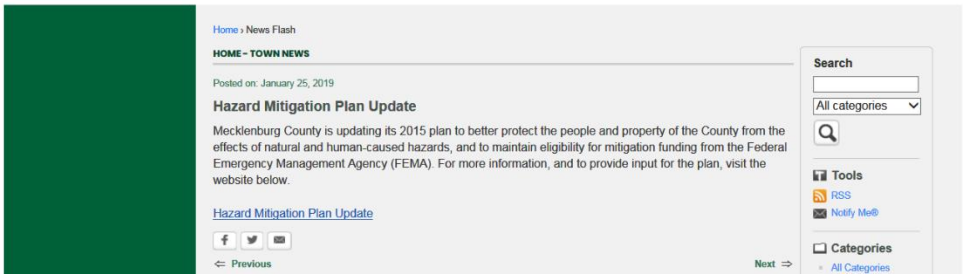
Home › News Flash
HOME – TOWN NEWS
Posted on: January 25, 2019
Hazard Mitigation Plan Update
Mecklenburg County is updating its 2015 plan to better protect the people and property of the County from the effects of natural and human-caused hazards, and to maintain eligibility for mitigation funding from the Federal Emergency Management Agency (FEMA). For more information, and to provide input for the plan, visit the website below.
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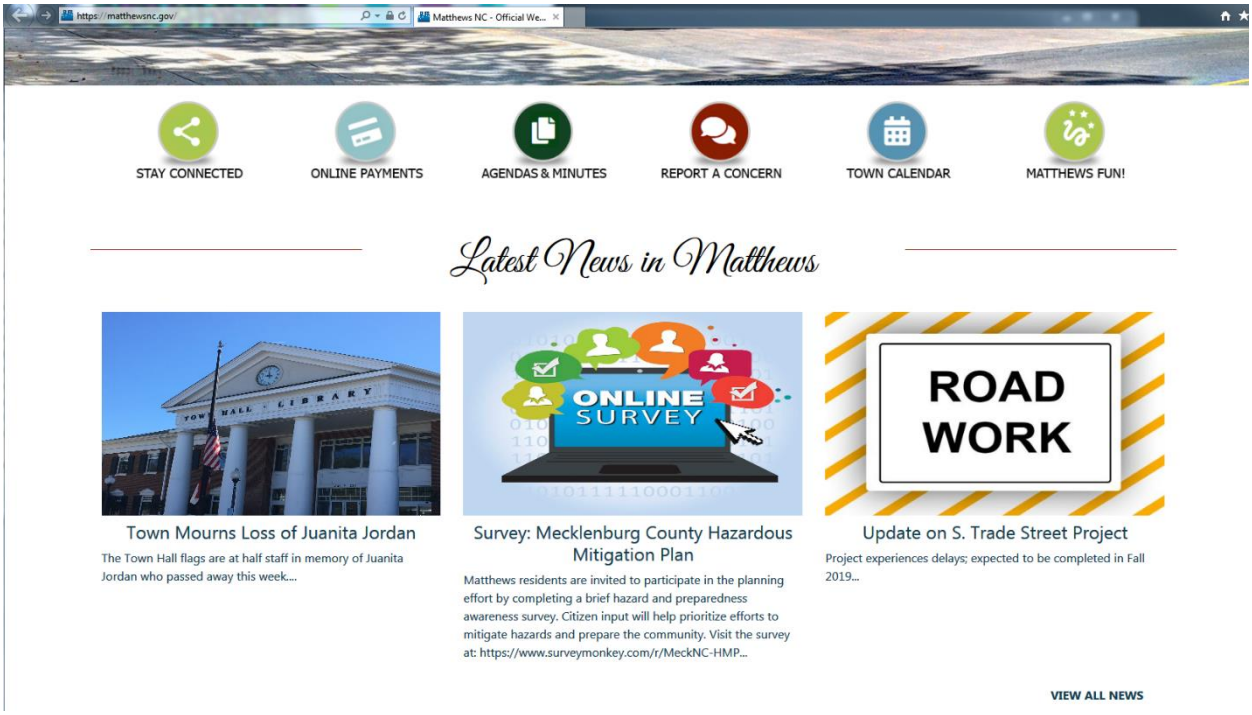
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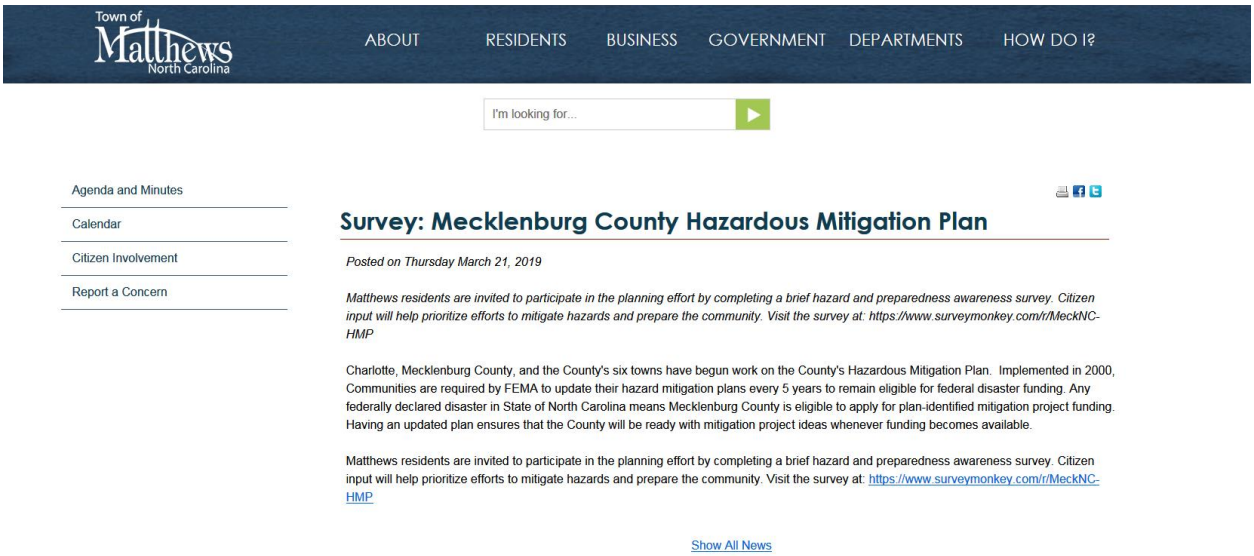
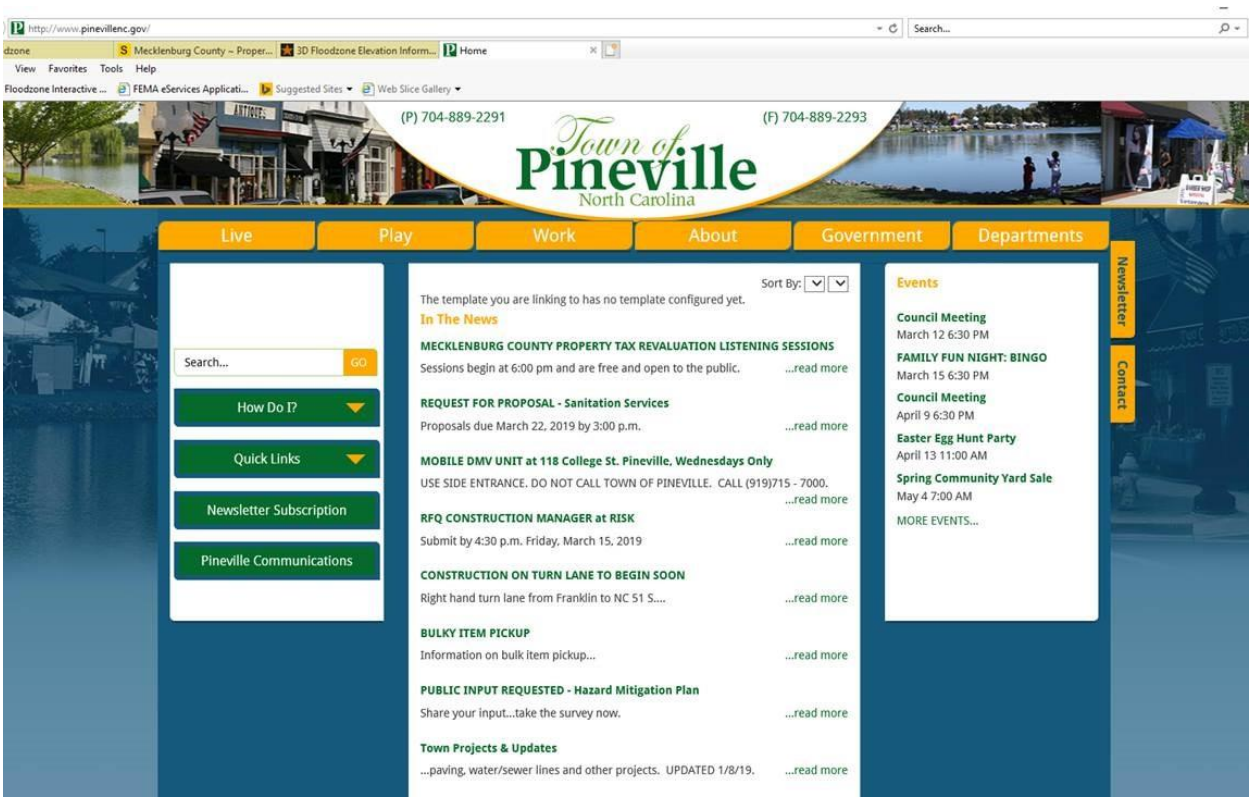
The Town Hall flags are at half staff in memory of Juanita Jordan who passed away this week....
ONLINE SURVEY
Survey: Mecklenburg County Hazardous Mitigation Plan
Matthews residents are invited to participate in the planning effort by completing a brief hazard and preparedness awareness survey. Citizen input will help prioritize efforts to mitigate hazards and prepare the community. Visit the survey at: https://www.surveymonkey.com/r/MeckNC-HMP...
ROAD WORK
Update on S. Trade Street Project
Project experiences delays; expected to be completed in Fall 2019...
VIEW ALL NEWS


Town of Matthews North Carolina
ABOUT
RESIDENTS
BUSINESS
GOVERNMENT
DEPARTMENTS
HOW DO I?
I'm looking for...
Agenda and Minutes
Calendar
Citizen Involvement
Report a Concern
Survey: Mecklenburg County Hazardous Mitigation Plan
Posted on Thursday March 21, 2019
Matthews residents are invited to participate in the planning effort by completing a brief hazard and preparedness awareness survey. Citizen input will help prioritize efforts to mitigate hazards and prepare the community. Visit the survey at: https://www.surveymonkey.com/r/MeckNC-HMP
Charlotte, Mecklenburg County, and the County's six towns have begun work on the County's Hazardous Mitigation Plan. Implemented in 2000, Communities are required by FEMA to update their hazard mitigation plans every 5 years to remain eligible for federal disaster funding. Any federally declared disaster in State of North Carolina means Mecklenburg County is eligible to apply for plan-identified mitigation project funding. Having an updated plan ensures that the County will be ready with mitigation project ideas whenever funding becomes available.
Matthews residents are invited to participate in the planning effort by completing a brief hazard and preparedness awareness survey. Citizen input will help prioritize efforts to mitigate hazards and prepare the community. Visit the survey at: https://www.surveymonkey.com/r/MeckNC-HMP
Show All News


(P) 704-889-2291
(F) 704-889-2293
Town of Pineville
North Carolina
Live
Play
Work
About
Government
Departments
Search...
GO
How Do I?
Quick Links
Newsletter Subscription
Pineville Communications
Sort By:
The template you are linking to has no template configured yet.
In The News
MECKLENBURG COUNTY PROPERTY TAX REVALUATION LISTENING SESSIONS
Sessions begin at 6:00 pm and are free and open to the public. ...read more
REQUEST FOR PROPOSAL - Sanitation Services
Proposals due March 22, 2019 by 3:00 p.m. ...read more
MOBILE DMV UNIT at 118 College St. Pineville, Wednesdays Only
USE SIDE ENTRANCE. DO NOT CALL TOWN OF PINEVILLE. CALL (919)715 - 7000. ...read more
RFQ CONSTRUCTION MANAGER at RISK
Submit by 4:30 p.m. Friday, March 15, 2019 ...read more
CONSTRUCTION ON TURN LANE TO BEGIN SOON
Right hand turn lane from Franklin to NC 51 S.... ...read more
BULKY ITEM PICKUP
Information on bulk item pickup... ...read more
PUBLIC INPUT REQUESTED - Hazard Mitigation Plan
Share your input...take the survey now. ...read more
Town Projects & Updates
...paving, water/sewer lines and other projects. UPDATED 1/8/19. ...read more
Events
Council Meeting
March 12 6:30 PM
FAMILY FUN NIGHT: BINGO
March 15 6:30 PM
Council Meeting
April 9 6:30 PM
Easter Egg Hunt Party
April 13 11:00 AM
Spring Community Yard Sale
May 4 7:00 AM
MORE EVENTS...
Newsletter
Contact

Public Survey

Mecklenburg County's participating jurisdictions 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.

Charlotte-Mecklenburg Multi-Jurisdictional Hazard Mitigation Plan
Public Survey

Online version can be found at: https://www.surveymonkey.com/r/MeckNC-HMP

Mecklenburg County, along with its local jurisdictions, is updating the Multi-Jurisdictional Hazard Mitigation Plan to assess and minimize risk to natural hazards, and your participation is important to us. Your input will help us to better understand the vulnerabilities within the County and how to best mitigate or reduce the impacts of these hazards. **Please help us by completing this survey by Friday, Sept. 13th and returning it to:**

Abby Moore, Wood
4021 Stirrup Creek Drive, Suite 100, Durham, NC 27703
Or by email to: abigail.moore@woodplc.com

This survey can also be completed online at: https://www.surveymonkey.com/r/MeckNC-HMP

If you have any questions about this survey or want to learn about more ways to participate in the Charlotte-Mecklenburg Multi-Jurisdictional 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. You can also visit the project website at www.mecknc HMP.com.

BACKGROUND INFORMATION

1. Where do you live?
   - ☐ Unincorporated Mecklenburg County
   - ☐ Charlotte
   - ☐ Cornelius
   - ☐ Davidson
   - ☐ Huntersville
   - ☐ Matthews
   - ☐ Mint Hill
   - ☐ Pineville
   - ☐ 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

1

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	____ Severe Weather (Thunderstorm/Lightning/Hail)
____ Drought	____ Severe Winter Storm
____ Earthquake	____ Sinkhole
____ Extreme Heat	____ Tornado
____ Flood	____ Wildfire
____ Hurricane & Tropical Storm	____ Hazardous Materials Incident
____ Landslide	____ Radiological Emergency

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.

☐ Television News/Advertisements	☐ County/City/Town website
☐ Radio News/Advertisements	☐ County/City/Town social media
☐ Public Forums/Workshops	☐ Email
☐ Public Library	☐ Text messages
☐ Print Media – newspaper, phone book, informational brochures	☐ 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.

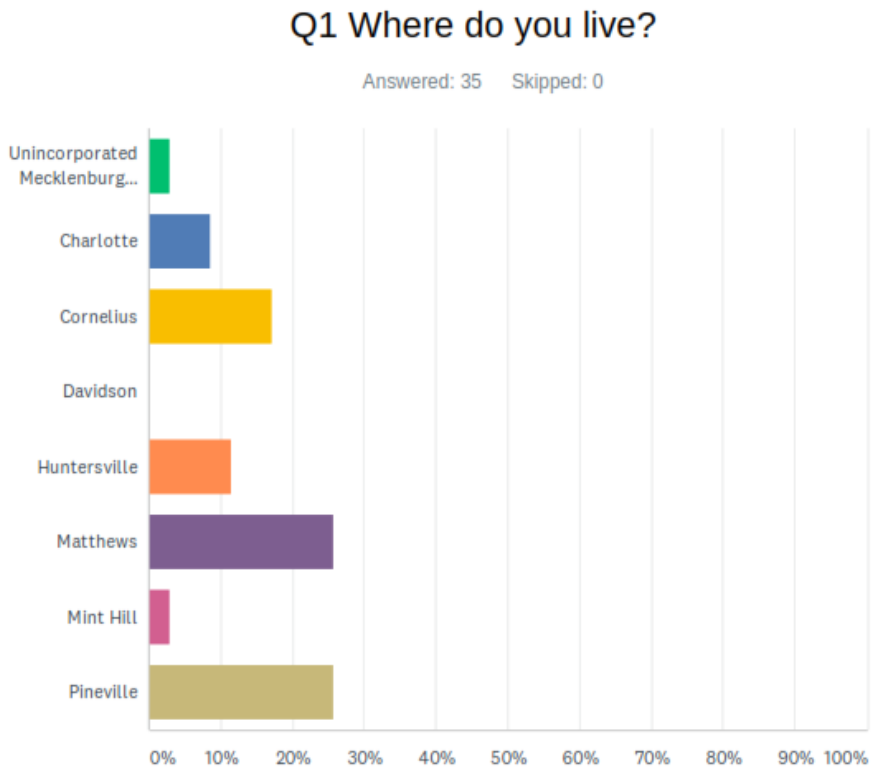
Name: _____ Email: _____

2

The County received 35 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.

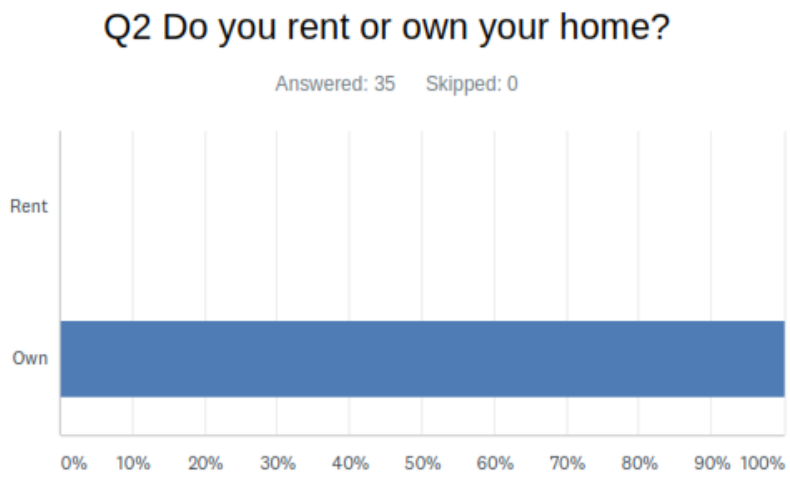
- The majority of responses came from residents of Matthews, Pineville, and Cornelius.
- All respondents own their home, which indicates ability of those engaged in the mitigation process to implement mitigation on their own properties. However, this also indicates that responses may be skewed toward established residents with more long-term awareness of their local hazards.
- Over 77% of respondents feel somewhat prepared or very prepared for a hazard event.
- Only 20% of respondents know where evacuation centers or storm shelters are located but over 91% say they are able to evacuate or take shelter if necessary, which indicates many respondents do not intend to rely on public shelters or evacuation centers. Again, these responses may be skewed by the demographic that engaged in this process and may not be representative of the planning area as a whole.
- Over 71% 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.
- Severe weather and extreme heat were rated the most significant hazards. Landslide and levee failure were rated the least significant hazards.
- Many respondents who reported having taken steps to mitigate risk at home reported preparedness actions such as emergency kits and supplies and evacuation plans. A few respondents also noted property protection actions including flood mitigation; however, these may be important ideas to promote in outreach.
- Respondents largely favored public information and structural projects followed by emergency services projects and preventive activities for mitigation.
- Text message and email were the most preferred methods of communication for information on hazard events.

Figure B.1 – Survey Response, Place of Residence



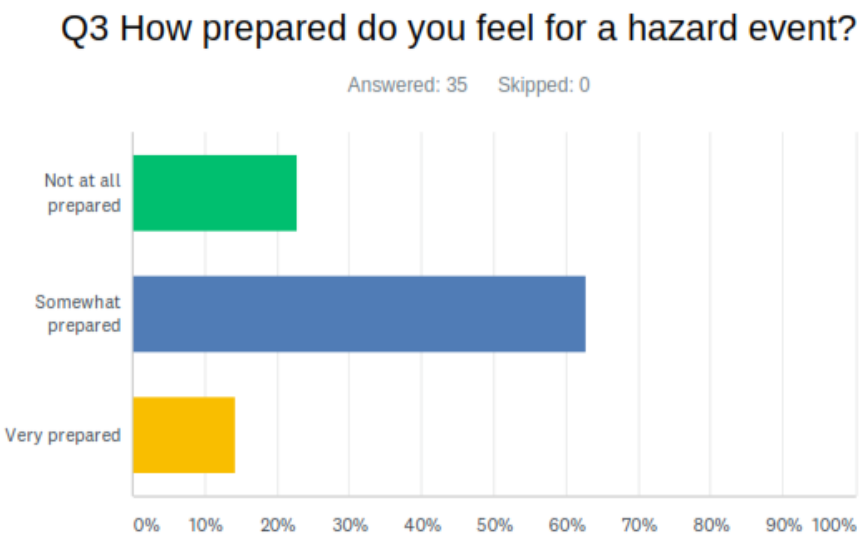
ANSWER CHOICES	RESPONSES	
Unincorporated Mecklenburg County	2.86%	1
Charlotte	8.57%	3
Cornelius	17.14%	6
Davidson	0.00%	0
Huntersville	11.43%	4
Matthews	25.71%	9
Mint Hill	2.86%	1
Pineville	25.71%	9
TOTAL		35

Figure B.2 – Survey Response, Home Ownership



ANSWER CHOICES	RESPONSES	
Rent	0.00%	0
Own	100.00%	35
TOTAL		35

Figure B.3 – Survey Response, Preparedness

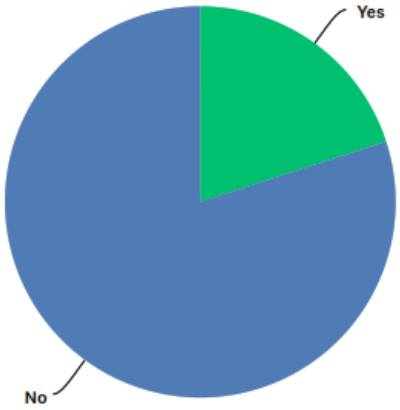


ANSWER CHOICES	RESPONSES	
Not at all prepared	22.86%	8
Somewhat prepared	62.86%	22
Very prepared	14.29%	5
TOTAL		35

Figure B.4 – Survey Response, Evacuation Center/Shelter Awareness

Q4 Do you know where evacuation centers or storm shelters are?

Answered: 35 Skipped: 0

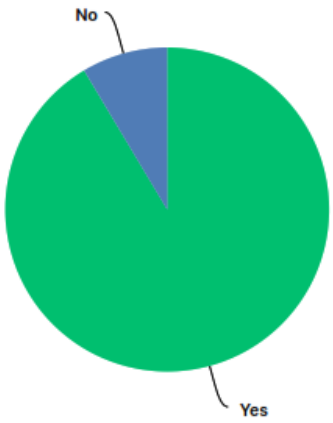


ANSWER CHOICES	RESPONSES	
Yes	20.00%	7
No	80.00%	28
TOTAL		35

Figure B.5 – Survey Response, Ability to Evacuate/Take Shelter

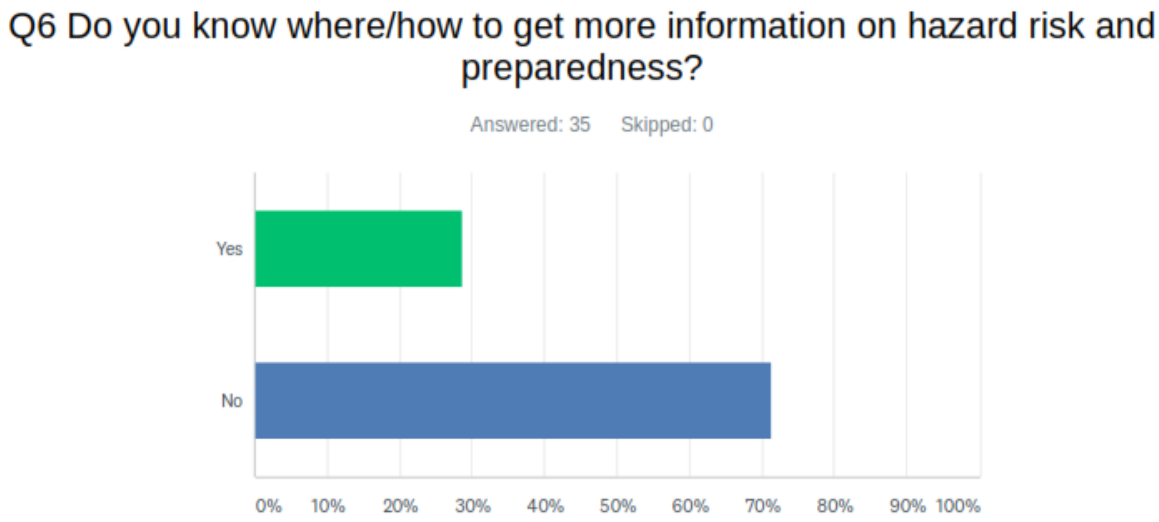
Q5 Are you able to evacuate or take shelter if necessary?

Answered: 35 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	91.43%	32
No	8.57%	3
TOTAL		35

Figure B.6 – Survey Response, Knowledge of Where to Find Hazard Information



ANSWER CHOICES	RESPONSES	
Yes	28.57%	10
No	71.43%	25
TOTAL		35

Figure B.7 – Survey Response, Hazard Significance Ratings

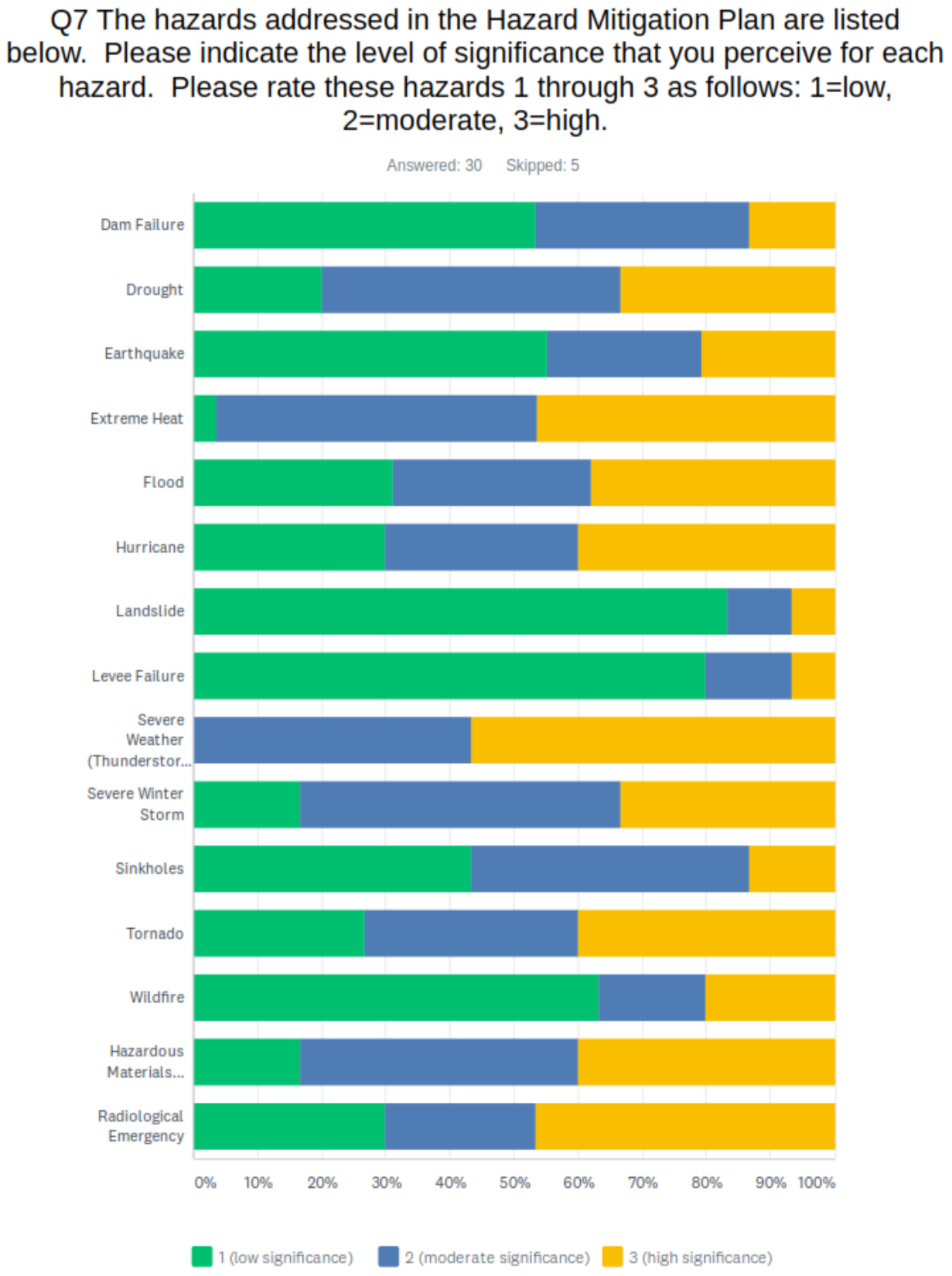


Figure B.8 – Survey Response, Key Hazard Issues/Concerns

Q8 Describe specific hazard issues/problem areas that you would like the planning committee to consider.

Answered: 18 Skipped: 17

#	RESPONSES	DATE
1	Nuclear Plants Failure. Tree Canopy Loss from Hurricane. At Risk Populations & Extreme Heat or Cold. Drought and Higher Water Consumption with Population & Industry Growth.	8/2/2019 1:28 PM
2	1) Nuclear power plant failure/terrorism/ bioterrorism 2) Clean water and shortage 3) Climate change effect on air, farming & ability to move commodities 4) Industrial pollution- air, water, ground	4/30/2019 6:51 PM
3	Terrorist attack using IED/dirty bomb/small nuke, Power grid failure due to EMP or solar storm	4/18/2019 4:03 PM
4	Forest fire and remove forest debris from public common areas such as Elizabeth Lane Elementary School. Debris consists of fallen trees, branches, pine needles, hazardous materials being transported on HWY 51 Matthews Pineville Rd. Hazardous spills into creeks etc.	4/16/2019 10:49 AM
5	None come to mind	4/16/2019 9:56 AM
6	none	4/15/2019 9:38 AM
7	Knowing where handicapped, infirm, extreme elderly are located in order to give emergency assistance.	4/15/2019 8:22 AM
8	Unknown	4/15/2019 8:13 AM
9	Traffic is a hazard in this city/county. The infrastructure is not keeping up with the growing population. There needs to be a short term and long term sustainable plan put in place, and then work the plan. Once the growth slows down there will not be enough income to get these problems addressed.	3/13/2019 5:21 PM
10	None	3/13/2019 2:55 PM
11	I wonder about iodine pills, and I cannot get information from my usual research. Maybe they don't even work, for all I know.	2/18/2019 12:29 PM
12	Nuclear power plant failure	2/15/2019 10:16 AM
13	N/A	2/14/2019 4:39 PM
14	flooding, storm damage (winter and summer), the Catawba Nuclear station.	2/14/2019 3:37 PM
15	Strengthening core components of the Emergency Management and Mitigation System	2/5/2019 9:01 PM
16	Epidemic	2/5/2019 5:29 PM
17	Rising water levels.	1/29/2019 11:47 AM
18	Radiological, Damm Failure, Riot	1/25/2019 4:16 PM

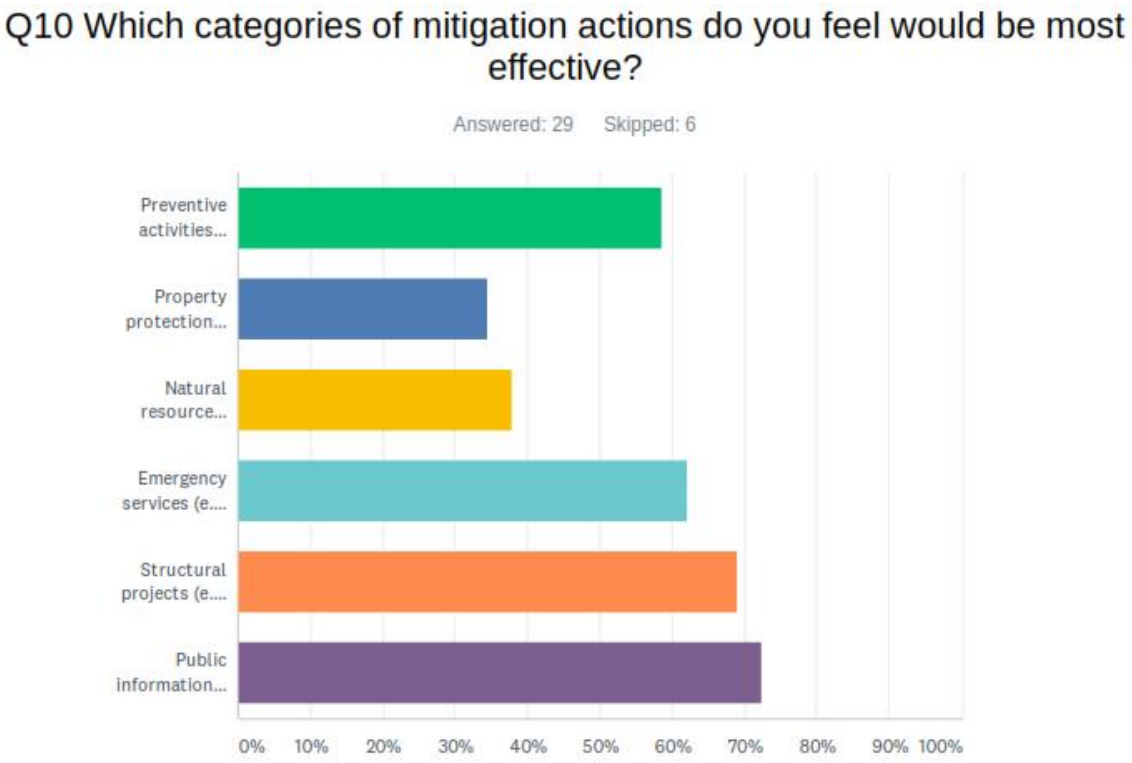
Figure B.9 – Survey Response, Personal Actions Taken for Mitigation

Q9 Describe any actions you have taken to mitigate hazard risk for your family, home, or neighborhood.

Answered: 21 Skipped: 14

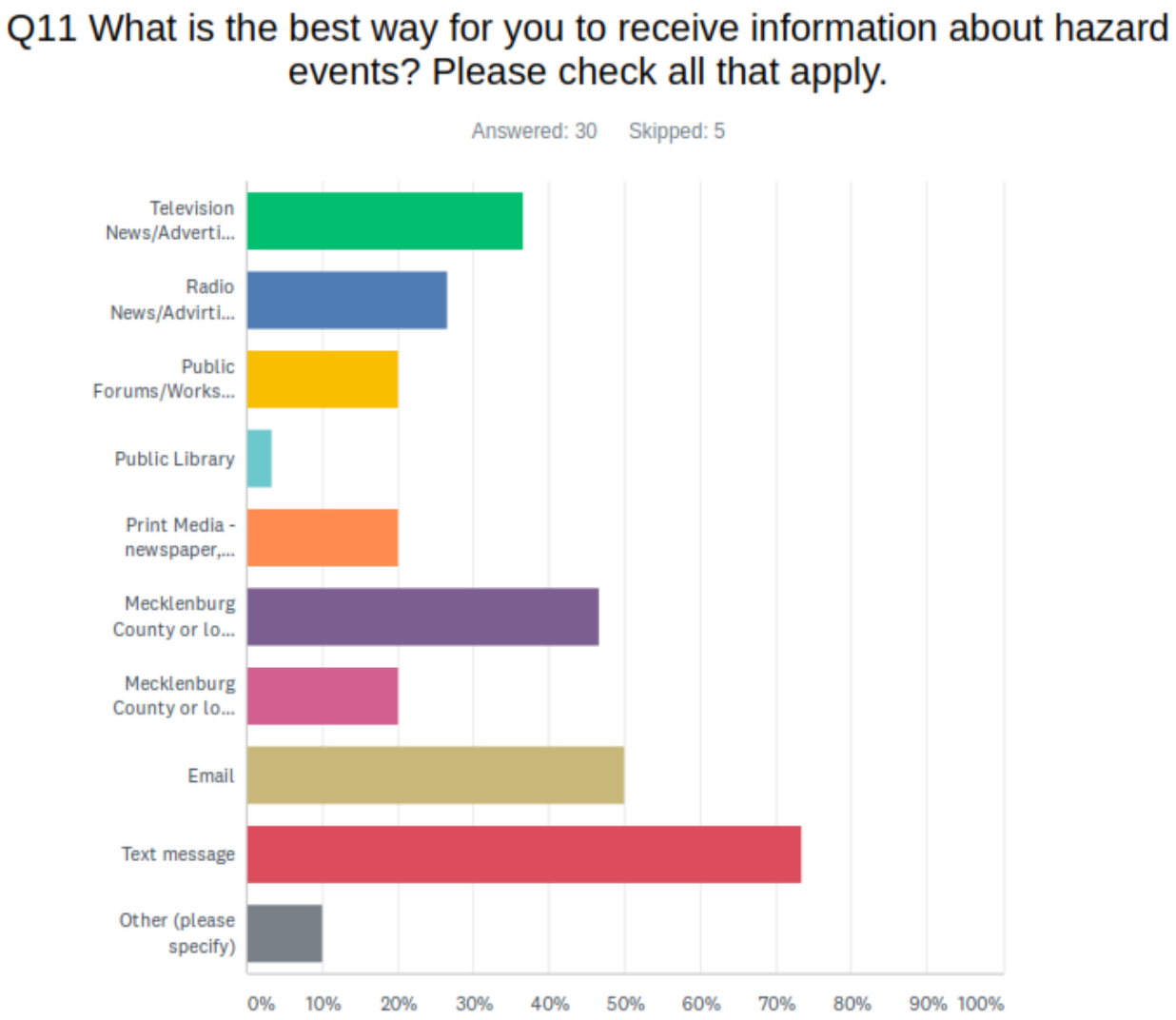
#	RESPONSES	DATE
1	None	11/20/2019 3:55 PM
2	Produce gardening in own yard for family and friends. Personal health upkeep for ability to walk and bike to key locations. Week long emergency rations and fuel and camping, hiking equipment. Talk to neighbors so I know them and have idea of some of their limitations on mobility.	8/2/2019 1:28 PM
3	1) extra clean bottled water 2) bought generator with frozen homemade meals for a couple weeks 3)organic fertilizers for yard 4) installed irrigation system that monitors rainfall, temperature and humidity 5) many indoor plants recommended by NASA to clean air	4/30/2019 6:51 PM
4	Emergency kit, first aid training	4/18/2019 4:03 PM
5	Sardis Plantation HOA is removing forest debris from HOA owned land and common areas.	4/16/2019 10:49 AM
6	None really	4/16/2019 9:56 AM
7	none	4/15/2019 9:38 AM
8	Installed home generator	4/15/2019 8:22 AM
9	Hurricane prep	4/15/2019 8:13 AM
10	We have a disaster plan in place and basic emergency supplies.	4/14/2019 9:04 PM
11	Self-survival kit prepared	3/19/2019 3:07 PM
12	Paying attention to the community and making the town aware of any issues noticed.	3/13/2019 5:21 PM
13	Develop a plan of action	3/13/2019 2:55 PM
14	better draining, better communication, better support for emergency services	3/12/2019 4:55 PM
15	Working with my HOA is hopeless, I've learned in 2 years there. All I do is get water and wood for the fireplace before a storm (or hurricane).	2/18/2019 12:29 PM
16	Prepared an emergency kit and checklist.	2/14/2019 4:39 PM
17	important papers in one place and easy to retrieve, prepared to keep some flooding from the inside of my house and I know my nuclear emergency evacuation starts at Pineville elementary school and ends at UNCC.	2/14/2019 3:37 PM
18	Family preparedness efforts	2/5/2019 9:01 PM
19	Built a French drain, built a kit for our most survivable room, subscribed to warnings, blog about disaster and what to do.	2/5/2019 5:29 PM
20	New Roof	1/29/2019 11:47 AM
21	Be Aware	1/25/2019 4:16 PM

Figure B.10 – Survey Response, Preferred Mitigation Categories



ANSWER CHOICES	RESPONSES	
Preventive activities (e.g. planning and zoning, building codes)	58.62%	17
Property protection (e.g. retrofitting, insurance, flood prone property buyout)	34.48%	10
Natural resource protection (e.g. wetlands protection, erosion control, forest health protection)	37.93%	11
Emergency services (e.g. hazard threat recognition, hazard warning systems, critical facilities protection)	62.07%	18
Structural projects (e.g. storm drain improvements, hazardous tree removal,	68.97%	20
Public information (e.g. outreach projects, environmental education, public education)	72.41%	21
Total Respondents: 29		

Figure B.11 – Survey Response, Preferred Public Outreach Methods



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. County, City, and Town representatives were asked to identify stakeholders to participate on the HMPC at the beginning of the planning process. Additionally, to further 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 is provided in Table B.3.

Stakeholders were also involved in development of the plan through specific requests for data.

From: Moore, Abigail
Sent: Monday, July 20, 2020 1:31 PM
To: Angela.Broome@redcross.org; lclark@uwcentralcarolinas.org; mmarsicano@fftc.org; bart@catawbalands.org; june@cleanaircarolina.org; lbelcher@habitatcharlotte.org; claytonm.wilcox@cms.k12.nc.us; cgonyar@uncc.edu; tosigler@davidson.edu; throwerr@queens.edu; Kandi.Deitemeyer@cpcc.edu; k.rapp@gastongov.com; bsummers@lincolncounty.org; kent.greene@co.iredell.nc.us; chris.soliz@rowancountync.gov; rssmith@cabarruscounty.us; donald.moye@unioncounty.nc.gov; roy.mcclure@fema.dhs.gov; Edwardine.Marrone@fema.dhs.gov; ktodd@ISO.com; jbratcher@iso.com; sharper@iso.com; ewstrom@usgs.gov; Randy.Mundt@ncdps.gov; jcrew@ncem.org; john.holley@ncdenr.gov; linda.culpepper@ncdenr.gov; Hannah.thompson@ncagr.gov; ccooke@charlotteregion.org; shante.williams@cmbcc.org
Cc: Stroud, David A
Subject: Mecklenburg County Hazard Mitigation Plan Final Public Meeting

Good afternoon,

Mecklenburg County and its incorporated communities have developed an update to the 2015 Multi-Jurisdictional Hazard Mitigation Plan. To assist with this process, the County, City, and Towns and the Hazard Mitigation Planning Committee are seeking stakeholder input and expertise to support the planning effort.

We invite you to attend a public information meeting on the draft plan to be held on Wednesday, July 22nd 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 www.MeckNChmp.com/draftDocuments.html. Please email any comments or feedback on the draft plan to me at abigail.moore@woodplc.com. We appreciate any input you may have!

Thank you for your assistance in this 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

wood.

Table B.3 – Stakeholder List

First Name	Last Name	Organization
Non-Profit Organizations		
Angela	Broome	American Red Cross Charlotte Metro Chapter, Executive Director
Laura	Clark	United Way of Central Carolinas
Dr. Michael	Marsicano	Foundation for the Carolinas, President
Bart	Landess	Catawba Land Conservancy, Executive Director
June	Blotnick	Clean Air Carolina, Executive Director
Laura	Belcher	Habitat for Humanity of Charlotte, President and CEO
Educational Institutions		
Dr. Clayton	Wilcox	Charlotte-Mecklenburg Schools, Superintendent
Christopher	Gonyar	UNC Charlotte Emergency Management, Director
Todd	Sigler	Davidson College Director of Public Safety
Ray	Thrower	Public Safety & Campus Police, Assistant Vice President
Dr. Kandi	Deitemeyer	Central Piedmont Community College, President
Surrounding Municipalities		
Keith	Rapp	Gaston County Office of Emergency Management, Director
Bill	Summers	Lincoln County Emergency Management, Director
Kent	Greene	Iredell Emergency Management, Director
Chris	Soliz	Rowan County Emergency Services, Chief
Bobby	Smith	Cabarrus County Emergency Management, Director
Donald	Moye	Union County Emergency Management, Director
Federal Government		
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
State Government		
Randy	Mundt	State NFIP Coordinator
Chris	Crew	State Hazard Mitigation Officer
John	Holley	NCDEQ - Land Quality Section Regional Office
Linda	Culpepper	DEQ Division of Water Resources, Director
Hannah	Thompson-Welch	NC Forest Service, Wildfire Mitigation Specialist
Business Community		
Colleen	Cooke	Charlotte Regional Business Alliance
Dr. Shante	Williams	Charlotte Mecklenburg Black Chamber of Commerce

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

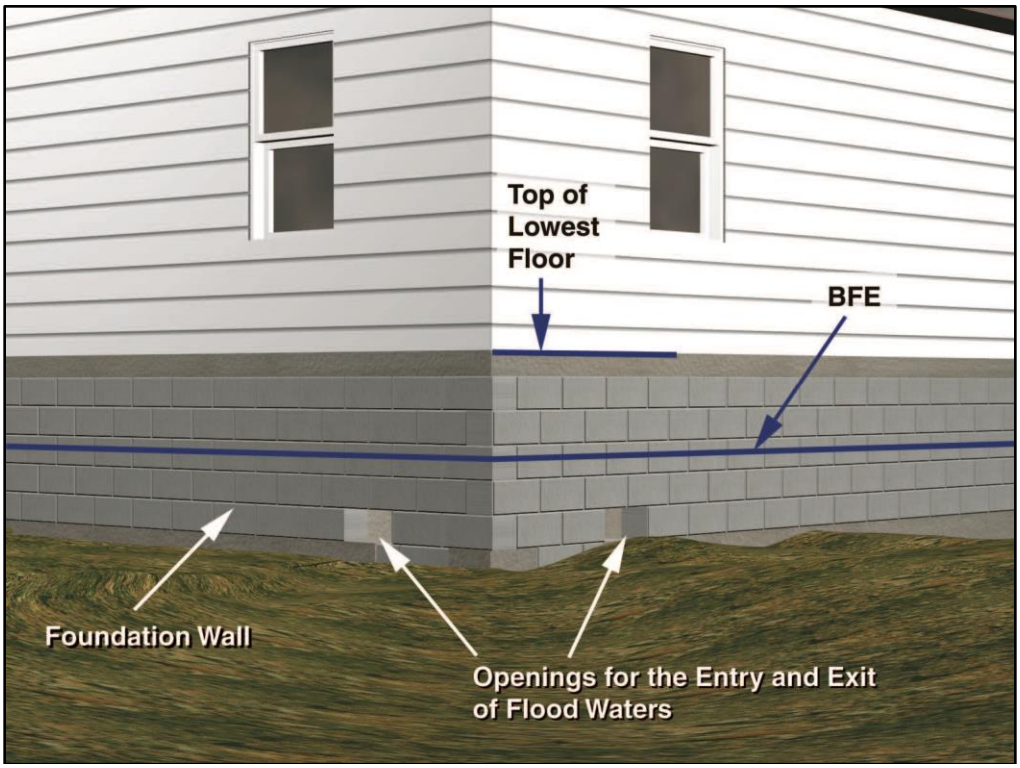
Preventative measures are designed to keep a problem - such as flooding - from occurring or from getting worse. The objective of preventative measures is to ensure that future development is not exposed to damage and does not cause an increase in damages to other properties. Building, zoning, planning 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 Mecklenburg County 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
Prevention Measures Considered by HMPC and Not Recommended			
-	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
Prevention Measures and Funding Recommended for Implementation			
Mecklenburg-3	Continue participation in the NFIP Community Rating System (CRS) with the goal of increasing CRS credit points to become a Class 5 community or better within five years.	Improving the County's CRS class will require enhanced floodplain management activities to reduce risk and will also provide financial benefits to policyholders.	SWS Operating budget

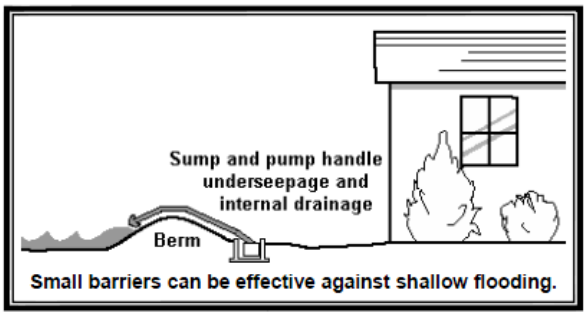
Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
Mecklenburg-6	Research possibility of using new H&H models to provide flood forecasting in the Flood Information Notification System (FINS). Research possibility of FINS system to provide inundation mapping based on results of new H&H models and explore alternate methods and expansion into other locations.	Improved modeling can assist the county in planning for additional floodplain management activities.	TBD
Charlotte-1	Consider the need to add or revise existing policies or regulations to more thoroughly address natural hazards during the update of the City's Zoning Ordinance.	Managing development through zoning will allow the city to protect existing and future development by managing stormwater and floodplains.	Local staff time

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

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.

This low floodwall has landscaping to minimize the adverse impact on the property's appearance.

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.

Small, wood frame buildings are the easiest to relocate

Source: Kennedy House Movers, Huntsville, AL

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.

Demolishing a repetitively flooded home

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 Mecklenburg County 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
Property Protection Measures Considered by HMPC and Not Recommended			
-	Develop flood barriers in high risk areas.	These structural projects may worsen flood impacts elsewhere. The planning committee opted to pursue projects that adapt to flooding and reduce risk on a regional level.	n/a
Property Protection Measures and Funding Recommended for Implementation			
Mecklenburg-8	Install back-up emergency generators at the following emergency shelters: Tuckasseegee Recreation Center, Grady Cole Center, Naomi Drennan Recreation Center	Protecting shelters will ensure individuals have a safe location to go to during hazard events.	FEMA Unified Hazard Mitigation Assistance / Storm Water Services capital fund
Pineville-1	Seek grant 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.	Critical facility improvements can ensure continuity of critical operations during hazard events, which can potentially save lives. Additionally these projects are cost beneficial due to available grant funding.	Local, State Grants, UHMA Grants, other federal grants

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 Mecklenburg County 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
Natural Resource Protection Measures Considered by HMPC and Not Recommended			
-	Create GIS layer of all conservation easement areas to protect natural and restored buffers.	This action was completed by the City of Charlotte and does not currently need further action to maintain.	n/a
-	Identify open space for acquisition and permanent conservation	This is not a priority for the planning committee due to financial cost of land acquisition.	n/a
Natural Resource Protection Measures and Funding Recommended for Implementation			
Pineville-7	Encourage clustering of residential lots outside of known hazard areas through the development and use of subdivision design and review guidelines.	This action, also considered a Prevention project, will result in preserved open space in flood-prone areas, protecting future development from risk.	Staff time and resources

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 Mecklenburg County 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
Emergency Services Measures Considered by HMPC and Not Recommended			
-	Enhance use of Connect-CTY® to warn people of impending hazards, potential emergencies and disasters.	All Towns are now part of CharMeck alerts, which allows for better coordination on hazard warning and notification.	n/a
Emergency Services Measures and Funding Recommended for Implementation			
Charlotte-10	Equip emergency responders and managers for flood emergencies, including swift water rescue.	Training will support improved rescue and response capabilities	Hazard Mitigation Grant Program (7% set aside), Emergency Management Performance Grants (EMPG)
Charlotte-13	Develop evacuation routes that are not adversely affected by flooding.	This action will protect life safety by reducing the potential that individuals will drive through flooded streets.	Local staff time and resources

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
Structural Project Measures Considered by HMPC and Not Recommended			
-	Consider channel diversion projects.	This strategy will not be cost effective in reducing risk in highly developed areas where mitigation is needed.	n/a
-	Continue to identify, rank and prioritize capital improvement projects, flood control (FC) projects and pond projects, using pre-established criteria for each.	This is an established practice of the City of Charlotte and does not require further resources through this plan to implement.	n/a
Structural Project Measures and Funding Recommended for Implementation			
Mecklenburg-5	Identify, fund, and implement eligible flood mitigation projects. FEMA-defined and locally verified "repetitive loss properties" to receive high priority.	Structural projects to mitigate repetitive loss properties will reduce potential property damage and may save lives.	FEMA Unified Hazard Mitigation Assistance / Storm Water Services capital fund

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 Mecklenburg County 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
Public Information and Outreach Measures Considered by HMPC and Not Recommended			
-	Build relationships and coordination with critical infrastructure partners, specifically power, utilities, and communications to build local resilience.	This action is addressed as needed during hazard events.	n/a
-	Inform public of flood risk by sending annual newsletter to owners and occupants of all buildings in floodplain.	Additional direct mailings are not cost effective. The planning committee is considering ways to improve online outreach.	n/a
Public Information and Outreach Measures and Funding Recommended for Implementation			
Mecklenburg-4	Update Flood Insurance Rate Maps to provide most accurate depiction of flood risk.	Enabling individuals to understand their flood risk will help them to take personal action to mitigate their risk.	Storm Water Services Capital Fund / CTP grant
Pineville-6	Advertise and promote the availability of flood insurance.	This is a low cost action that will encourage property protection.	Local

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