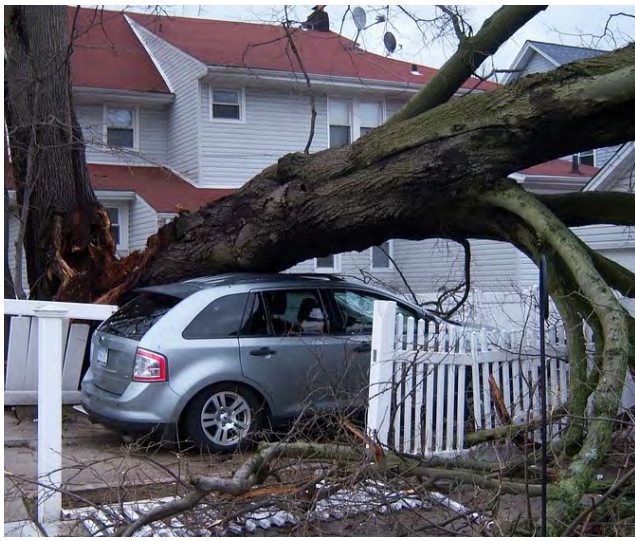
Outer Banks Regional Hazard Mitigation Plan









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1 Introduction

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

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

1.1 BACKGROUND

This document comprises a Hazard Mitigation Plan for the Outer Banks Region of North Carolina.

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

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

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

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

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

1.2 PURPOSE AND AUTHORITY

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

The planning area for the Outer Banks Region includes all incorporated municipalities and unincorporated areas in Currituck and Dare Counties. All participating jurisdictions are listed in Table 1.1.

Table 1.1 – Participating Jurisdictions in the Outer Banks Regional Hazard Mitigation Plan

Currituck County
Dare County
Town of Duck
Town of Kill Devil Hills
Town of Kitty Hawk
Town of Manteo
Town of Nags Head
Town of Southern Shores

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

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

- Coastal Hazards (Erosion, Rip Current, and Sea Level Rise)
- Drought
- Earthquake
- Extreme Heat
- Flood
- Hurricane & Tropical Storm
- Severe Weather (Thunderstorm Wind, Lightning, & Hail)

- Severe Winter Storm
- Tornado
- Wildfire
- Hazardous Materials Incident
- Radiological Emergency
- Cyber Threat
- Terrorism
- Transportation Infrastructure Failure

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 Outer Banks Regional Hazard Mitigation Plan is organized into the following sections:

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

2 Planning Process

Requirement §201.6(b): An open public involvement process is essential to the development of an effective plan. To develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:
1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and nonprofit interests to be involved in the planning process; and
3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.
Requirement §201.6(c)(1): The plan shall include the following:
1) Documentation of the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

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

- 2.1 Purpose and Vision
- 2.2 What's Changed in the Plan
- 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 Outer Banks Regional Hazard Mitigation Plan is to identify, assess, and mitigate hazard risk to better protect the people and property within Currituck and Dare Counties from the effects of natural and human-caused hazards. This plan documents progress on existing hazard mitigation planning efforts, updates the previous plan to reflect current conditions in the Region including relevant hazards and vulnerabilities, increases public education and awareness about the plan and planning process, maintains grant eligibility for participating jurisdictions, maintains compliance with state and federal requirements for local hazard mitigation plans, and identifies and outlines strategies the Counties and participating jurisdictions will use to decrease vulnerability and increase resiliency.

The Outer Banks Region Hazard Mitigation Planning Committee (HMPC) met on June 4th and June 5th and representatives discussed their vision for the planning area in terms of hazard mitigation planning. The committee was asked to consider what the successful implementation of the plan would achieve, what outcomes the plan would generate, and what the Outer Banks 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 that they agreed should define and guide the planning process and the planning area's approach to hazard mitigation.

The Outer Banks Region will maintain its unique quality of life and sense of place while planning and preparing for resilience in the face of future hazards. The Region will be prepared for and adaptable to hazards, and when confronted with disaster, the Region will recover stronger and smarter in a planned, balanced, sustainable manner that acknowledges the dynamic nature of hazard risks in a changing climate. Through innovation and collaboration, the Outer Banks Region will ensure a thriving, safe environment for residents and visitors.

2.2 WHAT'S CHANGED IN THE PLAN

Currituck and Dare Counties and their incorporated jurisdictions were participants in the previously approved Albemarle Regional Hazard Mitigation Plan. This plan was approved by FEMA on June 11, 2015.

For this plan update, Currituck and Dare Counties and their incorporated jurisdictions decided to separate from the Albemarle planning region and create their own Outer Banks Regional Plan in order to better focus on the unique risks, vulnerabilities, and needs of their communities.

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 Counties and participating municipalities in evaluating, monitoring and implementing the mitigation strategy outlined in their existing plans. Only the information and data still valid from the existing plans was carried forward as applicable into this update. The following requirements were addressed during the development of this regional 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 Albemarle Regional plan and provides the final decision made by the HMPC as to which hazards should be included in the new 2020 Outer Banks Regional Hazard Mitigation 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 Outer Banks Regional Hazard Mitigation Plan was based on DMA planning requirements and FEMA's associated guidance. This guidance is structured around a four-phase process:

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

Into this process, the planning consultant integrated a more detailed 10-step planning process used for FEMA's Community Rating System (CRS) and Flood Mitigation Assistance (FMA) 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; CRS Program; FMA 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	Step 4	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

CWPP Process	CRS Step	Fulfilling Plan Section
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 Counties' 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 Counties' effort to reorganize and coordinate for the plan update was led by Dare County Emergency Management Director, Drew Pearson, and the Currituck County Emergency Management Director, Mary Beth Newns. Consultants from Wood Environment and Infrastructure Solutions, Inc. assisted by leading the Counties through the planning process and preparing the plan document.

Planning Step 2: Involve the Public

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

Planning Step 3: Coordinate

As this plan is a the first for the newly established Outer Banks planning region, the participating communities had to establish a new HMPC to lead the planning effort. More details on the HMPC are provided in Section 2.4. Stakeholder coordination was incorporated into the formation of the HMPC and was sought through additional outreach methods. These efforts are detailed in Section 2.8 and documentation of additional stakeholder outreach is provided in Appendix B.

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. Communities in the Outer Banks Region 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. Data from these sources was incorporated into the risk assessment and hazard vulnerability sections of the plan as appropriate. The data was also used in determining the capability of each jurisdiction to implement certain mitigation strategies. 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 (Dare County Land Use Plan, Currituck County Land Use Plan, jurisdictional land use/comprehensive plans, etc.)	The Currituck and Dare County land use plans 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 6. They are also referenced in individual jurisdictional annexes.
Local Ordinances (Flood Damage Prevention Ordinances, Subdivision Ordinances, Zoning Ordinances, etc)	Local ordinances were referenced in the Capability Assessment in Section 6 and where applicable for updates or enforcement in Mitigation Action Plans in Section 7.
Dare County and Incorporated Jurisdictions (09/20/2006) and Currituck County and Incorporated Jurisdictions (12/21/2018) Flood Insurance Studies (FIS), Revised	The FIS reports were referenced in the preparation of the flood hazard profile in Section 4.
Albemarle Hazard Mitigation Plan, 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. GIS was 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.

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 NCEM and FEMA Region IV to review and approve, contingent upon final adoption by the Counties and their participating jurisdictions.

2.3.4 Phase IV – Plan Maintenance

Planning Step 9: Adopt the Plan

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

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

This Hazard Mitigation Plan was developed under the guidance of a HMPC. The Committee's representatives included representatives of County and Town departments, federal and state agencies, citizens, and other stakeholders.

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

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

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

- Participate in the process as part of the HMPC;
- 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 Outer Banks Regional HMPC, "participation" meant the following:

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

- Coordinating the formal adoption of the plan by local governing bodies.

Detailed summaries of HMPC meetings are provided under Section 2.5 Meetings and Workshops, including meeting dates, locations, and topics discussed. During the planning process, the HMPC members communicated through face-to-face meetings, email, and telephone conversations. This continued communication ensured that coordination was ongoing throughout the entire planning process despite the fact that not all HMPC members could be present at every meeting. Additionally, draft documents were distributed via the plan website so that the HMPC members could easily access and review them and provide comments.

The HMPC was comprised of two groups, a CRS Steering Committee, which led the planning and decision-making efforts throughout the planning process, and a Working Group comprised of additional local staff, which provided information to the CRS Steering Committee.

Table 2.4 – CRS Steering Committee

Jurisdiction	Representative	Agency	Position/Title
Currituck County	Mary Newns	Currituck County Emergency Management	Emergency Management/ Communications Director
Currituck County	Jason Litteral, CFM	Currituck County Planning and Community Development Department	Planner II
Currituck County	Lora Eddy	The Nature Conservancy	Coastal Engagement Coordinator
Currituck County	Warren Eadus	Quible and Associates, P.C.	President
Currituck County	Anthony Dickinson	Farm Bureau Insurance Group	Agent
Currituck County	Jason Summerton	Twiddy & Company, 4WD Area	Broker-in-Charge
Dare County	Drew Pearson	Dare County Emergency Management	Director
Dare County	Donna Creef	Dare County Planning & Zoning	Planning Director
Dare County	Noah Gillam	Dare County Planning & Zoning	Planner
Dare County	Pat Weston	N/A	Citizen Stakeholder – Hatteras Island
Dare County	Glenn Rainey	N/A	Citizen Stakeholder – Colington
Dare County	Buddy Shelton	N/A	Citizen Stakeholder – Mainland Dare
Dare County	John Finelli	N/A	Citizen Stakeholder – Martin Point
Duck	Joe Heard	Department of Community Development	Director
Duck	Sandy Cross	Department of Community Development	Permit Coordinator/CAMA LPO/CZO/CFM
Duck	Matt Price	--	Community Developer
Duck	Jim Braithwaite	--	Community Developer
Kitty Hawk	Rob Testerman	Kitty Hawk Planning & Inspections	Director
Kitty Hawk	Mike Talley	Kitty Hawk Fire Department	Fire Chief
Kitty Hawk	Mark Bissel	N/A	Citizen Stakeholder
Kill Devil Hills	Meredith Guns	Kill Devil Hills Planning & Inspections	Planning Director
Kill Devil Hills	Cameron Ray	Kill Devil Hills Planning & Inspections	Senior Planner
Kill Devil Hills	Doug Styons	N/A	Citizen Stakeholder
Kill Devil Hills	Mike O'Steen	N/A	Citizen Stakeholder
Kill Devil Hills	Skip Jones	N/A	Citizen Stakeholder

Jurisdiction	Representative	Agency	Position/Title
Nags Head	Holly White	Nags Head Planning & Development	Principal Planner
Nags Head	Shane Hite	Nags Head Fire Rescue	Deputy Fire Chief
Nags Head	Meade Gwinn	N/A	Citizen Stakeholder
Nags Head	Megan Lambert	N/A	Citizen Stakeholder
Manteo	Melissa Dickerson	Manteo Planning & Zoning	Planner
Manteo	Casey Howell	Manteo Finance Department	Finance Officer
Manteo	Malcolm Fearing	N/A	Citizen Stakeholder
Manteo	Taldage Jones	N/A	Citizen Stakeholder
Southern Shores	Wes Haskett	Southern Shores Administration/Planning & Code Enforcement	Interim Town Manager/Planning Director
Southern Shores	Dabni Shelton	Southern Shores Planning & Code Enforcement	Permit Officer
Southern Shores	Andy Ward	N/A	Citizen Stakeholder

Table 2.5 – Working Group

Jurisdiction	Representative	Agency	Position/Title
Currituck County	Rebecca Gay*	Currituck County Emergency Management	Deputy Emergency Management Coordinator
Currituck County	Steven Pyle	Currituck County Emergency Management	Deputy Emergency Management Coordinator
Currituck County	Laurie LoCicero	Currituck County Planning and Community Development Department	Director
Currituck County	Jennie Turner, CFM, CZO	Currituck County Planning and Community Development Department	Planner II
Currituck County	Randall Edwards	Currituck County Public Information Department	Information and Communications Officer
Currituck County	Chandler Sawyer	Engineering	Engineer
Currituck County	Eric Weatherly	Engineering	Engineer
Nags Head	Michael Zehner	Nags Head Planning & Development	Planning Director
Nags Head	Ed Snyder	Nags Head Planning & Development	Code Enforcement

*Vacated position during the planning process

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 (Kickoff) – Dare County Group	1) Introduction to DMA, CRS, and FMA requirements and the planning process 2) Review of HMPC responsibilities and the project schedule.	March 5, 2019	Dare County Emergency Operations Center, 370 Airport Road, Manteo
HMPC Mtg. #1 (Kickoff) – Currituck County Group		March 6, 2019	Historic Currituck County Courthouse, 2826 Caratoke Hwy, Currituck
HMPC Mtg. #2 – Currituck County Group	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	June 4, 2019	Lower Currituck Fire Department, 6323 Caratoke Hwy, Grandy
HMPC Mtg. #2 – Dare County Group		June 5, 2019	Dare County Emergency Operations Center, 370 Airport Road, Manteo
HMPC Mtg. #3	1) Review Draft Hazard Identification & Risk Assessment (HIRA) 2) Draft objectives and Mitigation Action Plans	July 24, 2019	Dare County Emergency Operations Center, 370 Airport Road, Manteo
HMPC Mtg. #4 – Currituck County Group	3) Review the Draft Hazard Mitigation Plan 4) Solicit comments and feedback	January 7, 2020	Currituck Courthouse 153 Courthouse Rd, Currituck, NC 27929
HMPC Mtg. #4 – Dare County Group		January 8, 2020	Dare County Emergency Operations Center, 370 Airport Road, Manteo

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 (Kick-Off) – Dare County	1) Introduction to DMA, CRS, and FMA requirements and the planning process 2) Review of HMPC responsibilities and the project schedule. 3) Review of Hazard Identification 4) Explanation of Mitigation Categories	March 5, 2019	Dare County Admin Building, 954 Marshall C. Collins Drive, Room 168, Manteo, NC, 27954
Public Meeting #1 (Kick-Off) – Currituck County		March 6, 2019	Currituck County Senior Center, 130 Community Way, Barco, NC 27917
Public Meeting #2 – Currituck County	1) Introduction to DMA, CRS, and FMA requirements and the planning process 2) Review of HMPC responsibilities and the project schedule. 3) Review of Hazard Identification 4) Explanation of Mitigation Categories	June 4, 2019	Wildlife Center, 1160 Village Lane, Corolla, NC 27927
Public Meeting #2 – Dare County		June 5, 2019	Fessenden Center Annex, 47017 Buxton Back Road, Buxton, NC 27920
Public Meeting #2 – Dare County		June 6, 2019	102 Town Hall Drive, Commissioners Meeting Room, Kill Devil Hills, NC 27948
Public Meeting #3 – Currituck County	1) Review "Draft" Hazard Mitigation Plan 2) Solicit comments and feedback	January 7, 2020	Currituck Courthouse 153 Courthouse Rd, Currituck, NC 27929
Public Meeting #3 – Dare County		January 8, 2020	Fessenden Center 47017 Buxton Back Road, Buxton, NC 27920
Public Meeting #3 – Dare County		January 9, 2020	Jockey's Ridge State Park Auditorium 300 W. Carolista Drive, Nags Head, NC 27959

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	Ongoing	Public Meeting announcements posted; Link to the plan website shared to expand reach; Requests for comments on the draft plan

Location	Date	Event/Message
Public survey	January 2019 – July 2019	Survey hosted online, made available via shareable link, and shared on the plan website; hard copies made available in local offices
Mitigation Flyer	June 2019	Developed a Mitigation Flyer summarizing the planning process; made available at public meetings
Plan website – Vision and Goals	July 2019	Final visions and goals posted to plan website for review
Plan website – HIRA draft	July 2019	Draft HIRA made available for review and comment online
Plan website – Draft Plan	January 2020	Full draft plan made available for review and comment online
Local newspaper article	March 2019	Description of the planning process, link and invitation to participate in the public survey, link to the plan website
Social media posts	March 2019, June 2019, January 2020	Public meeting announcements posted; link to the plan website shared; link to the public survey shared
Local community newsletters	March 2019, June 2019, January 2020	Direct email to residents on an email distribution list requesting public comment on the draft plan

AS detailed above, 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. Documentation of these activities is provided in Appendix B.

A public outreach survey was made available on March 5, 2019 and remained open for response until June 14, 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 in hard copy at the first public meeting and online on the plan website. In total, 853 responses were received.

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

- Over 92% of respondents own their home, which indicates ability of those engaged in the mitigation process to implement mitigation on their own properties.
- Only 8% of respondents say they feel not at all prepared for a hazard event; 63.4% feel somewhat prepared and 28.6% feel very prepared.
- 56.8% of respondents do not know where evacuation centers or storm shelters are located; however, 96.6% of respondents say they are able to evacuate or take shelter if necessary, which indicates that most people manage evacuating or taking shelter through their own resources. It is possible that these results skew toward those with more awareness of hazard risk and resources to respond.
- One quarter of respondents do not know where to get more information on hazard risk and preparedness.
- Hurricane was rated the most significant hazard, followed by flood, tornado, severe weather, and erosion. Earthquake was rated the least significant hazard, followed by drought.
- Many respondents who reported having taken steps to mitigate risk at home reported preparedness actions such as generators, evacuation plans, and emergency kits and supplies as well as home maintenance actions such as removing yard debris and trimming trees. Fewer respondents also noted prevention or property protection actions such as installing storm shutters, addressing localized drainage issues, or even elevating their homes; these may be important ideas to promote in outreach.

- Respondents favored structural projects and emergency services for mitigation; the mitigation category with the least support was property protection. Continued outreach on the importance of individual property protection may be beneficial.

Detailed survey results are provided in Appendix B.

2.8 INVOLVING THE STAKEHOLDERS

In addition to representatives of each participating jurisdiction, the Hazard Mitigation Planning Committee included a variety of stakeholders. Stakeholders on the HMPC included representatives from the Nature Conservancy, Farm Bureau Insurance Group, Quible and Associates, and Twiddy & Company. Input from additional stakeholders, including neighboring communities, was solicited through an invitation to attend the public meetings and review the draft plan. Documentation and details of this effort are provided in Appendix B. Stakeholders could also participate in the public survey; however, whether or not stakeholders participated is unknown due to the anonymous nature of the survey.

2.9 DOCUMENTATION OF PLAN PROGRESS

Progress on the mitigation strategy developed in the previous plan is documented in this plan update. Table 2.9 below details the status of mitigation actions from the previous plan. More detail on these actions is provided in Section 7: Mitigation Action Plans.

Table 2.9 – Status of Previous Mitigation Actions

Jurisdiction	Completed	Deleted	Carried Forward
Currituck County	14	14	29
Dare County	25	2	9
Town of Duck	2	15	19
Town of Kill Devil Hills	0	12	24
Town of Kitty Hawk	3	11	5
Town of Manteo	0	11	7
Town of Nags Head	15	68	16
Town of Southern Shores	1	9	18
Total	**60**	**142**	**127**

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 Outer Banks Regional Hazard Mitigation Plan

2015 Action #	Description	2019 Status	Status Comments/Explanation
Currituck County			
CUR2	Routinely inspect and clear debris from drainage system	Completed	Soil & Water routinely inspects drainage. Soil & Water awarded approx. $170,000 from 2016 Disaster Relief Funds for clear and snag of ditches. Moyock Watershed Service District is spending $35,000 to conduct heavy maintenance (removing debris/sediment, unclogging culverts) on ditches within the district.
CUR3	Prepare stormwater drainage studies and planning for mitigation of known problem areas.	Completed	**Whalehead**: Evaluation of current drainage system identified $2 million worth of improvements. Developing a capital improvement plan to implement recommendations. **Ocean Sands North, Crown Point**: 2 year ($300,000) report focusing on groundwater lowering systems should be completed in late 2018. Report recommends designing and implementing a groundwater lowering system that will provide for additional storage of stormwater within the underlying soils. Will require tax increase to fund project. **Guinea Mill Run Drainage Basin**: USACE hired in 2017 to complete $195,000 drainage modeling study looking at the ditches/drainage in the northwest portion of the county.Guinea Mill Run Planning Assistance to States Hydrology and Hydraulics Study completed in 2018. Working to identify funding source for study recommendations. **Moyock Watershed Service District:** Survey for potentially implementing a tax increase for drainage improvements collected April 2018. **Currituck Station:** Proposal of a regional drainage system that future developers would be required to adhere to. **Carova Service District:** working with advisory board on potentially implementing tax increase to fund improvements. **Nature Conservancy** is working on drainage basin study to determine flow patterns.
CUR4	Determine the feasibility of stormwater districts in watersheds, townships, or problem flooding areas through a study to mitigate against future flooding.	Completed	See CUR3 for status

2015 Action #	Description	2019 Status	Status Comments/Explanation
CUR12	Maintain participation and membership in the National Flood Insurance Program and the Community Rating System Program.	Deleted	Not intended to be included in 2015 plan as an action.
CUR13	Support and continue NC Floodplain Mapping Program updates of flood and hazard maps as needed.	Completed	Flood map updates completed Maps effective date: December 21, 2018.
CUR14	Investigate the feasibility of adopting higher standards such as protection of critical facilities that will benefit the County's CRS rating and increase the discount of flood insurance for home owners.	Completed	1 foot of freeboard has been incorporated into the unified development ordinance which has been officially adopted. Coastal Resilience tool (maps.coastalresilience.org/northcarolina/#) will be valuable in determining risk and redirecting growth to areas with less risk.
CUR44	Adopt appropriate land use or other regulatory policies/ordinances that assist in the mitigation of repetitive loss properties	Completed	The stormwater manual and unified development ordinance address this issue. We are currently updating our land use plan.
CUR60	Encourage NC Building Code to strengthen building codes and incorporate those higher standards for hazard resistance to mitigate structure damage via sending delegation to the Code Council.	Deleted	Need status
CUR21	Protect private and county assets, buildings, and critical facilities through implementation of cost-effective and technically feasible mitigation actions.	Deleted	Not intended to be included in 2015 plan as an action.
CUR40	Pursue mitigation of repetitive flood loss properties	Deleted	Not intended to be included in 2015 plan as an action.
CUR68	Survey County owned property to retrofit for hazards	Completed	EM / Fire Marshal completed county facility safety assessments in 2017 and provided recommendations to County Manager and Public Works.
CUR45	Preserve and/or restore natural and coastal areas or the natural functions of floodplains (coastal and riverine) and watershed areas.	Deleted	Not intended to be included in 2015 plan as an action.
CUR46	Protect/enhance landforms through both public and private efforts that serve as natural mitigaiton features by promoting dune grass plantings, installation of sand fencing, importing sand, and other appropriate measures.	Completed	The County offers a yearly dune grass, share cost, grant program aimed at enhancing vegetative cover on the dune system.
CUR48	Evaluate the adoption of a County ordinance address protection to the primary or frontal dune or damage to vegetation on the frontal dune	Completed	The unified development and CAMA regulations provide protection for primary frontal dunes. The subdivision ordinance provides protection of significant dunes by requiring a report from a licensed geologist.
CUR1	Continue to improve stormwater drainage in order to prevent flooding.	Deleted	Not intended to be included in 2015 plan as an action.

2015 Action #	Description	2019 Status	Status Comments/Explanation
CUR7	Work with NCDOT and neighboring communities to improve traffic flow throughout both mainland and the Outer Banks portion of Currituck County.	Deleted	Not intended to be included in 2015 plan as an action.
CUR9	Partner with NCDOT to evaluate areas on Hwy 12 and Caratoke Hwy and implement level of service standards for new development.	Deleted	Medians, improved intersections, improved access control, etc. are included in new development; however, no funding exists to retrofit existing problem areas.
CUR10	Encourage NCDOT to continue with road improvements (stop lights, turn/deceleration lanes, etc.)	Completed	We continue to work with DOT on major projects that would effect traffic flow through the County. Improved intersections, access control, etc. are identifed in the STIP, but are not currently funded. South Mills Rd. widening project funded beginning FY2019. US158 widening from NC-34 in Camden to NC168 in Barco funded beginning FY2023.
CUR28	Improve capability of the County to respond to hazards and improve the effectiveness of hazard mitigation strategies in regards to public safety response	Deleted	Not intended to be included in 2015 plan as an action.
CUR31	Improve water safety and water response through use agreements or easements with Homeowner Associations that have existing boat ramps with access to the sound.	Deleted	No progress
CUR33	Develop a strategy to facilitate post-disaster and recovery plans with the private sector including homeowner associations and critical facilities	Deleted	No progress
CUR35	Secure pumps for stormwater pumping prior to storm events	Completed	Engineering Department has contacts for stormwater pumps. Oceans Sand Emergency Pumping Plan approved by NCDEQ Div. of Water Resources; Currituck OBX Emergency Pumping Plan under review.
CUR38	Continue to develop Community Emergency Response Teams (CERT)	Completed	Continuous - Knotts Island continues to maintain a robust CERT.
CUR16	Continue to educate the public and increase awareness about hazards, how to develop and retrofit their properties against hazards, and individual responsibility for mitigating against hazard risk in order to protect public health, safety, and welfare.	Deleted	Not intended to be included in 2015 plan as an action.
CUR23	Educate, empower, and assist the most vulnerable populations from being impacted by potential hazards.	Deleted	Not intended to be included in 2015 plan as an action.
CUR24	Expand publications to include other languages	Completed	Our IT department is working to include Spanish copies of federal documents on our website.

2015 Action #	Description	2019 Status	Status Comments/Explanation
CUR36	Improve the dissemination of information to the public prior, during, and after events.	Completed	County continues to improve social media efforts.
CUR74	Continue to work on requirement for a real estate disclosure statement for home buyers and renters	Deleted	Need status
Dare County			
DAR2	Identify problem areas and prioritize projects to improve drainage systems throughout the county.	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
DAR3	Enforce ordinances that prevent fill or structures without a drainage plan.	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
DAR4	Assist property owners with safe and efficient clean up after storm events by implementing yearly contract with debris removal services	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
DAR5	Increase the number of properties that meet and exceed the published Base Flood Elevations.	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
DAR7	Implement a repetitive loss plan to reduce the potential damage from future events.	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
DAR10	Identify and prioritize funding to mitigate vulnerable structures and develop the repetitive loss plan	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
DAR11	Implementation and Enforcement of CAMA Use Standards for Coastal Wetland AECs as Identified under 15NCAC7H, Section 0205 and 0208	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
DAR12	Continue to Administer the CAMA Local Enforcement Program and Maintain the Staff Necessary for this Work.	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
DAR13	Refer Applicants to U.S. Army Corps of Engineers Permit Program, Specifically Section 404	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
DAR14	Facilitate Implementation of Permit Program for Wetland Management	Delete	No one knew what this was.
DAR19	Require Realtors to disclose flood zones. Develop and maintain relations with Real Estate Community and provide outreach and educational opportunities. Provide access to floodplain maps and floodplain information for the Real Estate Community.	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
DAR20	Enhance NFIP information by distributing NFIP brochures and including up to date flood maps on the County website.	Delete	Action was already completed
DAR22	Continue to participate in the Community Rating System. Look for additional activities to implement to improve Class rating.	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
DAR23	Continue participation in Storm Ready program.	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.

2015 Action #	Description	2019 Status	Status Comments/Explanation
DAR24	Develop Emergency Response Plan for Road/Bridge Loss	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
DAR25	Advocate for Beach Replacement	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
DAR26	Circulate brochures on all hazards identified in the risk assessment to educate the public on protective actions that they can prepare for in their disaster plans.	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
DAR27	Conduct annual outreach activities to increase awareness of all potential hazards that affect Dare County.	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
DAR29	Educate the public with assistance with safe and efficient clean up after storm events.	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
DAR30	Fund and implement assistance to property owners with safe and efficient clean up after storm events.	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
DAR31	Develop plan to increase the number of properties that meet and exceed Base Flood Elevation (BFE).	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
DAR32	Prioritize funding to increase the number of properties that meet and exceed BFE.	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
DAR34	Lobby local realtors board to require realtors to disclose flood zones	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
DAR35	Circulate Brochure on NFIP to enhance NFIP information.	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
DAR36	Put Flood Maps on the County's Website to enhance NFIP information.	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
DAR37	Continue to Participate in CRS Activities to enhance NFIP information.	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
DAR38	Update FIRM to enhance NFIP information.	Complete	Ongoing effort that does not require any additional effort or is an already well established policies/procedures.
Town of Duck			
DCK11	Research the use and storage of propane and develop an ordinance to regulate these storage tanks	Delete	Since the use and storage of propane is regulated by the NC Dept. of Agriculture it was the consensus of the OBX multi-jurisdictional CRS users group to remove this from proposed changes to model floodplain ordinance and therefore we are recommending removal of this action item.

2015 Action #	Description	2019 Status	Status Comments/Explanation
DCK15	Develop/Update policies to deal with encroaching development on the Town beaches and to preserve the Towns dune system.	Complete	The Town has adopted an ordinance to limit the encroachment of structures on the beach. Additionally, new setbacks have been adopted for accessory structures such as pools and dune decks to provide additional protection to the dune system. The Town has also prohibited sandbags. Following the completion of the Town's 1.7 mile beach nourishment project, the Town adopted standard minimizing the use of stairways and beach walkway structures in the nourished beach.
DCK17	Work with and support efforts by CAMA concerning beach re-nourishment and maintenance	Delete	Merged with action DCK16
DCK21	Develop an emergency communications network. Maintain a roster of business owners and homeowners associations.	Complete	
DCK22	Continue effective public information program to disseminate data on all hazards.	Delete	Merged with action DCK23
DCK24	Provide funding for stormwater improvements.	Delete	Merged with action DCK20
DCK25	Develop good construction materials information.	Delete	Merged with action DCK9
DCK26	Identify available property for open space.	Delete	Merged with action DCK13
DCK27	Develop and maintain the open space.	Delete	Merged with action DCK13
DCK28	Lobby the NC Board of Transportation and the NC Department of Transportation.	Delete	Merged with action DCK20
DCK30	Continue to identify who needs natural hazards information.	Delete	Merged with action DCK29
DCK31	Continue to develop/disseminate this information (dune protection, wind, erosion).	Delete	Merged with action DCK29
DCK32	Continue to research methods to get information to citizens.	Delete	Merged with action DCK29
DCK33	Develop/disseminate hurricane information to provide to tourists.	Delete	Merged with action DCK29
DCK34	Continue to disseminate the information through realtors and businesses.	Delete	Merged with action DCK29
DCK35	Develop and maintain a database of contact information for oceanfront and sound-front property owners where storm damage is likely to occur.	Delete	Merged with action DCK29
DCK36	Develop a method to post storm damage information on the Town website including property specific damage information.	Delete	Merged with action DCK29
Town of Kill Devil Hills			
KDH1	Continue to enforce the zoning ordinance and amend when necessary	Delete	Daily Function of the Department - Ongoing

2015 Action #	Description	2019 Status	Status Comments/Explanation
KDH2	Provide technical assistance to customers/citizens and continue to enforce current flood hazard ordinance	Delete	Daily Function of the Department - Ongoing
KDH4	Continue to implement the storm water management plan	Delete	Daily Function of the Department - Ongoing
KDH6	Monitor changes to the State Building Code and modify local regulations as necessary to minimize damage	Delete	Daily Function of the Department - Ongoing
KDH9	Continue enforcing the base flood elevation requirement of the Town's Flood Damage Prevention Ordinance	Delete	Daily Function of the Department - Ongoing
KDH13	Continue to support coastal barrier protection efforts by the State	Delete	Town does not control this.
KDH15	Support local CAMA officer with compliance efforts within AECs	Delete	Day to day but staff attend training to enforce State regulations.
KDH22	Work with NCDOT Strategic Office of Planning to enhance and construct infrastructure for evacuation	Delete	Town has no control over this task other than asking.
KDH27	Use beach nourishment as a storm protection measure and search for funding	Delete	Addressed through KDH11
KDH30	Technical Assistance - Continue to utilize technical assistance from state and federal agencies and private consultants to provide appropriate technical assistance to citizens and customers	Delete	Day to day
KDH32	Outreach Projects - Work with print, radio, and television media to effectuate outreach efforts in cooperation with Dare county and neighboring municipalities to educate the public on additional hazards identified in the risk assessment.	Delete	Covered by other outreach actions
KDH33	Develop updated floodplain map for public dissemination.	Delete	Covered by other outreach actions
Town of Kitty Hawk			
KHK1	Implement beach and dune renourishment projects	Completed	Renourishment on the horizon
KHK3	Revise the storm preparedness, response, and recovery plan	Delete	Done every year
KHK4	Educate homeowners on various mitigation techniques and resources available to them	Delete	Part of typical duties
KHK5	Provide homeowners with the resources necessary to individually hazard proof their own homes.	Delete	Part of typical duties
KHK6	Encourage homeowners to conduct an inventory of their assests to assist with damage claims.	Delete	Part of typical duties
KHK7	Encourage mitigation of Reptitive Loss Properties	Delete	Part of typical duties
KHK8	Educate citizens about dune vegetation	Delete	Part of typical outreach information
KHK11	Collect beach erosion data annually	Delete	Part of typical duties

2015 Action #	Description	2019 Status	Status Comments/Explanation
KHK13	Work w/ Dare Co. Control Group to prepare the provision of needed equipment and services to persons and businesses in need of assistance.	Delete	Part of typical recovery duties
KHK15	Define procedures and practices to maintain critical facilities and services to the maximum extent possible during and after a storm event.	Delete	Part of emergency preparedness, response and recovery plan.
KHK16	Implement beach and dune renourishment projects as funding becomes available.	Completed	Duplicate.
KHK17	Encourage NCDOT to elevate KH's roadway to Kitty Hawk Landing	Delete	Not necessarily an action.
KHK18	Maintain updated flood map information for citizens and customers	Delete	Part of every day duties
KHK19	Initiate outreach projects to inform the public on Town and County initiatives that will reduce hazard related losses of property and life.	Completed	Outreach material sent out twice a year, ongoing.
Town of Manteo			
MAN1	Making use of Dare County's flood plan, parcel data and aerial photographs in digital format	Delete	
MAN2	Maintains documents about flood insurance, flood protection, flood plain management, and the natural and beneficial functions of floodplains	Delete	These are required by CRS and already happen
MAN3	Assist local real estate agents with information handouts that will advise potential buyers to investigate the flood hazard for the property they are considering purchasing	Delete	This is a daily function of the Town's Planning Department
MAN6	Continue our policy controlling the development of critical public facilities in the 100-year flood plain in cases where viable alternatives exist.	Delete	These are required by CRS and already happen
MAN7	Continue to actively pursue state and federal grant funds to assist in the hazard mitigation recommendations included in the plan.	Delete	This is the whole purpose of having a well-intended plan
MAN13	The Town Planner will actively research and identify mitigation initiatives for grant applications and establish target dates for completion.	Delete	By way of this process we will identify mitigation initiatives and include them as action items in this plan
MAN14	Building inspector/Planner to enforce Town codified ordinances which include NFIP approved Flood Ordinance.	Delete	This is required to participate in NFIP and does not need to be listed as an action in the HMP
MAN15	The Town Planner to file for grant applications.	Delete	
MAN16	Building inspector/Planner to enforce Town codified ordinances which include NFIP approved Flood Ordinance.	Delete	Same as MAN14 - repeat

2015 Action #	Description	2019 Status	Status Comments/Explanation
MAN17	Continue to acquire and maintain back-up generators for lift stations and to supply electricity to critical Town facilities during periods of power outage.	Delete	Delete but combine with "and to supply electricity to critical Town facilities during periods of power outage" with existing MAN9
MAN18	Public Works Director to have regularly scheduled maintenance of stormwater system.	Delete	This is a requirement of CRS
Town of Nags Head			
NGH1	Continue participation in the National Flood Insurance Program. This includes updating town ordinances and flood maps as revisions and changes in FEMA and State requirements are made available.	Delete	Daily Duty
NGH2	Maintain the town's freeboard requirement and consider additional measures for flood damage reduction recognized by FEMA and the CRS program to reduce flood losses	Delete	Daily Duty
NGH3	Support the continued education and training of the Town's Building Inspectors and planning staff in inspections and mitigation activities related to flood. This shall include maintaining staff as certified floodplain managers.	Delete	Daily Duty
NGH4	Develop a program to identify businesses and material storage areas where significant amounts of toxic or hazardous products are stored which would be subject to flooding.	Completed	
NGH5	Continue to identify properties in repetitive loss areas and inform property owners in these areas of flood mitigation actions they can take to reduce flood losses.	Delete	Daily Duty
NGH7	Continue Town participation in the Community Rating System program and seek ways to improve the town's class six (6) rating.	Delete	Daily Duty
NGH8	Train town staff on the 2013 CRS Manual.	Delete	Daily Duty
NGH9	Following a severe storm or hurricane, evaluate reconstruction and repairs efforts for compliance with the adopted zoning ordinance, CAMA regulations, and all other applicable local, state and federal regulations.	Delete	Daily Duty
NGH10	Continue to maintain, enforce and evaluate the effectiveness of the comprehensive stormwater management ordinance adopted in 2014.	Completed	
NGH11	Evaluate methods to improve the effectiveness and property owner participation in the Town's Septic Health Program. This may include additional measures to monitor septic system operations with routine inspections.	Delete	Daily Duty

2015 Action #	Description	2019 Status	Status Comments/Explanation
NGH13	The Town shall take a proactive approach to educating citizens on the negative implications of using a septic system that has suffered storm damage. The Town will develop educational materials informing homeowners on the proper care of a system impacted by floodwaters.	Delete	Daily Duty
NGH15	Continue to pursue funding and permitting for the Town's beach nourishment program from Dare County and other levels of government	Delete	This action was combined with a newly revised action. 2019- With the adoption of the Fiscal Year 2018-2019 budget in June 2018, Nags Head's Board of Commissioners adopted the following tax rates: - The town-wide rate, levied on all properties in Nags Head, is $0.307, while an additional tax of $.175 (same rate as the previous year) has been levied in the Municipal Service District (MSD) which is comprised of all properties east of South Virginia Dare Trail and South Old Oregon Inlet Road. -One penny of revenue in the MSD generates $79,548. In addition to this revenue, Dare County has committed to at least half, or $12,573,356 million, of the estimated $25,546,711 million project cost. The contribution from the County, along with the funds from the Town's existing capital reserve fund, enables the Town to cover the debt service for the project with a lower MSD tax rate than what was established for the original project.
NGH17	Develop and implement a shoreline management plan to assist with stabilization of the beach between nourishment cycles. This may include a town program to provide planting and sand fencing based on a set of criteria for evaluating shoreline and dune conditions.	Delete	This action was combined with a newly revised action. The Town has been conducting shoreline management activities and establishing policies and strategies. However, there is not a long term plan in place at this time.
NGH19	Monitor and evaluate changing shoreline conditions on an annual basis as part of an overall shoreline management strategy.	Delete	This action was combined with a newly revised action. The Town is monitoring shoreline conditions on an annual basis as well as pre and post storm event.
NGH22	Maintain an emergency transportation route parallel to US 158. This may include Wrightsville Avenue, Memorial Avenue and even the Nags Head Woods Road as needed.	Completed	
NGH23	Comprehensively review and improve the Town's drainage system through the budget and CIP process.	Delete	The Town continue to review and improve the Town's drainage system through the budget and CIP process. Most recently, a stormwater master planning effort has been underway. The Town is devoting more staff time and funding for dedicated drainage and maintenance.

2015 Action #	Description	2019 Status	Status Comments/Explanation
NGH25	Continue to develop and implement a strategically prioritized list of stormwater projects as part of the Town's Capital Improvement Program.	Delete	The Town continue to review and improve the Town's drainage system through the budget and CIP process. Most recently, a stormwater master planning effort has been underway. The Town is devoting more staff time and funding for dedicated drainage and maintenance. The Town converted the Stormwater Utility into a dedicated 2 cent tax which is generating more revenue for stormwater projects and maintenance. Yearly it generates approximately $460,000.00.
NGH26	Collect necessary survey data and asset information to evaluate and program drainage and transportation projects as well as maintenance activities.	Delete	Daily Duty
NGH28	Perform annual maintenance of the Town's drainage system including vegetation removal, sediment removal, culvert cleaning and the re-establishment of drainage grade lines to improve drainage flow.	Delete	Daily Duty
NGH30	Incorporate drainage improvements into roadway, pathway, and related development projects in an effort to eliminate impediments, improve flow and enhance hydraulic capacity which can effectively result in an increased level of service and system efficiency. Examples include the continued development of the W. Side MultiUse Path, Holy Trinity Catholic Church, Flicker St. and Moongate Subdivision located in the Village of Nags Head.	Delete	Daily Duty
NGH32	Maintain public safety communications with Hospital, Colony Ridge staff and other special needs populations to assist with evacuation procedures prior to an event	Delete	Daily Duty
NGH33	Conduct a study to determine future impacts of recurring flooding associated with sea level rise on town infrastructure including streets, waterlines, electric power utilities, and wastewater systems.	Delete	This action was combined with a newly revised action. This project was initiated this as part of regional grant funded project. However, it was determined that the scale of tool proposed for the work was not appropriate for small communities like Nags Head. Staff is still seeking opportunities to complete this work.
NGH34	Continue to evaluate the need for and maintain fire breaks in wild land urban interface areas including residential communities adjacent to Nags Head Woods and the Cape Hatteras National Seashore as part of the ongoing evaluation of the Nags Head Urban Wild Fire Interface Plan.	Delete	This effort was combined into a new action. The Town is continuing to work with the Nature Conservancy and National Parks Services to evaluate and maintain fire breaks in these areas.

2015 Action #	Description	2019 Status	Status Comments/Explanation
NGH35	Plan and participate in controlled burn activities as necessary to strategically reduce fuel loads in Nags Head Woods and other areas to mitigate the impact of wild land urban interface fires.	Delete	This effort was combined into a new action. 2013- burned proximately 100 acres of marsh 2014- burned firebreak blocks proximately 8 acres 2015- maintained of firebreaks areas no burning 2016- wildfire event in marsh proximately 200 acres burned 2017- 11 acres burned in firebreak blocks 2018- burned proximately 100 acres of marsh.
NGH36	Continue the program to remove dead wood in critically fire prone areas.	Delete	This effort was combined into a new action. In addition, homeowners may access the fire prevention staff to determine an optimal way to create fire safe landscaping.
NGH39	Continue cooperation with the US Forest Service and Dare County for mutual aid fire protection.	Delete	Daily Duty
NGH40	Continue to inventory, recommend and implement improvements to fire hydrants, water distribution infrastructure, and other town infrastructure in support of fire planning efforts as part of the annual CIP process.	Delete	Daily Duty
NGH41	Update the Water Supply Shortage Plan and evaluate recommendations to implement water restrictions during periods of drought.	Completed	
NGH42	Continue to cooperate with Dare County on the development of additional water supply well facilities.	Delete	Daily Duty
NGH44	Continue to coordinate recovery and post storm response activities with Dare County, State and Federal Government on issues of mutual concern.	Delete	Daily Duty
NGH45	Continue to maintain and improve emergency operations and communications infrastructure including the EOC, backup EOC and mobile command center.	Delete	This effort was combined into a new action. Staff maintains and updates the Emergency Operation Plan that establishes the location of the EOC, back up EOC, and mobile command center.
NGH46	Following a severe storm the Town shall establish an information center staffed with Town, County, State and Federal employees who are available to assist property owners in the reentry and recovery process.	Delete	Daily Duty
NGH47	Following a declared emergency storm event, only those areas where damage assessment is complete and that have been declared relatively secure shall be open to the public.	Delete	Daily Duty

2015 Action #	Description	2019 Status	Status Comments/Explanation
NGH48	Identify and implement methods to streamline the damage assessment process to provide information to Dare County, the state, and any other agencies assisting the town with recovery efforts. This shall also include methods to expedite the availability of damage and condemnation information to Town staff and the public.	Delete	Daily Duty
NGH49	Pre-position debris removal and monitoring agreements on a yearly basis and seek pre-approved temporary disaster-debris management sites with NC DENR.	Delete	Daily Duty
NGH50	Obtain pre-storm authorization from the NC Department of Transportation (DOT) to clear DOT maintained roads after storm events.	Delete	Daily Duty
NGH51	Maintain mutual aid agreements and reevaluate as necessary to continue post-storm assistance with building inspections, damage assessment, utilities repair public facilities maintenance and additional public safety personnel. The Town shall continue participate in the Statewide Mutual Aid Compact.	Completed	
NGH52	Maintain a well trained staff level damage assessment team and staff knowledgeable in public disaster assistance policies.	Delete	Daily Duty
NGH53	Follow the Incident Command Structure and maintain a designated Emergency Management Coordinator and Deputy Emergency Management Coordinator.	Delete	This effort was combined into a new action. Staff continues to receive appropriate NIMS training to comply with the Incident Command Structure.
NGH54	Update emergency plans annually to include changes or modifications to critical facilities and include these in the Town's Emergency Operations Plan.	Delete	This effort was combined into a new action. The Emergency Operations Plan is updated annually to includes to critical facilities and other necessary updates.
NGH55	Continue to improve methods of providing public information both pre and post storm. This shall include an automated voice messaging system with storm damage and re-entry information, a Mayor's radio broadcast, email broadcasts, improved real-time website information with relevant local contact information, available information at traffic stops, and designation of a poststorm public information officer.	Completed	
NGH56	Communicate post-storm recovery and operations policies and procedures to residents and property owners prior to hurricane season. This includes providing this information through email the Local Government Access Channel, Town Website, and through social media.	Delete	Daily Duty

2015 Action #	Description	2019 Status	Status Comments/Explanation
NGH57	In its Emergency Operations Plan, the Town shall detail the process for distributing information internally and externally to the public before and after storms.	Delete	Daily Duty
NGH58	Continue the fire education program. This includes dissemination of information via newspaper articles, website or social media on fire protection, prescribed burns, fuel reduction activities and grants available from the State Division of Forestry for fire education.	Completed	
NGH59	The Town shall request authorization to extend any ocean outfall, which will be affected by any renourishment project.	Delete	The Town's CAMA permit for Beach Nourishment was modified to permit the extension of the outfalls to be affected by the widened beach. There is currently an extension underway and is being managed by NC DOT in South Nags Head.
NGH60	The Town will sponsor studies designed to determine the financial contribution the beach makes to the Outer Banks and the region.	Delete	Daily Duty
NGH61	Following a severe storm the Town shall consider purchasing land in damage prone areas.	Delete	This effort was combined with a newly revised action. The Town will consider purchasing land in damage prone areas as opportunities arise and on a case by case basis.
NGH62	The Town shall consider the applicability of requiring "V Zone" structural certification for structures in the 100year (A) flood zone.	Delete	Daily Duty
NGH63	The Town will actively work with FEMA and the State during the Statewide floodplain mapping project.	Delete	Daily Duty
NGH64	The Town shall develop regulations to require fuel tanks, including LP tanks to be adequately anchored to prevent flotation or submersion in the event of flooding.	Delete	Daily Duty
NGH65	During a hurricane the Town maintains a staff of essential personnel and elected officials within Town Hall, using the Town Hall building as the Emergency Operations Center of "EOC." When available the Town shall consider acquiring or building a command facility. Essential components may include a mobile radio transmission tower, satellite internet capability and enhanced telephone service.	Delete	Daily Duty
NGH66	Following a hurricane the Town shall establish an information center staffed with Town, State and Federal employees who are available to assist property owners in the reentry and recovery process.	Delete	Daily Duty

2015 Action #	Description	2019 Status	Status Comments/Explanation
NGH67	The Town leases space to mobile phone service providers on the Town's two water tanks. Cellular phone service provides an essential form of communication after a storm. The Town shall consider requiring cellular phone service providers to structurally design their tower mounted equipment to withstand greater wind loads than is required by the State building code.	Delete	Daily Duty
NGH68	The Town shall designate a Staff level Director and Deputy Director of Emergency Management.	Completed	
NGH69	The Town will develop regulations requiring a greater street standard (dimensional and construction) where it can be reasonably demonstrated that nearby streets may be destroyed by a storm or other natural event and that the proposed street may be required to accept greater amounts of traffic.	Delete	
NGH70	Prior to a flooding event, the Town's Street Department shall assemble the necessary traffic barricades and equipment to address flooding conditions noted in this plan.	Delete	Daily Duty. Carry forward into EOP.
NGH71	The Town shall identify alternative means of ingress and egress to the Outer Banks Hospital site and Colony Ridge Nursing Home facility.	Completed	Carry froward into EOP to ensure access is maintained.
NGH72	The Town shall extend the "Red Drum" outfall (most northern outfall) to efficiently drain the NCDOT conveyance system. NDOT is currently in design.	Completed	
NGH73	The Town Department of Public Works continually works to mitigate the impacts of flooding within identified areas of repetitive flooding within residential neighborhoods.	Delete	Daily Duty
NGH74	The Town has restructured the portion of the stormwater management ordinance as it relates to the use of fill. This approach is to treat runoff as the source and reduce the burden of Town drainage infrastructure from managing runoff originating from single-family development.	Delete	Daily Duty
NGH75	The Town shall continue aggressive monitoring of entry into condemned homes to prevent safety hazards.	Delete	Daily Duty
NGH76	Town shall create a policy that damaged Town infrastructure be built back to established Town standards only if it can be demonstrated that there is a reasonable and they have a reasonable expectation to survive future hazard events.	Delete	Daily Duty

2015 Action #	Description	2019 Status	Status Comments/Explanation
NGH77	Storm damage reconstruction shall reflect pre-storm conditions to the extent possible. Redevelopment shall comply with the Land Use Classification Map and the zoning ordinance.	Delete	Daily Duty
NGH78	As the amount of available vacant oceanfront land diminishes, the Town can expect redevelopment of existing sites. It is the Town's position that the existing oceanfront development regulations adequately address concerns such as building height and density, and that currently permitted uses adequately represent the desired uses for the oceanfront.	Delete	Daily Duty
NGH79	The Town shall require Hurricane Evacuation plans from sensitive, vulnerable or critical facilities which are likely to contain occupants who may not be sufficiently mobile to avoid death or injury during a flood or hurricane, including, but not limited to: hospitals, nursing homes, police stations and fire stations	Delete	Daily Duty
NGH80	The design of the proposed elementary school shall address flooding and hurricane resistant construction.	Completed	
NGH81	It is strongly urged that evacuation drills and tornado drills be conducted at the proposed elementary school.	Completed	
NGH84	The Town shall continue to acquire land for open space and recreational purposes.	Delete	This action was combined with a revised action. The Town continues to acquire land for open space and recreation purposes as need arise.
NGH85	The Town shall continue the program to remove dead wood in critically fire prone areas.	Delete	This action is a repeat
NGH86	The Town shall continue to review the water system throughout the Town for fire protection capabilities and prioritize capital improvements as necessary.	Delete	This action is a repeat
NGH87	With the installation of the new water tank, the Town shall install a new 12 inch water line from the Public Works facility to Barnes Street. This will increase fire flow to north end neighborhoods.	Completed	
NGH88	The Town shall research available data on underground storage tanks and leaking underground storage tanks.	Delete	Daily Duty
NGH89	The Town shall coordinate with Kill Devil Hills regarding fencing around their portion of the Fresh Pond.	Delete	Daily Duty
NGH90	The Town shall continue to evaluate the implementation of water restrictions during periods of drought.	Delete	Daily Duty

2015 Action #	Description	2019 Status	Status Comments/Explanation
NGH91	The Town of Nags Head shall continue to monitor develop and the installation of onsite septic systems with the Fresh Pond Area of Environmental Concern.	Delete	Daily Duty
NGH57 #2	Enter into an agreement prior to storm events to secure the helipad at the hospital for pre and post event needs.	Delete	Daily Duty. Carry forward into EOP.
NGH58 #2	Partner with the County, State and local agencies to develop a special needs registry list.	Delete	Daily Duty. Carry forward into EOP.
NGH59 #2	Investigate the development of a protocol and secure a location for the offsite storage (i.e. internet based storage or facility outside Town and County jurisdiction), back-up and recovery of important Town data.	Delete	Daily Duty. Carry forward into EOP.
NGH60 #2	Explore the feasibility of developing a Local Emergency Preparedness Committee (LEPC).	Delete	Daily Duty. Carry forward into EOP.
NGH61 #2	Development of a plan with procedures to address an active shooter/mass casualty situation within Town facilities.	Completed	
NGH62 #2	Research, evaluate and execute an internal emergency alert system.	Completed	
NGH65 #2	Partner with Dare County's Joint Information Section and other neighboring municipalities to establish a process and protocol for informing visitors, residents and special needs population of potential hazard events prior, during, and after events. This includes storm-related information as well as evacuation and re-entry. The policy should explore alternative non-traditional methods of information dissemination.	Delete	Daily Duty. Carry forward into EOP.
NGH69 #2	Proactively educate citizens on the negative implications of using a septic system that has suffered storm damage through development of education materials on the proper care of a system impacted by floodwaters.	Delete	This action is a repeat
Town of Southern Shores			
SOS6	Continue the periodic controlled burns of marshland to reduce wildfire fuels	Delete	Cannot occur since 2009 as a result of piers/docks being built over the marsh areas.
SOS7	Continue the testing of fire hydrants once a year and recording data	Delete	The Southern Shores Volunteer Fire Department continues to test fire hydrants once a year and records data.

2015 Action #	Description	2019 Status	Status Comments/Explanation
SOS8	Continue implementation of the Waterways and Beaches Ordinance	Delete	This is a duty. The Planning and Code Enforcement Department continues to implement the Waterways and Beaches Ordinance. The Town Community Resource Officer and contracted lifeguard service conduct patrols of the beach to ensure compliance. All development along Town waterways is approved following demonstration of compliance. The Town continues to send Notices of Violation for canal obstructions when warranted.
SOS17	Communicate with citizens about plans and the problems of providing services after a storm event	Delete	The Town utilizes a website, social media, and a bi- weekly newsletter to disseminate information regarding storm events and their effects.
SOS18	Develop a better flood warning system	Delete	The Town utilizes a website, social media, and a bi- weekly newsletter to disseminate information regarding storm events and their effects. Information from the State, FEMA, and Dare County Emergency Management can be shared with all three sources.
SOS20	Encourage food stores and pharmacies within the town to have alternative power supplies during and after storm events	Delete	Most, if not all, food stores and pharmacies in the Town have alternative power sources/supplies.
SOS24	Continue current public information outreach efforts regarding flooding	Delete	The Town utilizes a website, social media, and a bi-weekly newsletter to disseminate information regarding flooding. The Town also completes an annual outreach project containing flood information as part of the CRS program.
SOS25	Continue email and website services	Delete	Addressed in other actions
SOS26	Provide property owners and developers with information regarding the construction of FEMA "Safe Rooms" from the effects of tornadoes and severe storms	Delete	Addressed in other actions
SOS27	Develop guidelines for reconstruction efforts.	Complete	The Town's Emergency Operations Plan and Article XVI of the Town's Zoning Ordinance contain guidelines for reconstruction efforts.

3 Planning Area Profile

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

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

3.1 GEOGRAPHY AND ENVIRONMENT

The Outer Banks are located in the northeastern corner of the Coastal Plain of North Carolina. Much of its land area is barrier islands. Currituck County is located in the Virginia Beach-Norfolk-Newport News, VA-NC Metropolitan Statistical Area (MSA). Dare County is located in the Kill Devil Hills, NC MSA. Both MSAs are located in the larger Virginia Beach-Norfolk, VA-NC Combined Statistical Area. The Planning Area includes Currituck County unincorporated areas, Dare County unincorporated areas, Town of Duck, Town of Kill Devil Hills, Town of Kitty Hawk, Town of Manteo, Town of Nags Head, and the Town of Southern Shores. A location map is provided in Figure 3.1.

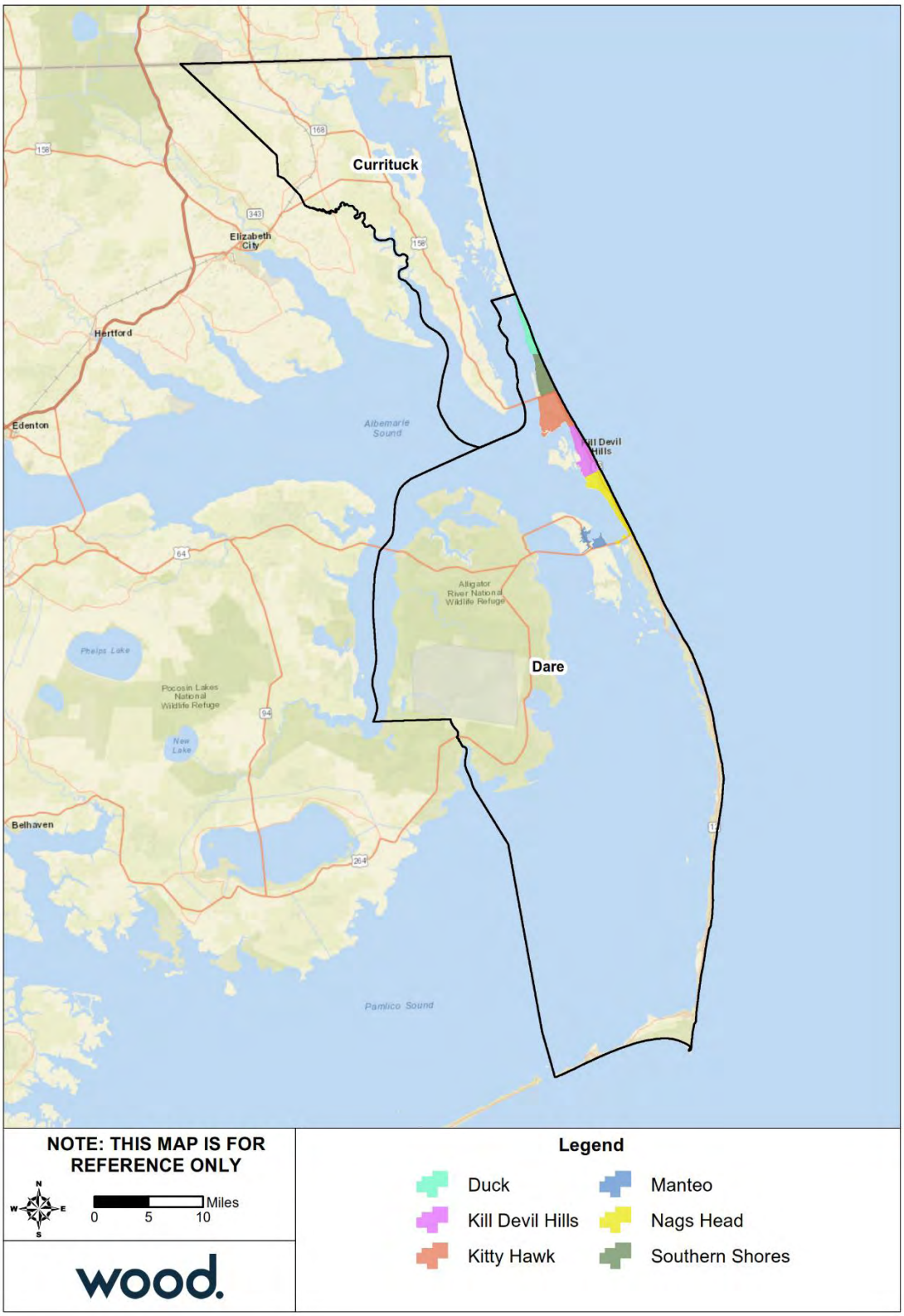
The planning area comprises a total land area of 645.14 square miles. The total land area of each participating jurisdiction is listed in Table 3.1.

Table 3.1 – Total Land Area of Participating Jurisdictions

Jurisdiction	Total Land Area
Currituck County	261.91
Unincorporated areas	261.91
Dare County	383.23
Town of Duck	2.42
Town of Kill Devil Hills	5.62
Town of Kitty Hawk	8.11
Town of Manteo	1.90
Town of Nags Head	6.59
Town of Southern Shores	3.95
Unincorporated areas	354.64
Region Total	645.14

Source: US Census Bureau, TIGERweb

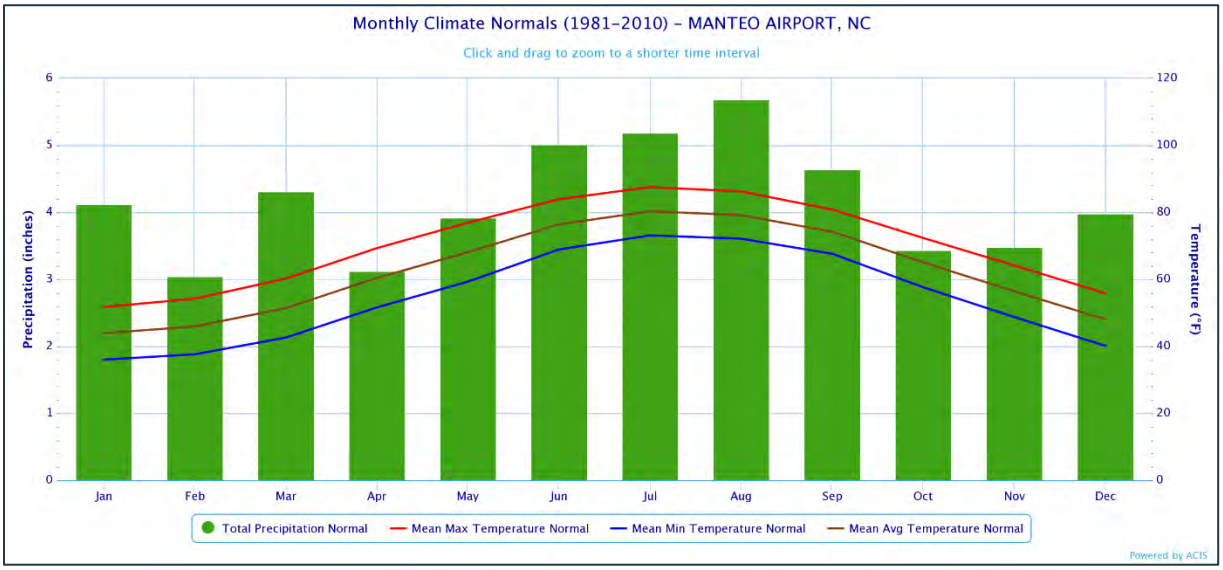
Figure 3.1 – Outer Banks Region and Participating Jurisdictions Location Map



Source: U.S. Census Bureau

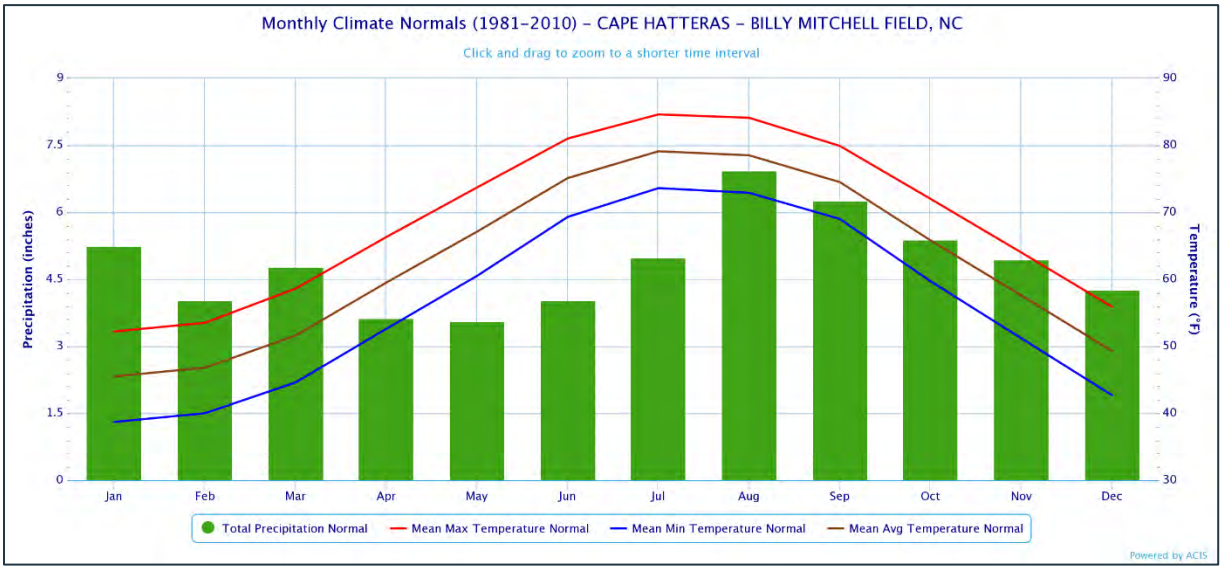
According to the Köppen climate classification system, the Outer Banks region has a humid subtropical climate characterized by mild winters and hot humid summers with significant precipitation even during the driest month. The region experiences an average annual high temperature of 69.5°F and an average annual low of 55.4°F. Average annual rainfall is approximately 54 inches and average annual snowfall is 1.3 inches. Figure 3.2 and Figure 3.3 show the average monthly precipitation for the Manteo Airport weather station and the Billy Mitchell Field weather station, respectively, which approximates temperature and precipitation of the Region. Note that the two graphs use different scales for both precipitation and temperature.

Figure 3.2 – Average Monthly Precipitation



Source: Northeast RCC CLIMOD 2.

Figure 3.3 – Average Monthly Precipitation



Source: Northeast RCC CLIMOD 2.

As shown in the map of HUC-8 watersheds in Figure 3.6, the majority of the Outer Banks region falls within the Albemarle watershed. The southern portion of the region, including Cape Hatteras, falls within the

Pamlico Sound watershed. The coastal region also sits on the Currituck, Albemarle, and Pamlico Sounds, and has many other water features including lakes, bays, and rivers.

Wetlands

According to data from the U.S. Fish and Wildlife Service's National Wetlands Inventory, there are approximately 10,825 acres of wetlands in the County. Wetlands areas are shown by type in Figure 3.7.

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

Parks, Preserve, and Conservation

The Outer Banks region is home to many parks, preserves, and other natural areas. There is one state park in the region – Jockey's Ridge State Park – located in Dare County. Also located in Dare County is the Cape Hatteras National Seashore. A number of other natural areas can be found within the two-county region which are detailed in Table 3.2 below.

Table 3.2 – Natural Areas, Outer Banks Region

County	Name
Dare County	Cape Hatteras National Seashore
	Jockey's Ridge State Park
	Run Hill State Natural Area
	Alligator River National Wildlife Refuge
	Pea Island National Wildlife Refuge
	Roanoke Island Marshes Dedicated Nature Preserve
	Kitty Hawk Woods Coastal Reserve
	Dare Game Land
Currituck County	Currituck National Wildlife Refuge
	Donald C. O'Brien Jr. Sanctuary and Audubon Center
	North River Game Land and Dedicated Wildlife Preserve

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. Dare County has 14 species that are listed with the U.S. Fish and Wildlife Services and Currituck County has 11, all of which are shared with Dare County. Table 3.3 below lists the species identified as threatened, endangered, or other classification and which county they can be found in.

Table 3.3 – Threatened and Endangered Species, Outer Banks Region

Group	Common Name	Scientific Name	Federal Status	County
Birds	Red-cockaded woodpecker	Picoides borealis	Endangered	C, D
Birds	Piping Plover	Charadrius melodus	Threatened	C, D
Birds	Roseate tern	Sterna dougallii dougallii	Endangered	D
Birds	Red knot	Calidris canutus rufa	Threatened	C, D
Flowering Plants	Seabeach amaranth	Amaranthus pumilus	Threatened	C, D
Mammals	West Indian Manatee	Trichechus manatus	Threatened	C, D

Group	Common Name	Scientific Name	Federal Status	County
Mammals	Red wolf	Canis rufus	Experimental Population, Non-Essential	D
Mammals	Northern Long-Eared Bat	Myotis septentrionalis	Threatened	C, D
Reptiles	American alligator	Alligator mississippiensis	Similarity of Appearance (Threatened)	D
Reptiles	Hawksbill sea turtle	Eretmochelys imbricata	Endangered	C, D
Reptiles	Leatherback sea turtle	Dermochelys coriacea	Endangered	C, D
Reptiles	Kemp's ridley sea turtle	Lepidochelys kempii	Endangered	C, D
Reptiles	Green sea turtle	Chelonia mydas	Threatened	C, D
Reptiles	Loggerhead sea turtle	Caretta caretta	Threatened	C, D

Source: U.S. Fish & Wildlife Service (https://ecos.fws.gov/ecp0/reports/species-by-current-range-county?fips=37183)
Key: C = Currituck County; D = Dare County

Land Cover

The National Oceanographic and Atmospheric Administration's (NOAA) Coastal Change Analysis Program (C-CAP) tracks land cover change for the coastal regions of the U.S. Understanding how land cover has changed and is continuing to change is important information for any hazard mitigation planning effort. The information below is meant to serve as a general overview of how Dare and Currituck counties have changed overtime. A detailed discussion of land cover change and development patterns can be found in each jurisdiction's annex.

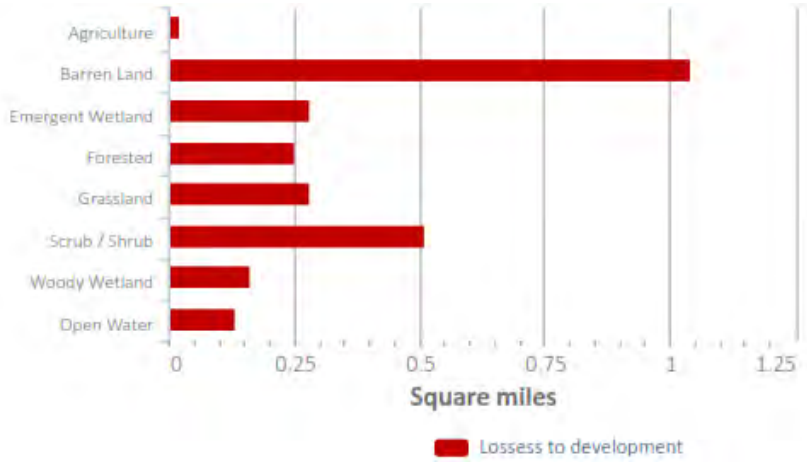
Dare County

Between 1996 to 2010, 12.65 square miles, or 0.81 percent of the land cover in the County has changed from one category to another. The largest net change in land is a loss of 2.51 square miles of barren land, or a 5.41 percent decrease. There was also a net increase of 1.64 square miles of open water. This could be due to land lost and converted to open water due to sea level change and might include the loss of wetlands.

The largest percent changes were increases in High Density Developed land and Open Space Developed land, with changes of 22.38 percent and 20.44 percent respectively. More development implies more impervious surfaces, which increases chances for flooding and decreases overall water quality. Still, at the time of this study, 98.5 percent of the county was non-developed land. Land lost to development tends to be permanent. Figure 3.4 illustrates the types of land that changed to developed during this time frame. Of the 2.61 square miles of development gained in the county between 1996 through 2010, over 1 mile was previously barren land.

As noted previously, wetlands are not only productive ecosystems, they play a vital role in protecting development and controlling erosion. While as of 2010, 22.35 percent of Dare County was wetlands, 2.59 square miles of wetlands were lost between 1996 through 2010. The majority of the lost wetland, over 2 square miles, changed to open water. The remainder changed to developed land, barren land, or agricultural land.

Figure 3.4 – Land Type Lost to Development, Dare County



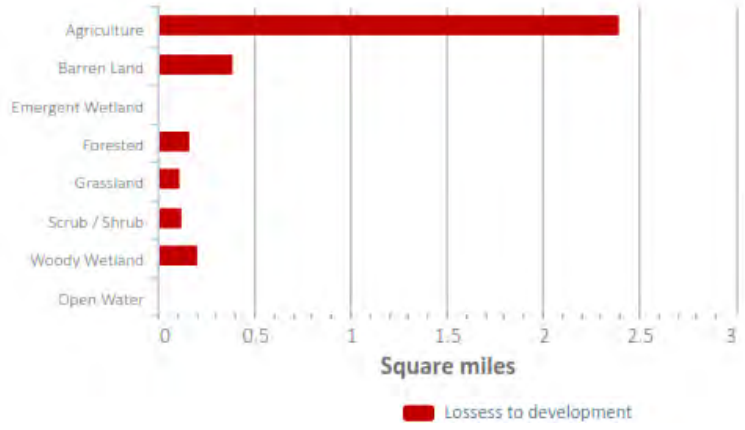
Source: NOAA C-CAP Atlas

Currituck County

In Currituck County, 3.16 percent of the land cover in the county changed between 1996-2010. The largest net change in land is a loss of 2.65 square miles of agricultural land, or a 3.33 percent change.

During this time frame, the county experienced high rates of growth in all types of developed land. The county saw a 39.3 percent increase in High Intensity Developed land, a 12.03 percent increase in Low Intensity Developed land, and a 46.54 increase in Open Space Developed land. In total, this led to an increase of 3.35 square miles of developed land and 0.74 square miles of impervious surfaces. However, as of 2010, 97.8 percent of the county remained non-developed. Figure 3.5 illustrates the types of land that changed to developed during this time frame. Of the development gained in the county between 1996 through 2010, almost 2.5 square miles were previously agricultural land.

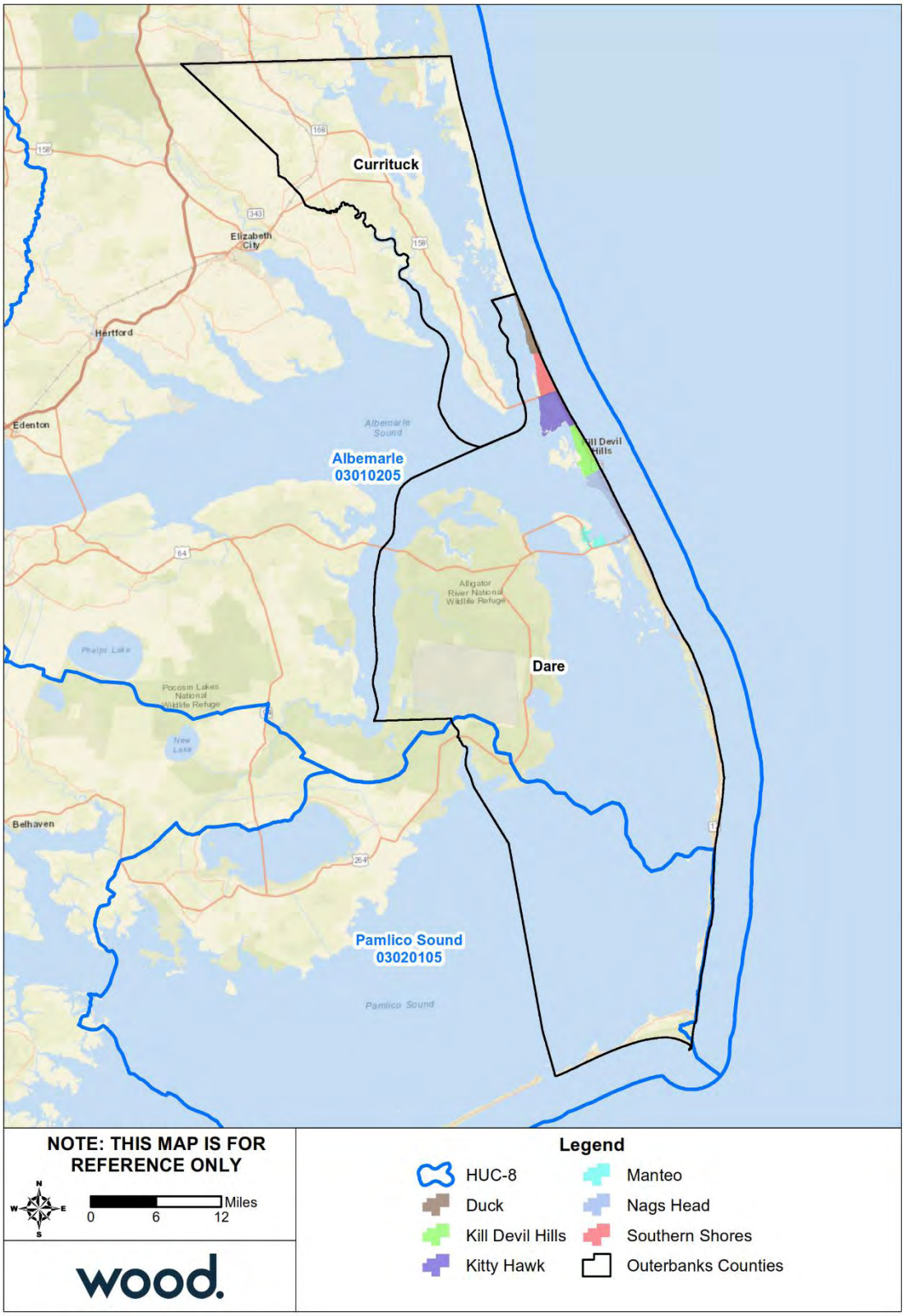
Figure 3.5 – Land Type Lost to Development, Currituck County



Source: NOAA C-CAP Atlas

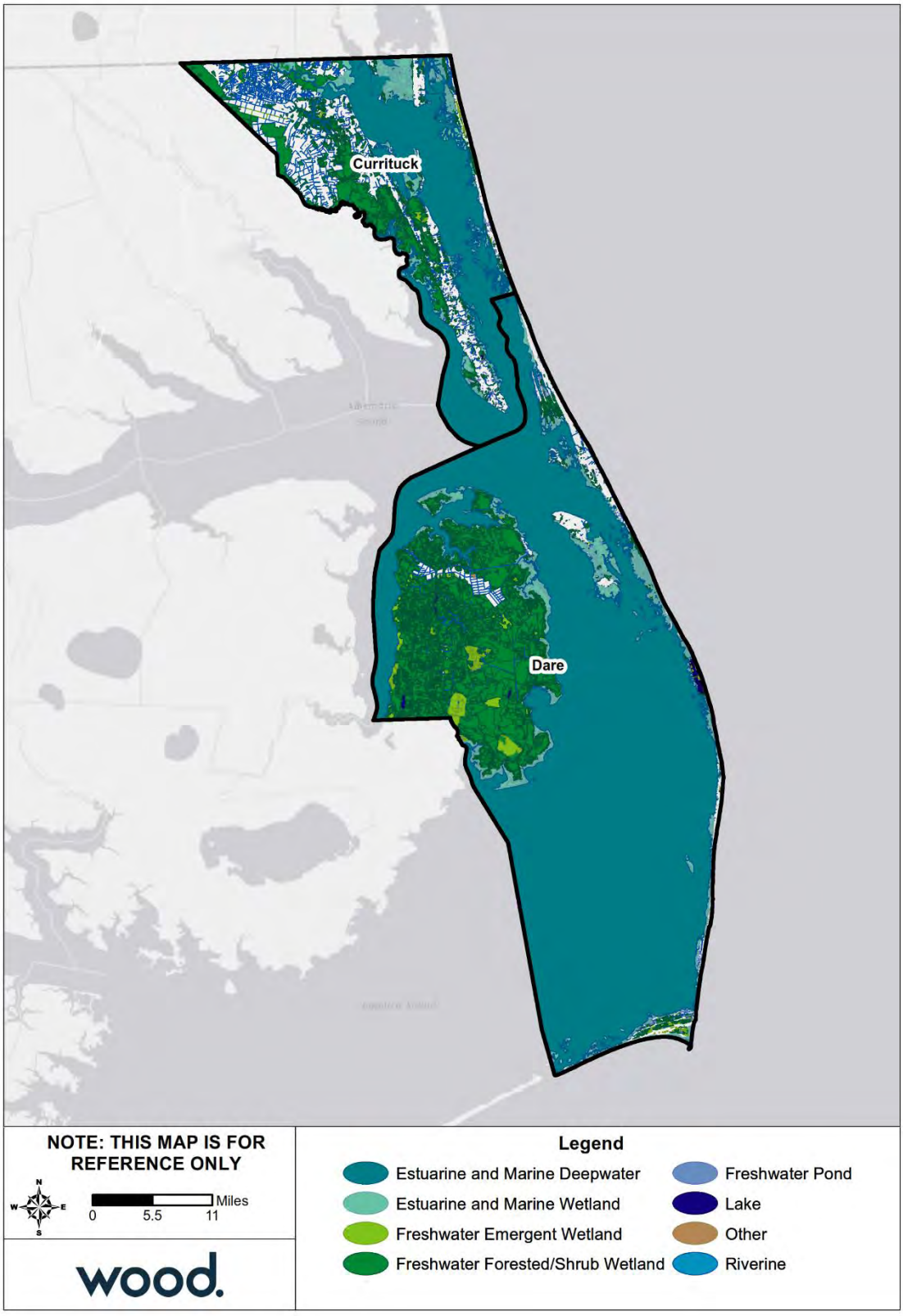
As noted previously, wetlands are not only productive ecosystems, they play a vital role in protecting development and controlling erosion. While as of 2010, 26.21 percent of Currituck County was wetlands, 0.81 square miles of wetlands were lost between 1996-2010. The majority of the lost wetland, over .5 square miles, changed to open water or agricultural land.

Figure 3.6 – HUC-8 Drainage Basins



Source: USDA Natural Resources Conservation Service

Figure 3.7 – Wetlands by Type in the Outer Banks Region



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

3.2 POPULATION AND DEMOGRAPHICS

Currituck and Dare Counties and the participating jurisdictions have experienced moderate population growth over the last several decades. From 2000 to 2017, the Region's total population grew by 26 percent, which equates to an average annual growth rate of about 1.5 percent. Overall population density in the Region increased from 89.1 persons per square mile in 2010 to 94.0 persons per square mile in 2017. All jurisdictions experienced growth between 2010 and 2017, with an average population increase across the Region of 5.6 percent. The Town of Duck grew by more than 40 percent, and all other towns or unincorporated areas grew between 3.5 to 7.2 percent. Table 3.4 provides population counts from 2000, 2010, and 2017 for each of the participating jurisdictions. Figure 3.8 on the following page shows 2017 population density by census tract in persons per square mile.

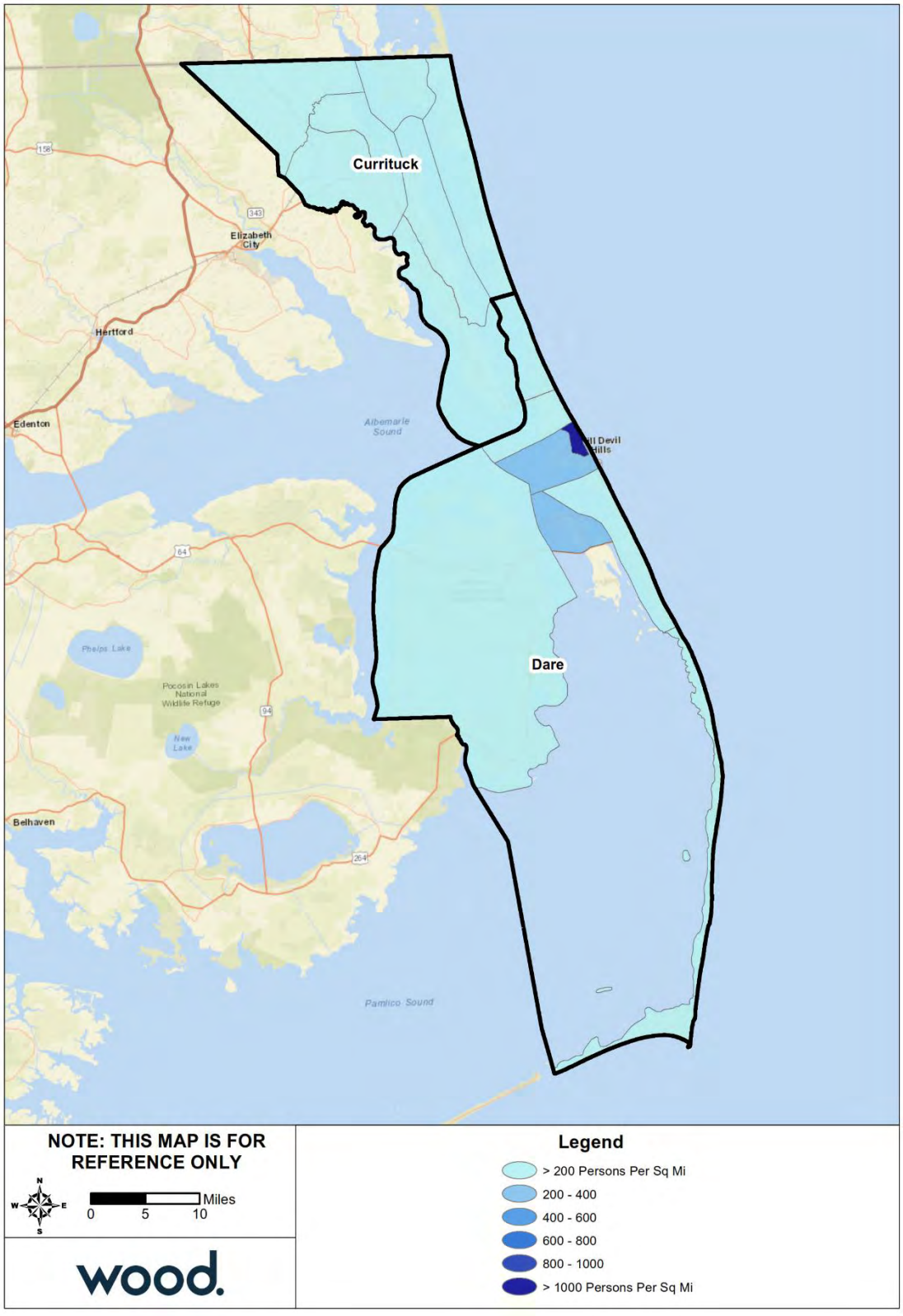
Table 3.4 – Outer Banks Region Population Counts

Jurisdiction	2000 Census Population	2010 Census Population	2017 ACS Population Estimate	Total Change 2010-2017	% Change 2010-2017
Currituck County					
Unincorporated Currituck County	18,190	23,547	25,247	1,700	7.22%
Dare County					
Unincorporated Dare County	15,126	16,691	17,312	621	3.72%
Town of Duck	--	369	531	162	43.90%
Town of Kill Devil Hills	5,897	6,683	6,978	295	4.41%
Town of Kitty Hawk	2,991	3,272	3,422	150	4.58%
Town of Manteo	1,052	1,434	1,485	51	3.56%
Town of Nags Head	2,700	2,757	2,855	98	3.55%
Town of Southern Shores	2,201	2,714	2,829	115	4.24%
Subtotal Dare	**29,967**	**33,920**	**35,412**	**1,492**	**4.40%**
Region Total	**48,157**	**57,467**	**60,659**	**3,192**	**5.55%**

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2017 Annual Estimates
Note: Population for the Town of Duck was not available for the 2000 census as it was incorporated in 2002.

As the Outer Banks is a popular vacation destination, the population of the region fluctuates at any given time, depending on the season. Dare County alone estimates its daily population during peak summer months—June, July, and August—increases by anywhere between 225,000 and 300,000 additional residents. Additional seasonal population can be expected in Currituck County as well. A large influx in population can cause increased traffic. Additionally, visitors are not necessarily aware of the hazards that impact the region or the emergency procedures in place in the event of such hazards. Details about how this influx of population impacts housing and economics in the region are discussed in subsequent sections.

Figure 3.8 – Population Density, 2017



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

According to 2017 American Community Survey 5-Year Estimates, the median age in the Outer Banks Region was 44.6, which is older than the median age of the State of North Carolina (38.4) and of the United States (37.8). Of the population aged 25 years and over, 90.9 percent have a high school degree or higher and 27 percent have a bachelor's degree or higher. Approximately 5.4 percent of the Region's residents speak a language other than English at home. This information is further detailed by county in Table 3.5 The racial characteristics of the participating jurisdictions are presented in Table 3.6. Generally, white persons make up the majority of the population in the region, accounting for approximately 91 percent of the population in the Outer Banks region overall.

Table 3.5 – Outer Banks Region Demographic Summary, 2017

County	Currituck	Dare
Median Age	42.9	46.0
Educational Attainment		
High school graduate or higher[1]	87.6%	93.2%
Bachelor's degree or higher[1]	22.9%	29.8%
Language Spoken at Home		
Speak language other than English	3.6%	6.6%
Speak English less than "very well"[2]	28.5%	40.1%

Source: US Census Bureau, American Community Survey 2013-2017 5-Year Estimates; [1]Of the population aged 25 and older; [2]Of the population that speaks a language other than English at home

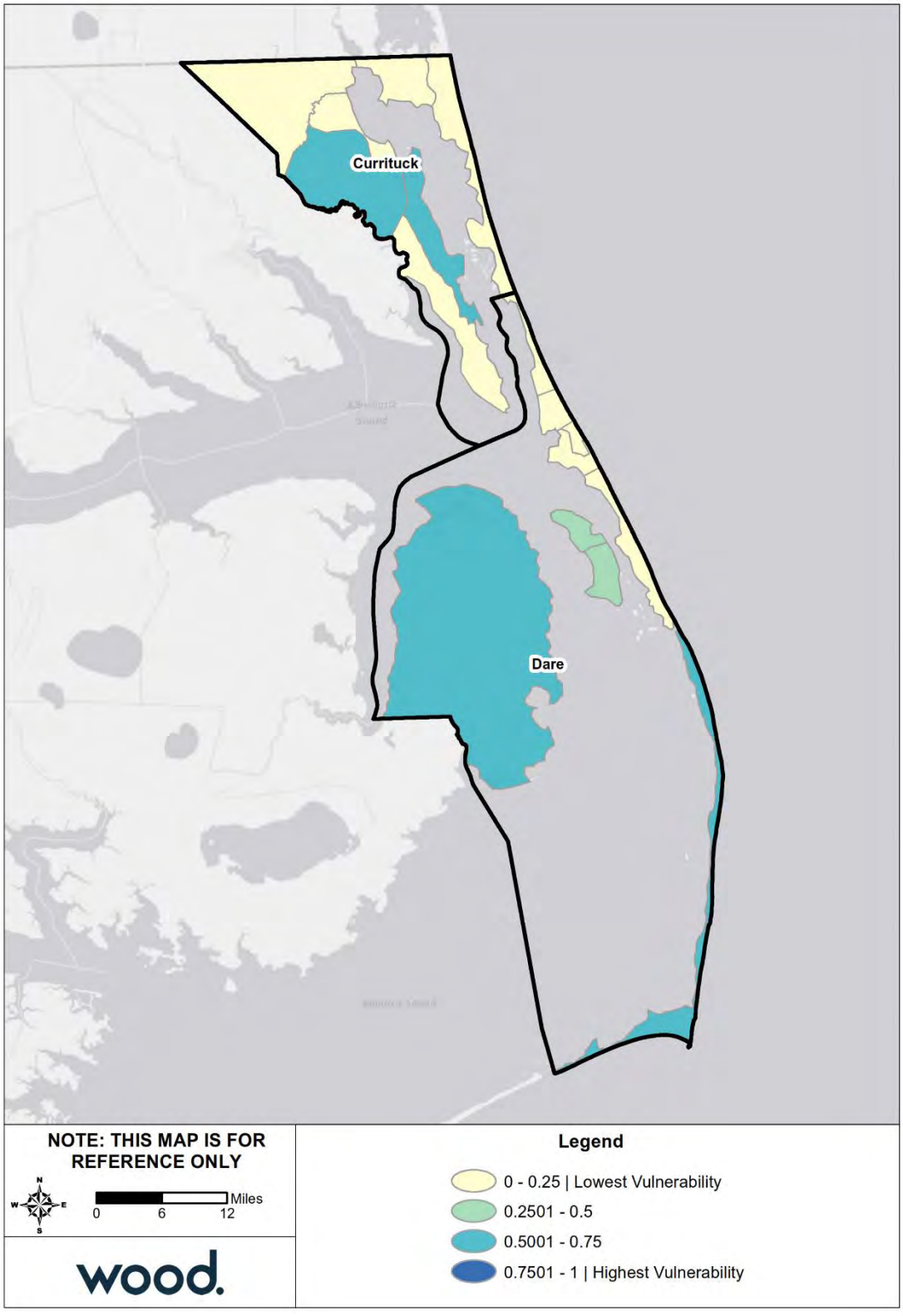
Table 3.6 – Racial Demographics of Outer Banks Region Jurisdictions, 2017

Jurisdiction	White, %	Black, %	Asian, %	Other Race, %	Two or More Races, %	Persons of Hispanic or Latino Origin*, %
Currituck County						
Currituck County	90.2	5.4	0.4	1.2	2.7	3.6
Dare County						
Unincorporated Dare County	97.2	1.3	0.6	3.1	2.4	6.2
Town of Duck	98.1	0.9	0.8	0.0	0.2	1.3
Town of Kill Devil Hills	90.4	1.8	0.7	5.0	2.1	12.2
Town of Kitty Hawk	97.8	0.9	0.5	0.0	0.8	1.3
Town of Manteo	92.4	2.2	0.5	4.0	0.9	5.6
Town of Nags Head	92.1	1.2	0.8	2.1	3.8	1.6
Town of Southern Shores	93.6	0.0	0.0	2.6	3.9	1.6
Dare County Total	*91.6*	*2.1*	*0.6*	*3.0*	*2.7*	*7.1*
Region Total	**91.0**	**3.5**	**0.5**	**2.2**	**2.7**	**5.7**

Source: US Census Bureau, American Community Survey 2013-2017 5-Year Estimates
*Persons of Hispanic origin may be of any race, so also are included in applicable race categories

Figure 3.9 displays social vulnerability information for the Outer Banks Region by census tract according to 2016 data and analysis by the Centers for Disease Control and Prevention (CDC). The CDC's Social Vulnerability Index (SVI) indicates the relative vulnerability within census tracts based on 15 social factors: poverty, unemployment, income, education, age, disability, household composition, minority status, language, housing type, and transportation access. Higher social vulnerability is an indicator that a community may be limited in its ability to respond to and recover from hazard events. Therefore, using this SVI information can help the Region and jurisdictions to prioritize pre-disaster aid, allocate emergency preparedness and response resources, and plan for the provision of recovery support.

Figure 3.9 – Social Vulnerability Index by Census Tract, 2016



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

3.3 HISTORIC PROPERTIES

As of July 7, 2019, Currituck County had 13 listings on the National Register of Historic Places and Dare County had 32, detailed in Table 3.7. Of the 45 total listings in the region, six listings are Historic Districts. Listing on the National Register signifies that these structures and districts have been determined to be worthy of preservation for their historical or cultural values. In addition to these properties, there are three National Historic Landmarks in the Region; all three are located in Dare County.

Table 3.7 – National Register of Historic Places Listings in the Outer Banks Region

Ref#	Property Name	Status Date	Category	City
Currituck County				
09001104	Jarvisburg Colored School	12/11/2009	Building	Jarvisburg
12001156	Coinjock Colored School	1/9/2013	Building	Coinjock
15000238	Flyway Club	5/12/2015	Building	Knotts Island
72000959	Twin Houses	4/13/1972	Building	Shawboro
73001333	Currituck Beach Lighthouse	10/15/1973	Structure	Corolla
79001697	Currituck County Courthouse And Jail	5/10/1979	Building	Currituck
80002816	Currituck Shooting Club	5/28/1980	Building	Corolla
80002817	Whalehead Club	4/16/1980	Building	Corolla
80002818	Baum Site	12/8/1980	Site	Poplar Branch
80002819	Culong	2/1/1980	Building	Shawboro
80002820	Shaw House	4/17/1980	Building	Shawboro
98001210	Grandy School, (Former)	9/25/1998	Building	Grandy
99000911	Currituck Beach Lighthouse Complex (Boundary Increase)	1/12/2000	District	Corolla
Dare County				
01000558	Ballance, Ellsworth and Lovie, House	5/25/2001	Building	Hatteras
03000339	Daniels, John T., House	5/1/2003	Building	Manteo
03000607	Bodie Island Light Station	7/4/2003	District	Nags Head
04001389	Midgett, Mattie, Store and House	12/23/2004	Building	Nags Head
04001392	Sea Foam Motel	12/23/2004	Building	Nags Head
05001544	Markham--Albertson--Stinson Cottage	1/13/2006	Building	Nags Head
09000847	Midgett, Rasmus, House	10/21/2009	Building	Waves
13000780	E.M. CLARK (shipwreck and remains)	9/25/2013	Site	Cape Hatteras
13000781	DIXIE ARROW (shipwreck and remains)	9/25/2013	Site	Ocracoke
13000782	EMPIRE GEM (shipwreck and remains)	9/25/2013	Site	Cape Hatteras
15000541	LIGHT VESSEL 71 (shipwreck)	8/19/2015	Site	Buxton
15000805	U-85 (submarine) shipwreck and remains	11/12/2015	Site	Nags Head
15000806	U-701 (submarine) shipwreck and remains	11/12/2015	Site	Buxton
15000864	U-576 and BLUEFIELDS (shipwrecks and remains)	12/8/2015	Site	Hatteras
66000071	Wright Brothers National Memorial	10/15/1966	District	Kill Devil Hills
66000102	Fort Raleigh National Historic Site	10/15/1966	Site	Manteo
74002299	USS MONITOR	10/11/1974	Site	Cape Hatteras
75001253	Oregon Inlet Station	12/23/1975	Building	Rodanthe
76000164	Chicamacomico Life Saving Station	12/12/1976	Building	Rodanthe
77000997	Nags Head Beach Cottages Historic District	8/19/1977	District	Nags Head
78000266	Cape Hatteras Light Station	3/29/1978	District	Buxton
78000268	Hatteras Weather Bureau Station	2/17/1978	Building	Hatteras

Ref#	Property Name	Status Date	Category	City
78001942	Caffeys Inlet Lifesaving Station	1/30/1978	Building	Duck
79000251	Bodie Island Lifesaving/Coast Guard Station	2/9/1979	District	Nags Head
82001295	Meekins, Thedore S., House	12/17/1982	Building	Manteo
82004798	Creef, George Washington, House	8/12/1982	Building	Manteo
84000073	Kitty Hawk Life-Saving Station	10/11/1984	Building	Kitty Hawk
91001625	USS HURON	11/15/1991	Structure	Nags Head
92001835	First Colony Inn	1/21/1993	Building	Nags Head
93000997	Salvo Post Office	9/23/1993	Building	Salvo
99000062	Sam's Diner	1/27/1999	Building	Kill Devil Hills
100002802	C.S.S. CURLEW (side-wheel steamer)	8/31/2018	Structure	Mann's Harbor

Source: National Parks Service, National Register of Historic Places, October 2018

3.4 HOUSING

According to the 2013-2017 ACS 5-Year Estimates, there are 60,659 housing units in the Outer Banks Region, of which 50.5 percent are occupied. Approximately 25.5% 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. Higher rates of home ownership in some jurisdictions, including Duck, Kitty Hawk, Nags Head, and Southern Shores may indicate that more residents in these areas are able to implement certain types of mitigation in their homes.

Median home value in the Outer Banks Region is $263,506. Of the Region's owner-occupied housing units, 67.0 percent have a mortgage. More than 35 percent of householders moved into their current homes since the year 2010, and another 34 percent moved in between 2000 and 2009, which indicates the growth the area has experienced. Householders of 3.7 percent of occupied housing units have no vehicle available to them; these residents may have difficulty in the event of an evacuation.

Over 80 percent of housing units in the Outer banks Region are detached single family homes, with an additional 1.1 percent attached single family homes. Approximately 8.3 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.

Approximately 50 percent of all housing units in the region were built after 1990, and 22.9 percent were built between 1980 and 1989. While this housing stock is not particularly new, it is not particularly old, either. Age can indicate the potential vulnerability of a structure to certain hazards. For example, Currituck County first entered the National Flood Insurance Program in 1984 and Dare County in 1978. Therefore, based on housing age estimates up to 28.4 percent of housing in Currituck County and 27.4 percent of housing in Dare County was built before any floodplain development restrictions were required. Several jurisdictions did not enter the NFIP until years later; therefore, the actual percent of housing built without floodplain development restrictions may be higher.

The seasonal nature of the region is particularly evident in the housing market. With a population of 35,412 and 34,290 housing units, Dare County is the only county in the state of North Carolina to have approximately the same number of housing units as people. Currituck County has approximately 1.6 people per housing unit. This is still lower than the state as a whole, which has approximately 2.2 people per housing unit.

Of all the housing units in the Outer Banks region, 49.6 are vacant. Of these vacant units, 73.8 percent are for seasonal, recreational, or occasional use. Per the U.S. Census Bureau, these units are used or intended for use only in certain seasons throughout the year. Such units include those used for summer recreation such as beach cottages and can also include timeshares. Both the Town of Duck and the Town of Nags Head have exceptionally high numbers of seasonal units, with 68.8 percent of housing units in Duck and 59.4 percent of housing units in Nags Head categorized as seasonal. Table 3.8 and Table 3.9 provide further detail on housing in the region.

Table 3.8 – Housing Characteristics, Outer Banks, 2010 and 2017

Jurisdiction	Housing Units (2010)	Housing Units (2017)	Housing Units Percent Change (2010-2017)	Owner-Occupied, Percent (2017)[1]	Vacant Units, Percent (2017)[2]	Median Home Value (2017)
Currituck County						
Unincorporated Currituck County	14,453	15,326	6.0%	82.5	36.3	$244,500
Dare County						
Unincorporated Dare County	12,351	13,052	5.7%	70.2	43.7	--
Town of Duck	2,722	2,906	6.8%	81.0	90.6	$542,300
Town of Kill Devil Hills	6,617	6,433	-2.8%	58.5	54.3	$240,200
Town of Kitty Hawk	3,196	3,227	1.0%	76.7	52.5	$321,300
Town of Manteo	1,353	1,416	4.7%	53.8	50.2	$310,800
Town of Nags Head	4,884	4,882	0.0%	66.2	73.6	$319,300
Town of Southern Shores	2,369	2,374	0.2%	93.0	50.3	$446,500
Dare County	**33,492**	**34,290**	**2.4%**	**69.4**	**55.5**	**$285,000**
Region Total	**47,945**	**49,616**	**3.5%**	**74.5**	**49.6**	**$285,000**

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2013-2017 5-Year Estimates
Note: 1) Owner-Occupied reported as percent of occupied units; 2) vacant-unit reported as a percent of the total number of housing units.

Table 3.9 – Season Housing Units, Outer Banks, 2017

Jurisdiction	Seasonal Units	Percent of All Units	Percent of Vacant Units
Currituck County			
Currituck County	3,977	25.9	71.5
Dare County			
Unincorporated Dare County	3,808	29.2	29.2
Town of Duck	1,998	68.8	75.9
Town of Kill Devil Hills	2,545	39.6	72.8
Town of Kitty Hawk	1,381	42.8	81.6
Town of Manteo	593	41.9	83.4
Town of Nags Head	2,899	59.4	80.7
Town of Southern Shores	930	39.2	77.4
Dare County Total	**14,154**	**41.3**	**74.4**
Region Total	**18,131**	**36.5**	**73.8**

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

3.5 INFRASTRUCTURE

3.5.1 Transportation

Many roadways run through the Outer Banks Region, however no major interstates serve the region. Currituck County is served primarily by North Carolina Highway 168, which connects the county to Virginia (where it is State Route 168) and U.S. Route 158, which traverses the county from east to west, ending at Whalebone Junction in Nags Head. This is the primary route used to access the Outer Banks from the North. Dare County is served by U.S. Route 64, another east-west highway that connects mainland Dare County to Roanoke Island and further to the Outer Banks barrier island. This is the primary highway used to access the Outer Banks barrier island from the south or west. At Whalebone Junction, it meets Route 158. Once on the barrier island, the primary route is North Carolina Highway 12, which runs north-south from northern Currituck County to Hatteras.

Two ferry lines serve the region. One runs from mainland Currituck to Knotts Island but does not continue to the barrier island. Another runs, as an extension of Highway 12, between Ocracoke and Hatteras. However, to get to or from the mainland to Ocracoke, another ferry is necessary.

The Dare County Tourism Authority recommends flying to the Norfolk International Airport or Raleigh/Durham Airport to access the Outer Banks. There are two airports within the region, the Currituck Regional Airport, which only offers small, seasonal flights, and the Dare County Airport, which only hosts cargo flights.

Both Currituck and Dare Counties have demand responsive public transit services. Currituck County's is provided by the Inter-County Public Transportation Authority (ICPTA) which also serves Pasquotank, Perquimans, Camden, and Chowan Counties, and Dare County's service is provided by the Dare County Transportation System. Both systems require two days' notice to schedule transportation and only run Monday through Friday. They are open to anyone and charge a fare of 3 to 4 dollars per one-way trip. Additionally, these systems provide "out of county" transportation to large medical centers.

3.5.2 Utilities

Electric power for the region is provided by various providers, including Dominion NC Power, Albemarle Electric Membership Corporation, Cape Hatteras Electric, and Tideland Electric. Water is provided by the individual counties. In Currituck County, natural gas is provided by Piedmont Natural Gas.

3.6 CURRENT AND FUTURE LAND USE

In Dare County, current and future land use is predominantly regulated at the jurisdictional level. The Dare County Planning Department is responsible for land-use planning in the unincorporated areas of the County. In addition to traditional land use planning, they must operate under the provisions of the NC Coastal Area Management Act. Due to the length of Dare County, all maps in the plan are divided by region. Figure 3.10 below shows the Hatteras region with general classifications for future land use in the county. The current plan was adopted in December 2010 and as of July 2019 the County was in the process of updating the Land Use Plan. Further information on land use planning in Dare County is available on the County's website. Additional information on each individual jurisdiction's land use can be found in the jurisdictional annexes.

In Currituck County, land use, environment, and development regulations fall under the umbrella of the Planning and Zoning Division. In addition to creating and updating the Land Use Plan, the division is responsible for enforcing the Unified Development Ordinance. The County's most recent plan was adopted in November 2006 and amended twice in August 2008 and April 2009. As of July 2019, the county was undertaking the process of updating the current land use plan. Details on the new plan can be found

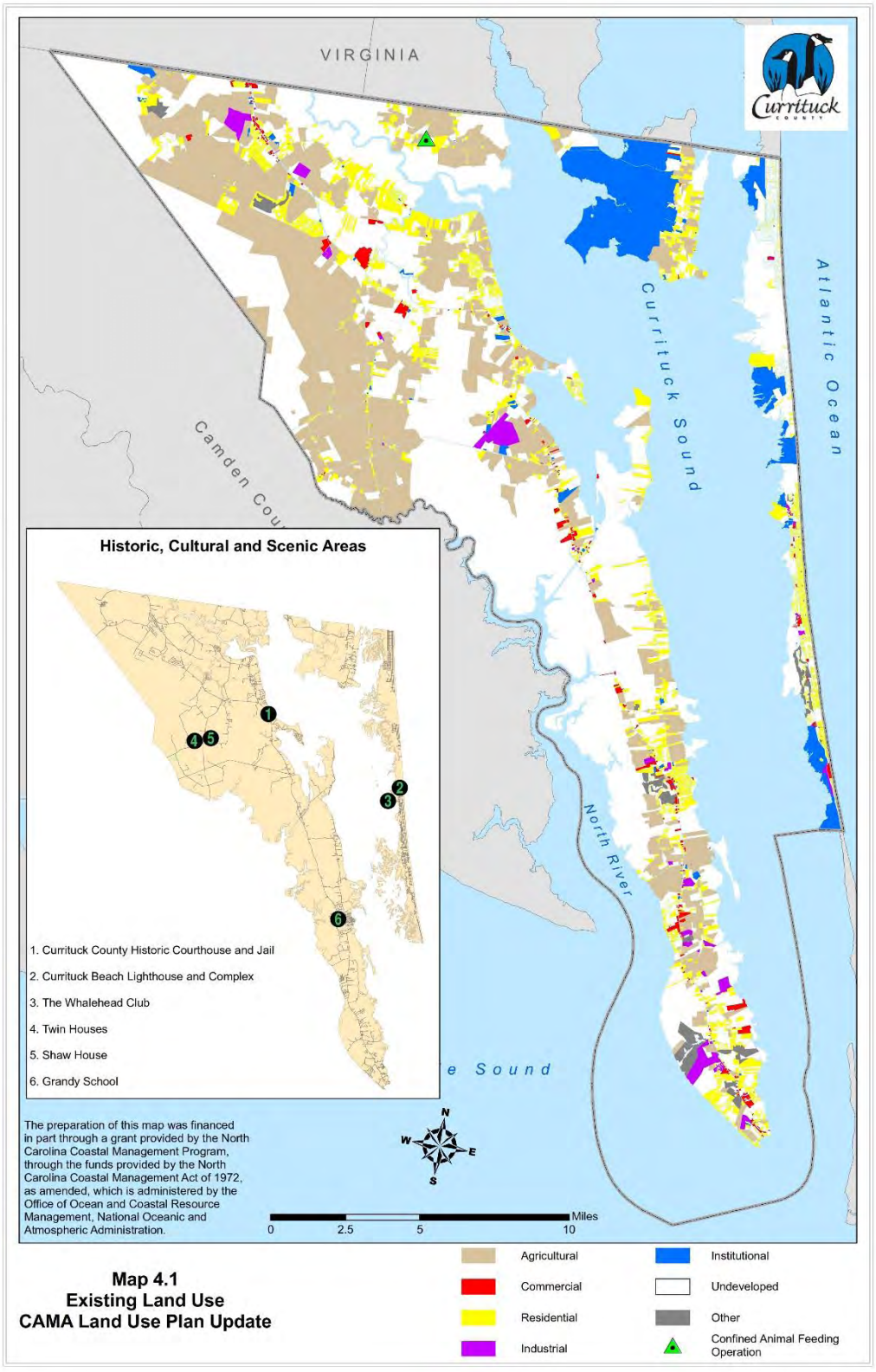
on the "Imagine Currituck" website and in the Currituck County annex. As of the 2006 plan, only 18 percent of the County's total acreage was developed. 29 percent of the county was agriculture, and 53 percent was undeveloped. Of the developed acres, 47 percent was residential. Figure 3.11 on the following page shows the existing land use in the County from the 2006 plan.

Figure 3.10 – Dare County Future Land Use Classification, Hatteras



Source: Dare County Planning

Figure 3.11 – Existing Land Use, Currituck County



Source: Currituck County 2006 Land Use Plan

3.7 EMPLOYMENT AND INDUSTRY

The Outer Banks region is best known as a coastal tourist destination. Every year the region sees an influx of visitors during the summer months from across the state and the country. Between 2014 through 2018, Dare County averaged over $455 million in gross occupancy receipts (as reported to Dare County for occupancy tax purposes) per year. Over 68 percent of the tourism over the five-year span occurred between the months of June through August, highlighting not only the influx of people, but the increase in tax revenue related to lodging and sales.

VisitNC estimates that in 2017, visitors to Currituck County spent $230.9 million, an increase of 2.77 percent from the previous year, and visitors to Dare County spent $1.13 billion, an increase of 2.75 percent from the previous year. The region's reliance on tourism could have serious negative consequences in the case of a hazardous event that damages or destroys the region's beaches and other major tourist attractions.

3.7.1 Wages and Employment

Per the 2013-2017 American Community Survey 5-Year Estimates, the median household income for the Outer Banks Region was $58,634, which is over 16 percent higher than the state's median household income ($50,320). However, approximately 9% of the population is considered to be living below the poverty level. Moreover, 10.7 percent of people under 18 years of age are living below the poverty level.

Table 3.10 shows employment statistics for all participating jurisdictions. Table 3.11 shows occupation statistics for all participating jurisdictions.

Table 3.10 – Employment Statistics for Outer Banks Region, 2017

Jurisdiction	Population in Labor Force	Percent Employed* (%)	Percent Unemployed* (%)	Percent Not in Labor Force* (%)	Unemployment Rate (%)
Currituck County	**12,960**	**59.9**	**3.0**	**36.0**	**4.8**
Dare County	**19,503**	**63.0**	**3.5**	**33.3**	**5.2**
Duck	209	39.6	2.6	57.8	6.2
Kill Devil Hills	4,288	70.7	5.3	24.1	7.0
Kitty Hawk	2,167	68.7	4.5	25.6	6.1
Manteo	733	54.7	4.0	40.8	6.9
Nags Head	1,640	64.4	1.7	33.9	2.6
Southern Shores	1,365	54.3	1.0	44.3	1.9
Region Total	**32,463**	**61.7**	**3.3**	**34.4**	**5.0**

Source: U.S. Census Bureau, 2013-2017 American Community Survey 5-Year Estimates
Note: This table reports only the civilian labor force. The labor force in armed services accounted for 0.6% of the population 16 and over across the region. Currituck County and Kitty Hawk had slightly higher populations in the armed forces, at 1.1% and 1.3%, respectively. Population employed, population unemployed, and population not in labor force are reported as a percent of the total population aged 16 years and older.

Table 3.11 – Percent of Employed Population by Occupation for Outer Banks, 2017

Occupation	Management, business, science and arts (%)	Service (%)	Sales and Office (%)	Natural Resources, Construction, and Maintenance (%)	Production, transportation, and material moving (%)
Currituck County	**30.3**	**17.2**	**27.4**	**16.2**	**9.0**
Dare County	**30.9**	**19.8**	**28.0**	**12.5**	**8.8**
Duck	38.3	26.0	28.6	7.1	0.0
Kill Devil Hills	28.3	26.4	25.1	12.5	7.7

Occupation	Management, business, science and arts (%)	Service (%)	Sales and Office (%)	Natural Resources, Construction, and Maintenance (%)	Production, transportation, and material moving (%)
Kitty Hawk	34.4	15.0	29.0	12.4	9.3
Manteo	27.2	19.4	26.3	13.3	13.9
Nags Head	44.7	14.8	23.4	7.4	9.7
Southern Shores	40.8	18.1	33.1	4.8	3.2
Region Total	**30.6**	**18.7**	**27.8**	**14.0**	**8.9**

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

Across the Region as a whole, major industry sectors in 2017 included Arts, Entertainment, and Recreation, and Accommodation and Food Services (15.8 percent of employment); Retail Trade (13.7 percent of employment); Educational Services, and Health Care and Social Assistance (13.4 percent of employment); and Construction (11.0 percent of employment).

Dare County accounts for the majority of its own employment, as approximately 90.8 percent of workers worked in their county of residence as of 2016. In Currituck County, however, only 32.9 percent of workers worked within the county. Another 22.1 percent worked outside of the county of residence, but within the state, many of which were likely commuting to Dare County. Notably, 45 percent of workers in Currituck County worked outside their state of residence. This is likely due to Currituck County's proximity to Virginia.

Table 3.12 summarizes the major employers in Currituck and Dare Counties from AccessNC as of the 2015 4th Quarter.

Table 3.12 – Major Employers, Outer Banks Region

Employer	Estimated Employees
Currituck County	
Currituck County Board of Education	500-999
Currituck County Finance Office	250-499
Academi Training Center	250-499
Sentara Internal Medicine Physician	100-249
Coastal Staffing	100-249
Food Lion	100-249
Twiddy & Co	100-249
Dare County	
Dare County Schools	500-999
County of Dare	500-999
Carolina Designs Realty	250-499
Vidant Medical Center	250-499
NC Department of Transportation	250-499
Village Realty and Management Service	250-499
Food Lion	250-499
WalMart Associates	100-249
SPM Resorts	100-249
Trion Solutions	100-249

Source: ACCESSNC Employer Profile

4 Risk Assessment

4.1 OVERVIEW

This section describes the Hazard Identification and Risk Assessment process for the development of the Outer Banks Regional Hazard Mitigation Plan. It describes how the Region 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 Currituck and Dare Counties, including the unincorporated areas 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 planning area and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events. This risk assessment followed the methodology described in the FEMA publication Understanding Your Risks—Identifying Hazards and Estimating Losses (FEMA 386-2, 2002), which breaks the assessment down to a four-step process:



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

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

4.2 HAZARD IDENTIFICATION

To identify hazards relevant to the planning area, the HMPC began with a review of the list of hazards identified in the 2018 State Hazard Mitigation Plan and the 2015 Albemarle Regional Hazard Mitigation Plan, which the Outer Banks region participated in before becoming its own region. This review of hazards is 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 Albemarle Regional HMP?
Flooding	Yes	Yes
Hurricanes and Coastal Hazards (Rip Currents, Nor'easters)	Yes	Yes
Severe Winter Weather (Freezing Rain, Snowstorms, Blizzards, Wind Chill, Extreme Cold)	Yes	Yes
Extreme Heat	Yes	Yes
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 (Tornados evaluated as a separate hazard)
Landslide	Yes	Yes
Sinkholes	Yes	Yes
Erosion	Yes	Yes
Rip Currents	No	Yes
Tsunami	No	Yes
Hazardous Materials Incident	Yes	No
Radiological Emergency	Yes	No
Terrorism	Yes	Yes
Infectious Disease	Yes	Yes (as Public Health Events and Pandemic Events)
Cyber Threat	Yes	Yes
Electromagnetic Pulse	Yes	No
Active Shooter/Mass Casualty	No	Yes
Transportation Infrastructure Impacts	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 Albemarle Regional 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. Due to its reliance on reporting from a variety

of sources, the accuracy of NCEI data can be limited. However, it still provides a good starting point for assessing the occurrence of various hazard events in the planning area. The NCEI database contains 455 records of severe weather events that occurred in Currituck and Dare Counties in the 20-year period from 1999 through 2018. Table 4.2 summarizes these events.

Table 4.2 – NCEI Severe Weather Reports for Currituck and Dare Counties, 1999 – 2018

Type	# of Events	Property Damage	Crop Damage	Deaths	Injuries
Blizzard	2	$0	$0	0	0
Coastal Flood	26	$18,835,000	$0	0	0
Cold/Wind Chill	0	$0	$0	0	0
Drought	6	$0	$0	0	0
Extreme Cold/Wind Chill	0	$0	$0	0	0
Excessive Heat	2	$0	$0	0	0
Flash Flood	14	$0	$0	0	0
Flood	13	$500,000	$0	0	0
Hail	58	$0	$0	0	0
Heat	2	$0	$0	0	0
Heavy Rain	19	$0	$0	0	0
Heavy Snow	6	$0	$0	0	0
High Wind	54	$595,000	$0	0	0
Hurricane	26	$371,413,000	$19,850,000	0	0
Ice Storm	0	$0	$0	0	0
Lightning	12	$84,000	$0	3	6
Strong Wind	3	$11,000	$0	0	0
Thunderstorm Wind	96	$619,000	$0	0	8
Tornado	16	$1,347,000	$0	0	5
Tropical Storm	31	$18,744,000	$0	0	0
Wildfire	0	$0	$0	0	0
Winter Storm	42	$0	$0	0	0
Winter Weather	27	$0	$0	0	0
Total:	**455**	**$412,148,000**	**$19,850,000**	**3**	**19**

Source: National Center for Environmental Information Events Database, accessed January 2019
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 Currituck and Dare Counties in order to identify significant hazards. Federal and/or state disaster declarations may be granted when the Governor certifies that the combined local, county and state resources are insufficient and that the situation is beyond their recovery capabilities. When the local 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, Currituck and Dare Counties have been designated in 12 different major disaster declarations, of which 11 affected Dare County and 7 affected Currituck County. These declarations are detailed in Table 4.3.

Table 4.3 – FEMA Major Disaster Declarations, Currituck and Dare Counties

County*	Disaster #	Date	Incident Type	Event Title
D	4412	1/31/2019	Hurricane	Tropical Storm Michael
D	4393	9/14/2018	Hurricane	Hurricane Florence

County*	Disaster #	Date	Incident Type	Event Title
C, D	4285	10/10/2016	Hurricane	Hurricane Matthew
C, D	4019	8/31/2011	Hurricane	Hurricane Irene
C	1969	4/19/2011	Severe Storm(s)	Severe Storms, Tornados, and Flooding
D	1608	10/7/2005	Hurricane	Hurricane Ophelia
C, D	1490	9/18/2003	Hurricane	Hurricane Isabel
C, D	1292	9/16/1999	Hurricane	Hurricane Floyd Major Disaster Declarations
D	1291	9/9/1999	Hurricane	Hurricane Dennis
C, D	1240	8/27/1998	Hurricane	Hurricane Bonnie
D	1200	1/15/1998	Severe Storm(s)	Severe Storms and Flooding
D	1003	9/10/1993	Hurricane	Hurricane Emily
C, D	881	12/2/1988	Tornado	Severe Storms & Tornados

Source: FEMA Disaster Declarations Summary, updated March 15, 2019
*County code: C = Currituck, D = Dare

Using the above information and additional discussion, the HMPC evaluated each hazard's significance to the planning area in order to decide which hazards to include in this plan update. Some hazard titles have been updated either to better encompass the full scope of a hazard or to assess closely related hazards together. Table 4.4 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 plan and 2015 Albemarle plan identify this as a high priority hazard. Several past disaster declarations were for flooding events.
Hurricane and Tropical Storm	Yes	The 2018 State plan and 2015 Albemarle plan identify hurricane as a high priority hazard. The region is vulnerable to hurricane winds, rains, and storm surge. The majority of the region's past disaster declarations have been for hurricane events.
Coastal Hazards (Erosion, Rip Current, Sea Level Rise)	Yes	The 2018 state plan addressed this along with hurricanes. The 2015 Albemarle plan addressed erosion and rip currents. Due to the number of coastal threats the region faces, the HMPC found it necessary to evaluate them as separate hazards. For the purposes of this plan, coastal hazards will include erosion, rip currents, and sea level rise.
Nor'easters	Yes (Addressed with Hurricanes and Flood)	The Albemarle plan found nor'easters to be a moderate-high priority hazard. However, the impacts of nor'easters mirror those of hurricanes and tropical storms. Therefore, nor'easters will be addressed within the hurricane and flood hazards profile.
Severe Winter Weather	Yes	The 2015 Albemarle plan and 2018 State plan addressed this hazard, and the region identifies it as a moderate priority hazard.
Extreme Heat	Yes	The 2015 Albemarle plan and the 2018 State plan addressed this hazard. NCEI reports 4 heat events for the region.
Earthquake	Yes	The 2015 Albemarle plan and the State HMP addressed this hazard. Earthquake is a low priority hazard but still merits study.
Wildfire	Yes	The 2015 Albemarle plan identified wildfire as a moderate-high priority hazard.
Dam Failure	No	The 2015 Albemarle plan did not identify any dams in Currituck or Dare Counties. NC Dam Inventory does not list dams in either county.
Levee Failure	No	The 2015 Albemarle plan addressed this hazard in conjunction with dam failure but did not list any levees or historical levee failures in the region.

Hazard	Included in this plan update?	Explanation for Decision
		The USACE's National Levee Database does not identify any USACE or non-USACE levees in the region.
Drought	Yes	The 2015 Albemarle plan addressed this hazard. The 2018 State Plan notes that drought occurrence is lower in the northeastern region of the state, but it is still a relevant hazard to the planning area.
Severe Thunderstorm, Lightning, and Hail	Yes	The 2015 Albemarle plan and 2018 State plan addressed this hazard. NCEI reports 223 severe weather-related events in the past 20 years.
Tornado	Yes	The 2015 Albemarle plan and the 2018 State plan addressed this hazard. NCEI reports 16 tornado segments that have passed through the region. The region has received two major disaster declarations for tornados.
Landslide	No	The 2015 Albemarle plan and 2018 State plan addressed this hazard, however the regional plan found minimal risk and the State plan notes that risk is concentrated in the western portions of the state.
Sinkholes	No	The 2015 Albemarle plan and 2018 State plan addressed this hazard, however the regional plan found minimal risk. USGS data does not indicate any geological basis for sinkhole risk in the region. If sinkholes occur, they are generally the result of human development.
Erosion	Yes (under Coastal Hazards)	The 2015 Albemarle plan addressed this hazard and found it to be a high priority hazard. The 2018 State plan also addressed this hazard for coastal areas, including the Outer Banks region.
Rip Currents	Yes (under Coastal Hazards)	The State plan does not address this hazard, but the 2015 Albemarle plan finds this to be a moderate priority hazard. The vulnerability to rip currents given the region's coastal location and prominence as a tourist destination warrant inclusion in this plan. Rip currents will be addressed under the Coastal Hazards profile.
Tsunami	Yes (under Earthquake)	The 2015 Albemarle plan addressed this hazard but found it unlikely. There were no past events in or near the planning area.
Hazardous Materials Incident	Yes	The 2018 State plan addressed this hazard, but the 2015 Albemarle plan did not. However, the HMPC believes this hazard is significant enough to warrant inclusion in the plan.
Radiological Emergency	Yes	The 2015 Albemarle plan did not address this hazard. The 2018 State plan does not identify significant radiological hazard for Currituck or Dare Counties. However, the HMPC felt it should be included in this update.
Terrorism (Active Shooter/Mass Casualty)	Yes	The 2015 Albemarle plan addressed this hazard and found it to be a low priority hazard to the planning area. There have not been any instances of terrorism in Currituck or Dare Counties. However, the HMPC felt this threat warrants inclusion in the plan.
Infectious Disease/Pandemic/ Public Health Events	No	The State HMP reports the entire State is equally at risk, but vulnerability is low across all but one impact category. The 2015 Albemarle plan found this to be a low priority hazard.
Cyber Threat	Yes	This threat was mentioned in the previous plan. The HMPC felt this hazard should continue to be discussed.
Electromagnetic Pulse	No	The region considers this hazard more appropriately addressed at the State level.
Transportation Infrastructure Impacts	Yes	This hazard is not addressed in the State plan. Infrastructure vulnerability will be evaluated relative to each natural hazard that may impact it. However, the HMPC also wanted to consider Infrastructure Failure that may occur due to accidental damages unrelated to other hazards.

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

- Coastal Hazards (Erosion, Rip Current, and Sea Level Rise)
- Drought
- Earthquake
- Extreme Heat
- Flood
- Hurricane & Tropical Storm
- Severe Weather (Thunderstorm Wind, Lightning, & Hail)
- Severe Winter Storm
- Tornado
- Wildfire
- Hazardous Materials Incident
- Radiological Emergency
- Cyber Threat
- Terrorism
- Transportation Infrastructure Failure

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 Outer Banks Region.

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.

Past Occurrences

This section contains information on historical events, including the location and consequences of all past events on record within or near the Outer Banks Region.

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*** – A 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 Outer Banks Regional Hazard Mitigation Plan.
- Exposure and vulnerability estimates provided by the North Carolina Emergency Management IRISK database.

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

Key methodologies and assumptions made 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 Outer Banks Region. 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 Outer Banks 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.

4.4 ASSET INVENTORY

4.4.1 Population

North Carolina Emergency Management's (NCEM) 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 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)
Currituck			
Currituck County (Unincorporated Area)	23,540	3,041	1,329
Dare			
Dare County (Unincorporated Area)	16,893	2,574	916
Town of Duck	369	56	20
Town of Kill Devil Hills	6,635	1,011	360
Town of Kitty Hawk	3,270	498	177
Town of Manteo	1,258	192	68
Town of Nags Head	2,786	425	151
Town of Southern Shores	2,695	411	146
Subtotal Dare	**33,906**	**5,167**	**1,838**
Region Total	**57,446**	**8,208**	**3,167**

Source: NCEM IRISK Database; 2010 Decennial Census

4.4.2 Property

Building counts were also provided by the IRISK database. These values were generated using locally-provided building footprint and parcel data as well as data generated by North Carolina Emergency Management. The methodology for generating the building asset inventory is described in greater detail in Section 4.3. Note that these building counts were gathered in 2010, and the Region has since experienced some growth and redevelopment. Therefore, the exposure reflected in the following tables is an underestimate of actual present-day exposure. For example, the North Carolina Floodplain Mapping Program indicated an estimated 14,703 buildings were in unincorporated Dare County as of the release of preliminary revised FIRMs in 2016, which is a nearly eight percent increase from 2010 numbers. Chapter 2 Planning Area Profile describes the growth that has occurred since 2010 and provides a means of estimating the degree to which exposure and vulnerability may have increased.

Table 4.7 – Building Counts and Values by Jurisdiction

Jurisdiction	Building Count	Building Value
Currituck		
Currituck County (Unincorporated Area)	17,069	$2,979,468,915
Dare		
Dare County (Unincorporated Area)	13,634	$2,386,317,125
Town of Duck	2,400	$736,869,444
Town of Kill Devil Hills	5,972	$974,106,060
Town of Kitty Hawk	2,803	$637,910,353

Jurisdiction	Building Count	Building Value
Town of Manteo	918	$282,189,726
Town of Nags Head	4,827	$1,094,947,456
Town of Southern Shores	2,496	$685,384,316
Subtotal Dare	**33,050**	**$6,797,724,480**
Region Total	**50,119**	**$9,777,193,394**

Source: NCEM IRISK Database

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

Table 4.8 provides a summary recent development not included in IRISK as an estimate of additional asset exposure in the Region.

Table 4.8 – Parcel Development Not Included in IRISK, as of November 2019

Jurisdiction	Improved Parcel Count	Total Improved Value
Currituck County		
Unincorporated Currituck County	3,399	$664,833,300
Dare County		
Duck	78	$24,632,900
Kill Devil Hills	416	$93,552,200
Kitty Hawk	221	$50,065,300
Manteo	131	$23,359,300
Nags Head	288	$74,889,500
Southern Shores	167	$47,677,000
Unincorporated Dare County	945	$207,054,100
Region Total	**5,645**	**$1,186,063,600**

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

4.4.3 Critical Facilities

The IRISK database also identifies Critical Infrastructure and Key Resources (CIKR) buildings as well as High Potential Loss Properties. Critical infrastructure are assets, systems, networks, and functions that would have a debilitating impact on security, the economy, or public health and safety if disrupted. Key resources are public or private resources essential to operation of the economy and the government. High potential loss facilities are those that represent a high potential for damaging effects on their community. These properties were also identified in 2010 and are likely an underestimate of the exposure of current CIKR and High Potential Loss Properties. These properties are detailed in Table 4.9 and Table 4.10, respectively.

Table 4.9 – Critical Infrastructure and Key Resources by Type and Jurisdiction

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	EM	Healthcare	Government Facilities	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Currituck County	431	20	1	758	3	144	0	117	29	1	0	161	4	16	19	**1,704**
Dare County	18	14	0	553	0	100	1	101	11	1	1	51	5	10	13	**879**
Town of Duck	1	4	0	66	1	4	0	2	0	0	0	5	0	2	1	**86**
Town of Kill Devil Hills	1	11	0	249	4	45	0	12	10	1	0	29	4	1	5	**372**
Town of Kitty Hawk	9	39	0	405	0	105	0	12	9	0	0	57	12	9	9	**666**
Town of Manteo	1	5	0	106	3	5	0	19	3	0	0	20	0	1	0	**163**
Town of Nags Head	6	27	0	831	12	48	0	36	48	0	0	12	6	12	24	**1,062**
Town of Southern Shores	0	6	0	57	3	39	0	6	3	0	0	21	0	9	3	**147**
Total	**467**	**126**	**1**	**3,025**	**26**	**490**	**1**	**305**	**113**	**3**	**1**	**356**	**31**	**60**	**74**	**5,079**

Source: NCEM Risk Management Tool

Table 4.10 – High Potential Loss Properties by Use and Jurisdiction

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Currituck County	11	21	0	16	1	5	5	**59**
Dare County	37	15	0	12	0	1	2	**67**
Town of Duck	27	5	0	0	0	1	0	**33**
Town of Kill Devil Hills	40	28	0	3	0	0	2	**73**
Town of Kitty Hawk	3	54	0	3	0	3	12	**75**
Town of Manteo	11	12	0	6	0	3	0	**32**
Town of Nags Head	66	78	0	18	0	6	0	**168**
Town of Southern Shores	30	9	0	3	0	3	0	**45**
Total	**225**	**222**	**0**	**61**	**1**	**22**	**21**	**552**

Source: NCEM Risk Management Tool

In addition to examining CIKR overall, critical facilities and assets were examined against known hazard areas, where possible, in this risk assessment. These critical facilities and assets are those that could severely disrupt emergency operations or response and recovery efforts should they be damaged by a hazard event. This list of facilities was compiled from a subset of the CIKR inventory and supplemented by HMPC input. Critical facility exposure and risk is accounted for in the exposure and vulnerability of CIKR.

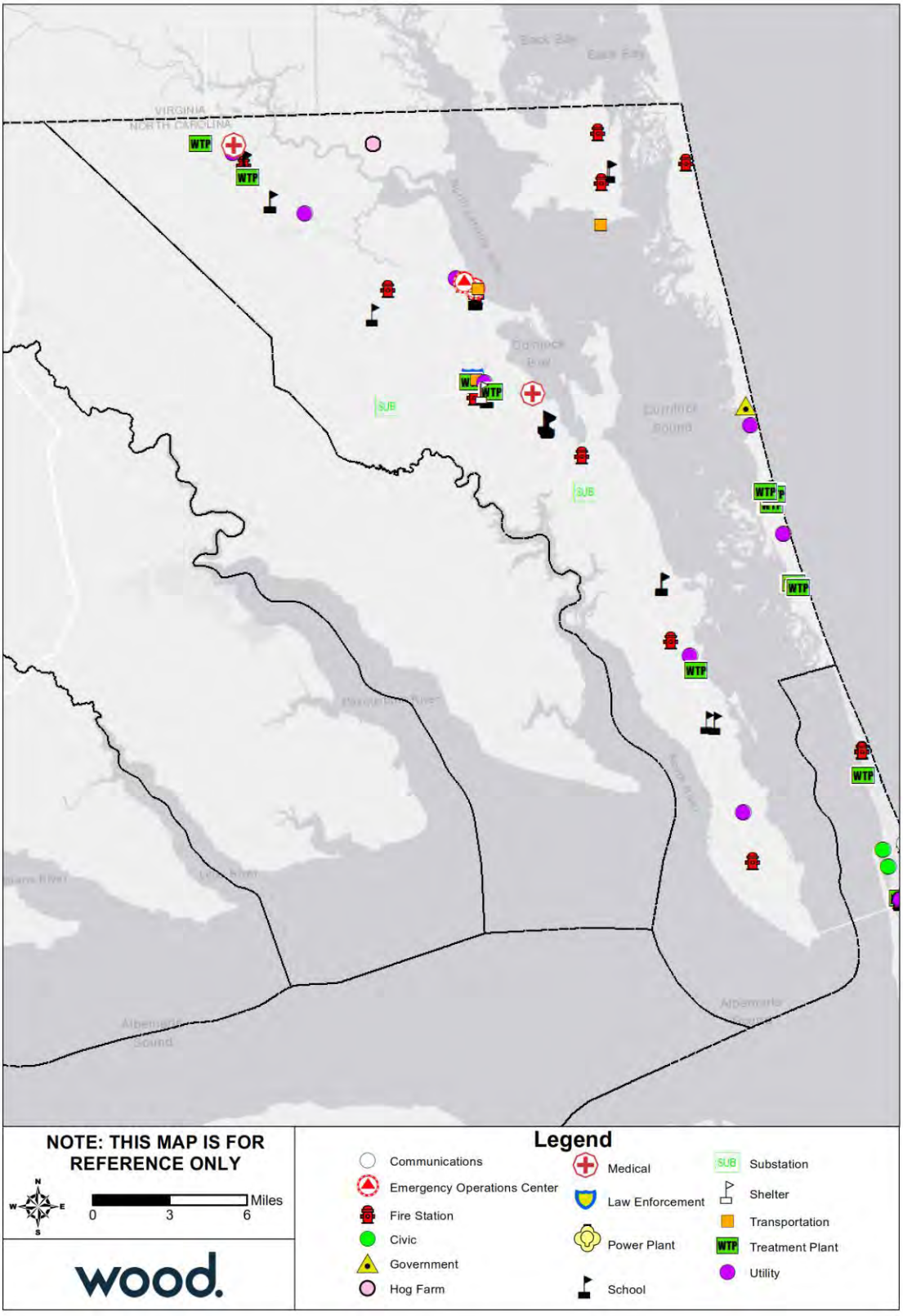
Critical facilities are summarized in Table 4.11 and shown by County in Figure 4.1 and Figure 4.2. These facilities are mapped by jurisdiction in the jurisdictional annexes.

Table 4.11 – Critical Facilities, Outer Banks Region

Asset	Count
Civic	4
Communications	2
Emergency Operations Center	4
Fire Station	34
Government	3
Hog Farm	1
Hospital	1
Medical	2
Police Station	10
Power Plant	5
School	82
Shelter	1
Substation	4
Transportation	3
Treatment Plant	59
Utility	11
Total	**226**

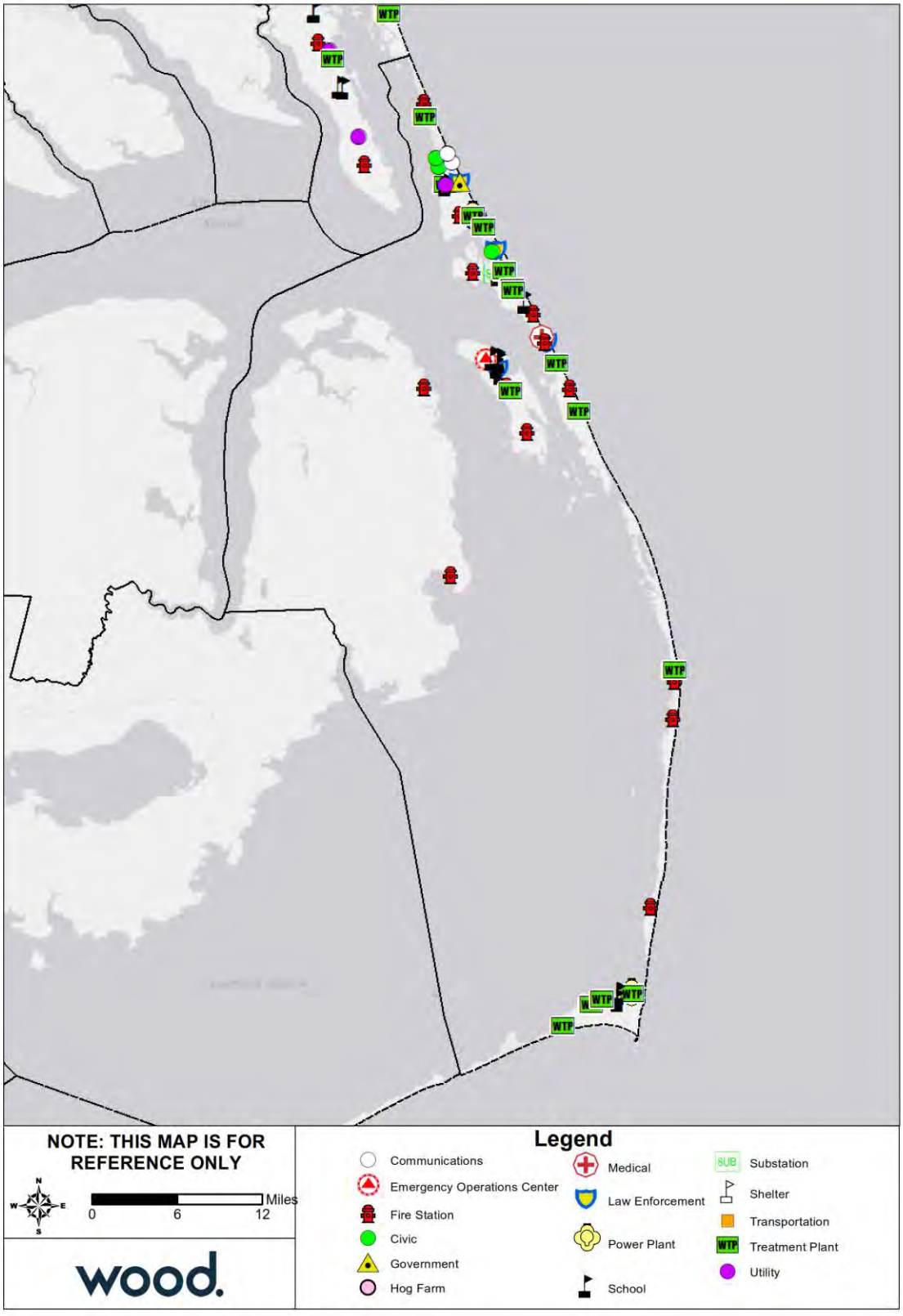
Source: NCEM IRISK Database; HMPC input; GIS analysis

Figure 4.1 – Currituck County Critical Facilities



Source: NCEM IRISK Database, GIS Analysis

Figure 4.2 – Dare County Critical Facilities



Source: NCEM IRISK Database, GIS Analysis

4.5 HAZARD PROFILES, ANALYSIS, AND VULNERABILITY

4.5.1 Coastal Hazards (Erosion, Rip Current, and Sea Level Rise)

4.5.1.1 Erosion

Hazard Background

Coastal erosion is the wearing away and transportation of material away from one section of shoreline and deposited offshore or in another section of shoreline. Coastal erosion impacts both oceanfront and estuarine shorelines. Erosion can be caused by large storms, flooding, strong wave action, sea level rise, and human activities—such as land uses that over-develop the shoreline, alterations to the shoreline or dunes, and hard shoreline stabilization structures like breakwaters and seawalls—that wear away the beaches and estuarine shorelines along the coast. Erosion undermines and often destroys homes, businesses, and public infrastructure and can have long-term economic and social consequences. According to NOAA, coastal erosion is responsible for approximately $500 million per year in coastal property loss in the United States, including damage to structures and loss of land.

Coastal erosion has both natural causes and causes related to human activities. Gradual coastal erosion and accretion results naturally from the impacts of tidal longshore currents. Severe coastal erosion can occur over a short period when the state is impacted by hurricanes, tropical storms and other weather systems. Sand is continually removed by longshore currents in some areas, but it is also continually replaced by sand carried in by the same type of currents. Structures such as piers or sea walls, jetties, and navigational inlets may interrupt the movement of sand. Sand can become "trapped" in one place by these types of structures. The currents will, of course, continue to flow, though depleted of sand trapped elsewhere. With significant amounts of sand trapped in the system, the continuing motion of currents (now deficient in sand) results in erosion. In this way, human construction activities that result in the unnatural trapping of sand have the potential to result in significant coastal erosion.

Erosion rates and potential impacts are highly localized. Severe storms can remove wide beaches, along with substantial dunes, in a single event. In undeveloped areas, high recession rates are not likely to cause significant concern, but in some heavily populated locations, one or two feet of erosion may be considered catastrophic (NOAA, 2014).

Estuaries are partially enclosed, coastal water bodies where freshwater meats saltwater from the ocean. They are influenced by tides but still protected from the full force of ocean waves. Estuaries are often referred to as bays or sounds. Estuarine coastlines can experience erosion through short-term processes, such as tides, storms, wind, and boat wakes, as well as long-term processes, such as sea level rise. Many variables determine the rate of estuarine erosion including shoreline type, geographic location and size of the associated estuary, the type and abundance of vegetation, and the frequency and intensity of storms. Estuarine erosion is problematic as more development occurs along estuarine shorelines.

Warning Time: 1 – More than 24 hours

Duration: 4 – More than 1 week

Location

Erosion can occur along any shoreline in the region, including oceanfront and estuarine areas. Erosion is likely to be frequent and severe along the Atlantic coast, but erosion of estuarine shorelines can also occur and may be just as severe; however, data on rates of erosion along estuarine shorelines is very limited. Though estuarine erosion is not monitored as closely as ocean erosion, the amount of estuarine shoreline in the Region is far greater. The estuarine coastline in the Outer Banks Region includes areas within the

Pamlico and Albemarle Sounds, including the Currituck Sound. The western coast of the barrier island directly abuts these estuaries, as does Roanoke Island and the eastern coast of the mainland. Table 4.12 details shoreline length in the Region per the North Carolina Division of Coastal Management.

Table 4.12 – Shoreline Length

County	Estuarine Shoreline	Ocean Shoreline
Currituck	1,100 miles	20 miles
Dare	946 miles	110 miles

Source: NC Division of Coastal Management Estuarine Shoreline Mapping Project, 2012; HMPC input

Extent

Erosion can be measured as a rate of change from a known previous condition. The North Carolina Division of Coastal Management (DCM) developed a Long-Term Average Annual Erosion Rate Update Study in 2019 based on updated shoreline measurements from 2016. Per this study, the average blocked erosion rate value increased slightly, relative to the average calculated in the 2011 DCM study. Figure 4.3 and Figure 4.4 on the following pages show the calculated erosion and accretion rates along the oceanfront and inlet coastlines. Larger scale maps showing more detail are included in the jurisdictional annexes.

Estuarine erosion rates were measured as part of the development of the Hazard Vulnerability Assessment (HVA), a coastal hazard assessment tool created through the Governor's South Atlantic Alliance (GSAA). Per analysis by Corbett and Walsh, this data indicates long-term erosion on most estuarine shorelines and several hotspots of erosion, including the southern and western portions of Roanoke Island and stretches of coastline near Rodanthe and Buxton, shown in Figure 4.5.

Erosion rates can vary significantly across the region due to several factors including fetch, shoreline orientation, and soil composition. To account for these variations, long-term erosion can also be measured by land cover changes and increases in open water. While a small fraction of the shoreline may exhibit accretion over a short period of time, cumulative impacts can still indicate an overall loss of estuarine coastline and marsh habitat. Table 4.13 provides data compiled by the HMPC from the NOAA Coastal Change Analysis Program (C-CAP) showing land cover changes in the Region from 1996 to 2010.

Table 4.13 – Land Cover Changes, 1996-2010

Land Cover Type	Currituck Net Change	Dare Net Change
Development	3.35 sq. mi	2.61 sq. mi
Agriculture	-2.65 sq. mi	0
Forested	-1.46 sq. mi	-0.64 sq. mi
Wetland	-0.78 sq. mi	-0.54 sq. mi
Barren Land	0.05 sq. mi	-2.51 sq. mi
Open Water	0.69 sq. mi	1.64 sq. mi

Source: https://coast.noaa.gov/digitalcoast/data/ccapregional.html

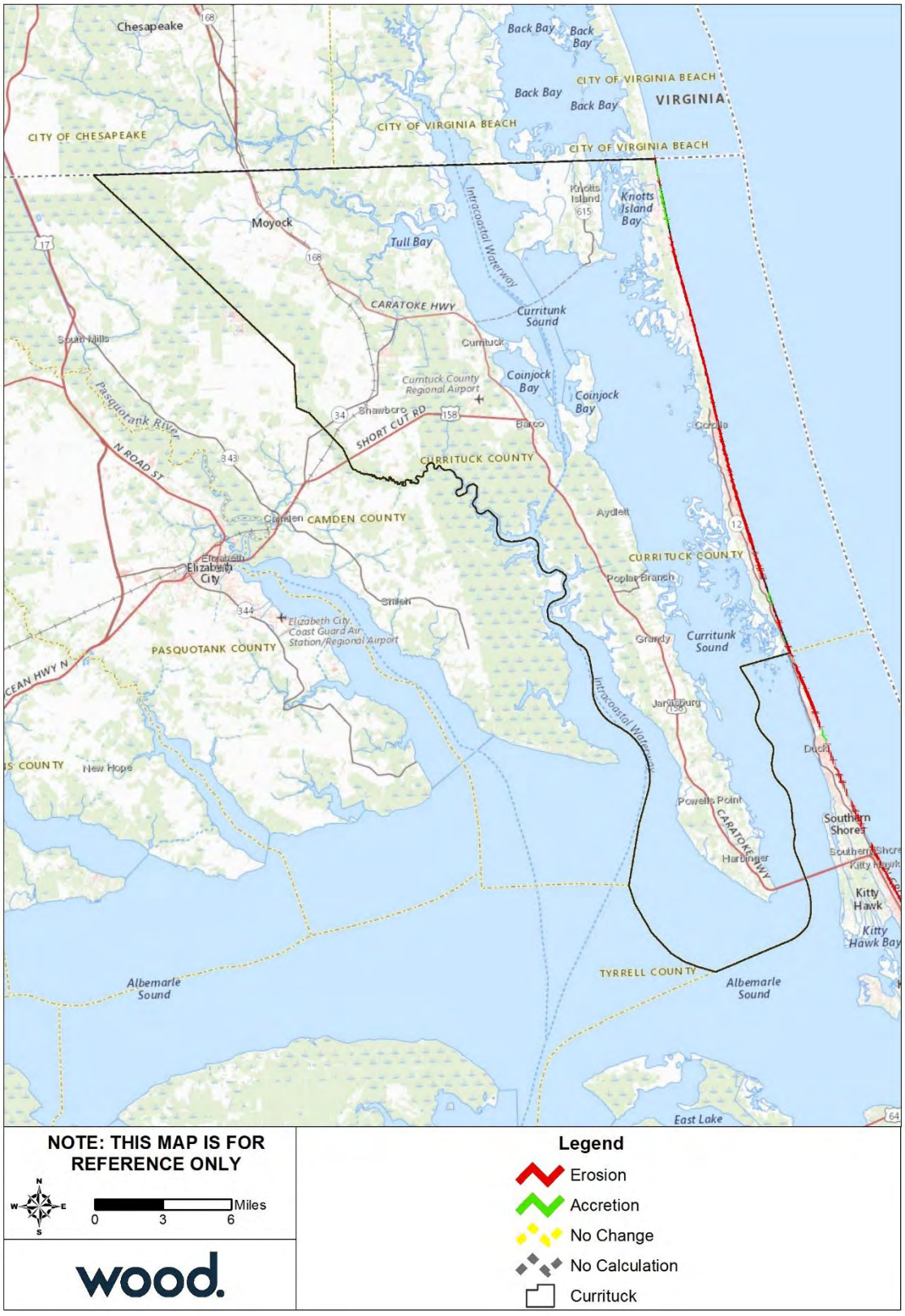
The C-CAP data indicates net increases in open water and net decreases in wetland and forested land in both counties. Additionally, both counties saw an increase in development, and Dare County saw a large decrease in barren land. Increases in developed land likely result increased impervious surfaces, which may increase stormwater runoff, alter drainage patterns, and further exacerbate erosion and flood issues.

Erosion may cause property and infrastructure damage but is unlikely to cause injury or death.

Impact: 2 – Limited

Spatial Extent: 3 – Moderate

Figure 4.3 – Ocean Shoreline Change, 2019, Currituck County



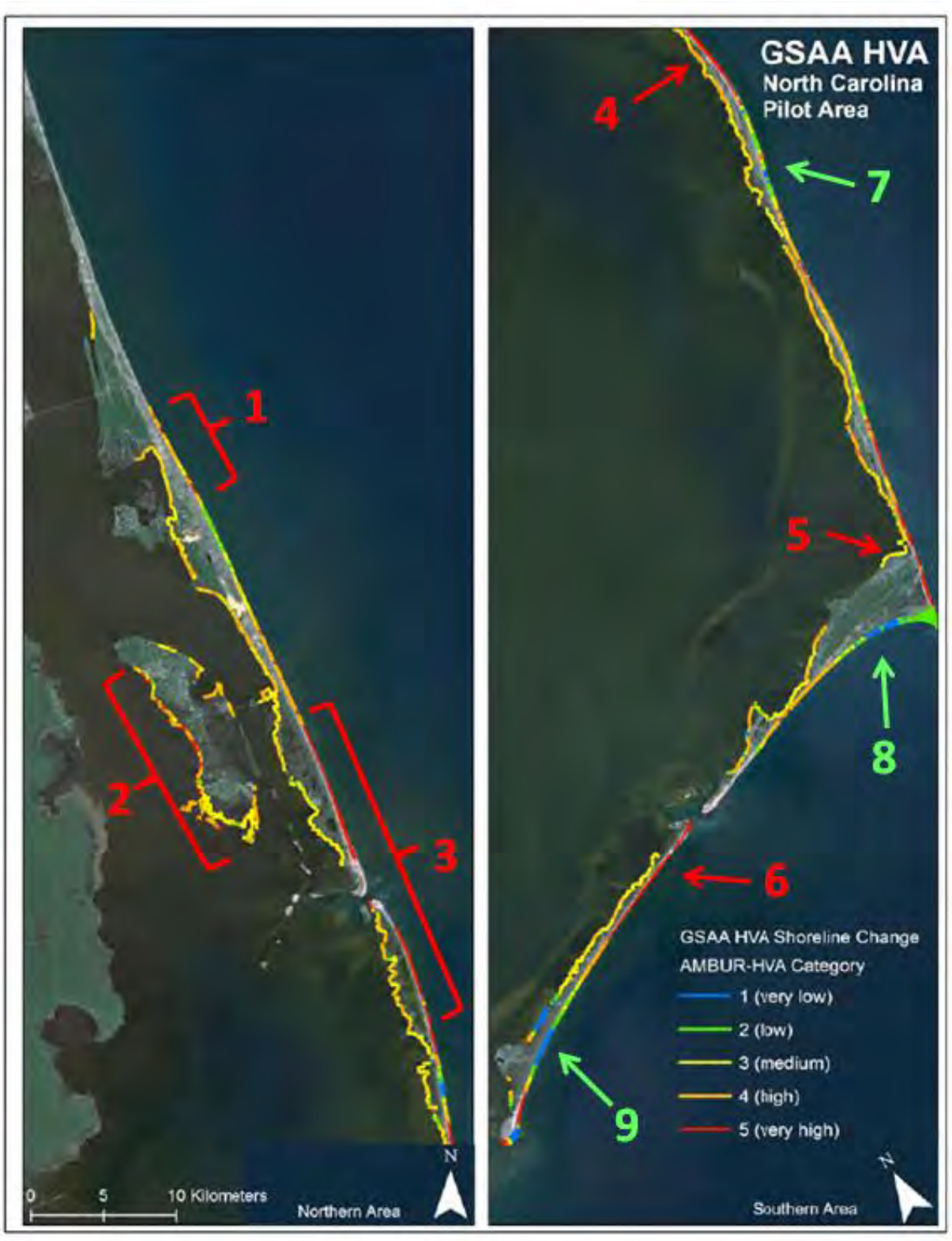
Source: North Carolina Division of Coastal Management

Figure 4.4 – Ocean Shoreline Change, 2019, Dare County



Source: North Carolina Division of Coastal Management

Figure 4.5 – Shoreline Erosion Rates in Southern Dare County



Source: Corbett and Walsh. GSAA Hazard Vulnerability Assessment Results

Another way to measure expected oceanfront erosion is by the North Carolina Division of Coastal Management's erosion rate maps and setback factors, which are used to regulate development. Per NC DEQ, "North Carolina's oceanfront construction setback factors are calculated using the long-term (approximately 50 years) average annual shoreline change rates for the purpose of establishing oceanfront construction Setback Factors and Ocean Erodible Areas of Environmental Concern, which were initially established by the Coastal Resources Commission (CRC) under the Coastal Area Management Act (CAMA) in 1979." New 2019 Setback Factors were approved by the Coastal Resources Commission on February 28, 2019 and are expected to become effective in August 2019. Shoreline change rates and Setback Factors can be found in the North Carolina 2019 Oceanfront Setback Factors & Long-Term Average Annual Erosion Rate Update Study: Methods Report, dated January 16, 2019 and made available on the NC DEQ website.

Historical Occurrences

As Figure 4.3 shows, shoreline erosion is occurring along the coast of the Outer Banks. Per an examination of event narratives in NCEI records for hurricanes, tropical storms, storm surges, and coastal floods, many events that have occurred in the Outer Banks region between 1999 and 2018 caused erosion. Table 4.14 below summarizes these events.

Table 4.14 – NCEI Events with Erosion Effects, 1999-2018, Outer Banks Region

Location	Event Name	Date	Event Type	Reported Property Damage
Eastern/Western Dare (Zone)	Hurricane Dennis	8/30-9/1/1999	Hurricane	$0
Eastern Dare (Zone)	Hurricane Floyd	9/14/1999	Hurricane	$0
Eastern Dare (Zone), Eastern Currituck (Zone)	Hurricane Isabel	9/17-9/18/2003	Hurricane	$347,000,000
Western Dare (Zone)	Tropical Storm Ernesto	8/31/2006	Tropical Storm	$10,000
Eastern Dare (Zone)	--	11/22/2006	Coastal Flood	$2,100,000
Eastern Dare (Zone)	--	5/7/2007	Coastal Flood	$30,000
Eastern Dare (Zone)	Tropical Storm Gabrielle	9/9/2007	Storm Surge	$0
Eastern Dare (Zone)	--	11/3/2007	Coastal Flood	$72,000
Eastern Dare (Zone), Eastern/ Western Currituck (Zone)	Tropical Storm Hanna	9/5-9/6/2008	Tropical Storm	$30,000
Eastern Currituck (Zone)	Unnamed Nor'easter	11/12/2009	Coastal Flood	$5,000,000
Eastern/Western Dare (Zone)	Hurricane Earl	9/2/2010	Tropical Storm, Storm Surge	$547,000
Eastern Dare (Zone)	Hurricane Sandy	10/28/2012	Tropical Storm, Storm Surge	$14,000,000
Eastern/Western Dare (Zone)	Tropical Storm Andrea	6/6/2013	Tropical Storm, Storm Surge	$0
Eastern Dare (Zone)	--	10/4/2015	Coastal Flood	$590,000
Eastern Currituck (Zone), Eastern Dare (Zone)	Tropical Storm Hermine	9/2/2016	Tropical Storm	$5,410,000
Eastern Dare (Zone)	Hurricane Matthew	10/8/2016	Hurricane	$0

Source: NCEI
Note: Damages are reported for the entire event and are not necessarily erosion related.

Recorded incidents of erosion in the Region include:

August 30-September 1, 1999 – For most counties, Hurricane Dennis left relatively little in its wake, however on the Outer Banks, erosion and the storm tide effects were extreme. Unfortunately, the

hurricane approached eastern North Carolina during one of the highest astronomical tides of the month. The dune structure on Hatteras Island was breeched in numerous locations.

September 19, 2003 – Hurricane Isabel made landfall early in the afternoon on September 19th as a category two hurricane. Major ocean overwash and beach erosion occurred along the Outer Banks, where waves of up to 20 feet accompanied a 6 to 8-foot storm surge.

November 22, 2006 – Strong low pressure developed off the southeast United States coast on November 20th. This low then slowly lifted north to the North Carolina coast on Wednesday November 22nd. The storm system produced heavy rain of 4 to 8 inches, very strong winds of 40 to 60 mph, and significant coastal flooding across eastern North Carolina as it approached the region. Significant coastal flooding was reported across Outer Banks Dare county, mainly for areas north of Buxton. Water levels of 4 to 6 feet above normal reported with significant beach erosion and ocean overwash.

November 12, 2009 – An intense Nor'easter produced moderate to severe coastal flooding across much of the Currituck Outer Banks. The peak tide height at Duck was 7.20 feet above MLLW, which was 3.22 feet above the astronomical tide. Numerous streets, homes and businesses were flooded in low lying areas of the county close or directly exposed to the Atlantic Ocean, especially in the Corolla and Carova Beach areas. There was also severe beach erosion and loss of protective dunes.

October 8, 2016 – Hurricane Matthew moved northeast offshore of the North Carolina coast late on October 8th through October 9th. Strong winds of 40 to 60 mph inland and 60 to 80 mph along the coast occurred as Matthew passed offshore mainly during the evening of October 8th through the morning of the 9th. Storm surge inundation on the ocean side was generally 1 to 3 feet above ground producing significant beach erosion.

Probability of Future Occurrence

Erosion and accretion are natural processes that are likely to continue to occur. Although data on historical erosion rates is only available for ocean shorelines, erosion is expected to continue affecting estuarine shorelines as well. The likelihood of significant instances of erosion will likely be tied to the occurrence of hurricane, tropical storm, and nor'easter events. According to NCEI, 16 events caused reported erosion in the region over the 20-year span between 1999-2018. This equates to an 80 percent chance of erosion occurring every year. Additionally, drawing from the likelihood of hurricanes, tropical storms, and Nor'easters, erosion is likely to occur.

Probability: 3 – Likely

Climate Change

As discussed under Climate Change in Section 0 and Section 4.5.6, climate change is expected to make heavy rain events and tropical storms and hurricanes more frequent and intense. As a result, the erosion typically caused by these storms can be expected to occur more frequently. Coastal erosion is also expected to increase as a result of rising seas. A 2018 study found that globally, between 1984 and 2015 erosion outweighed accretion (Mentaschi et al., 2018). However, the study could not conclude the degree to which erosion during this period is attributed to climate changes or increased coastal development. Nonetheless, increases in erosion have been observed and are expected to continue.

4.5.1.2 Rip Current

Hazard Background

Rip currents are powerful, narrow channels of seaward flowing water along the coast, extending from the shoreline to outside the surf zone. Rip currents form when there are variations in wave breaking along the beach due to the flow of water from areas with more wave breaking and corresponding higher wave setup to areas with less wave breaking and corresponding lower wave setup.

The National Weather Service (NWS) describes three major types of rip currents:

- **Bathymetrically-controlled rip currents** are those that occur at relatively fixed locations due to sandbars, submarine canyons and ridges, reefs, or other offshore features. These rip currents can be referred to as channelized or focused. Channelized currents are the most documented and well understood and occur in deep channels through shallow sandbars. Channelized rip currents are typically between 5 to 100 yards wide, 3 to 10 feet deep, and anywhere from 50 to 500 yards apart. Focused rip currents can occur along flat featureless beaches and appear as offshore directed plumes of turbulent water and sediment. These rip currents may last for days, weeks, or months.
- **Structurally-controlled rip currents** occur adjacent to man-made structures such as groins, jetties, and piers and natural features like rock outcrops.
- **Hydrodynamically-controlled rip currents** occur solely as a result of wave and current interactions, typically from waves originating from two different sources approaching the beach from different directions. These rip currents are transient and may only last for several minutes.

General warning of rip current risk may be provided by lifeguards or available via the National Weather Service (NWS), but there is often little to no warning for individuals regarding specific rip current sites. Some rip currents may last for days while others may only last for minutes.

Warning Time: 4 – Less than six hours

Duration: 2 – Less than 24 hours

Location

Rip currents can occur along any oceanfront or area that experiences breaking waves. These areas make up much of the region.

Extent

One measure of rip currents is the flow speed of the current. Per NWS, channelized rip currents typically flow about 1-2 feet per second and can reach up to 8 feet per second. Rip currents do not have a steady flow but can experience rip pulses for short periods of time during which flows can suddenly accelerate to more than double their normal speed. Despite these measurable features, rip currents are not typically measured and recorded in these ways. Another way to consider the magnitude of a rip current is by its impacts. The HMPC is most concerned with rip currents causing deaths, injuries, or property damages.

The National Weather Service Forecast Offices provides rip current risk level warnings on an Experimental Beach Forecast Webpage; the forecast locations provided by the Newport-Morehead City Office are shown in Figure 4.6, indicated by the umbrella symbols. This tool indicates whether a section of the beach has low, moderate, or high rip current risk based on current surf conditions. The rip current risk levels carry the following descriptions, given as warnings to beach-goers:

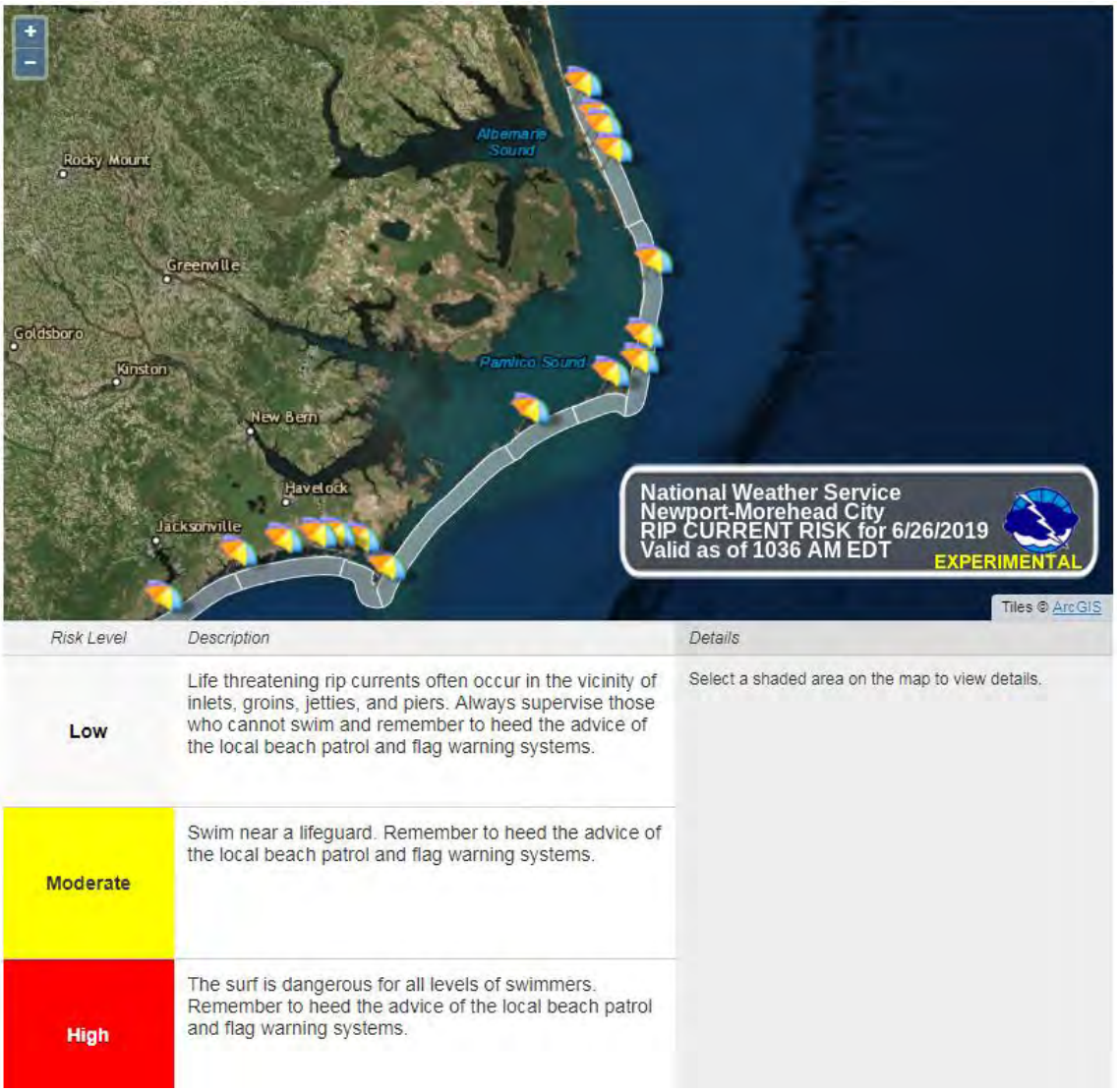
- Low: Life threatening rip currents often occur in the vicinity of inlets, groins, jetties, and piers. Always supervise those who cannot swim and remember to heed the advice of the local beach patrol and flag warning systems.
- Moderate: Swim near a lifeguard. Remember to heed the advice of the local beach patrol and flag warning systems.
- High: The surf is dangerous for all levels of swimmers. Remember to heed the advice of the local beach patrol and flag warning systems.

For the Outer Banks Region, rip current risk levels are provided for Corolla, Duck, Kitty Hawk, Kill Devil Hills, Nags Head, Rodanthe, Avon, Buxton, and Frisco. Although rip currents occur as highly localized events, the HMPC felt a larger spatial extent was appropriate given that risk warnings are issued for entire coastlines.

Impact: 3 – Critical

Spatial Extent: 3 – Moderate

Figure 4.6 – NWS Rip Current Risk Level Forecast



Source: National Weather Service Experimental Beach Forecast Webpage

Historical Occurrences

Rip currents are listed in NCEI's storm events database only when they cause a drowning, near-drowning, result in one or more rescues, or damage to watercraft. Table 4.15 lists all rip current events recorded by NCEI for the Outer Banks Region during the 20-year period between 1999-2018. In total, 25 rip current events were reported, 23 of which occurred in Dare County. These events caused 24 deaths and no injuries, property, or crop damage.

Table 4.15 – NCEI Records of Rip Currents, 1999-2018, Outer Banks Region

Location	Date	Time	Deaths	Injuries	Reported Property Damage	Reported Crop Damage
Rodanthe	6/22/2002	1733	1	0	0	0
(Hat)Cape Hatteras	9/4/2003	1700	1	0	0	0
Nags Head	8/5/2004	1500	1	0	0	0
Corolla	9/22/2004	815	1	0	0	0
Corolla	9/23/2004	1100	1	0	0	0
Kill Devil Hills	5/27/2005	1400	1	0	0	0
Nags Head	6/22/2005	1430	1	0	0	0
Eastern Dare (Zone)	9/22/2006	1130	1	0	0	0
Eastern Dare (Zone)	7/1/2007	1130	1	0	0	0
Eastern Dare (Zone)	7/24/2009	1600	1	0	0	0
Eastern Dare (Zone)	9/18/2009	1350	1	0	0	0
Eastern Dare (Zone)	6/20/2012	1300	1	0	0	0
Eastern Dare (Zone)	7/25/2012	1745	1	0	0	0
Eastern Dare (Zone)	6/26/2013	1500	0	0	0	0
Eastern Dare (Zone)	6/4/2016	1200	0	0	0	0
Eastern Dare (Zone)	7/22/2016	1420	1	0	0	0
Eastern Dare (Zone)	9/9/2016	1338	2	0	0	0
Eastern Dare (Zone)	10/2/2016	1006	1	0	0	0
Eastern Dare (Zone)	10/13/2016	1600	1	0	0	0
Eastern Dare (Zone)	10/19/2016	1630	1	0	0	0
Eastern Dare (Zone)	6/6/2017	1230	1	0	0	0
Eastern Dare (Zone)	9/9/2017	1700	1	0	0	0
Eastern Dare (Zone)	6/6/2018	900	1	0	0	0
Eastern Dare (Zone)	6/28/2018	1628	1	0	0	0
Eastern Dare (Zone)	10/1/2018	1000	1	0	0	0
		Total	**24**	**0**	**$0**	**$0**

Source: NCEI

The following narratives detail selected events reported in the table above:

September 4, 2003 – Dare County Emergency Management reported a rip current drowning of a Maryland man near Cape Hatteras. Swells generated from Hurricane Fabian, which was 875 miles southeast of the Outer Banks, caused heavy surf and rip currents across the entire Eastern North Carolina coastline.

May 27, 2005 – Two swimmers at the Ramada Plaza in Kill Devil Hills were pulled away from the shore by a strong rip current during the mid afternoon. One man drowned.

July 25, 2012 – A man and woman swimming near the Cape Hatteras Light House were pulled out to sea by a rip current. They were found face down in the surf and rescued. The man survived but the woman died.

June 6, 2017 – A 17 year old male died from a rip current off Frisco. The victim was last seen going into the water on a boogie board urging others to come back toward shore but succumbed to the rip current himself. His body was recovered the next morning, on June 7th.

October 1, 2018 – The initial call came in around 10:00 a.m. of two swimmers in trouble in Rodanthe. The victim's friend started CPR, which was continued by local paramedics. Efforts to revive the Baldwinsville, New York man were unsuccessful, and the victim died in the surf zone due to a rip current.

The National Weather Service has also tracked surf zone fatalities since 2013, including deaths caused by rip current, high surf, sneaker waves, and other causes. Data is available by location starting in 2014. Fatalities reported in the Outer Banks Region between 2014-2018 are listed below.

Table 4.16 – Surf Zone Fatalities, 2014-2018

Year	Cause	Count	Locations
2018	High Surf	4	Kitty Hawk Beach, Kill Devil Hills, Duck, Southern Shores
2018	Rip Current	3	Frisco Day, Avon, Rodanthe
2018	Unknown	1	Buxton
2017	Rip Current	3	Corolla, Hatteras Point (Buxton)
2016	Rip Current	7	Corolla, Rodanthe, Salvo, Buxton, Frisco
2015	Unknown	1	Duck
2014	N/A	0	N/A

Source: National Weather Service

Probability of Future Occurrence

Rip currents are ongoing phenomena that are always occurring along ocean surf zones. Rip currents are guaranteed to continue occurring, however, of concern to the HMPC is the probability of rip currents resulting in death, injury, or property damages. NCEI records indicate there have been 24 deaths due to rip currents over a 20-year period from 1999 through 2018. This equates to 1.2 deaths per year, or an over percent annual probability of significant rip current impacts.

Probability: 4 – Highly Likely

Climate Change

Research on the impacts of climate change on rip currents are limited; however, the climate change factors that affect coastal erosion may also impact rip currents. Erosion and accretion result in changes to coastal bathymetry, which affects the location of rip currents. As large-scale erosion events occur more frequently, the location of rip currents may become more unpredictable.

4.5.1.3 Sea Level Rise

Hazard Background

Sea level rise is the increase in sea levels as a result of atmospheric and oceanic warming which causes water expansion as well as ice melt from ice sheets and glaciers. Sea level rise is a result of global climate change. Climate change may be due to natural internal processes or external forces such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use (IPCC, 2014). Climate change is a natural occurrence in which the earth has warmed and cooled periodically over geologic time. The recent and rapid warming of the earth over the past century has been cause for concern, as this warming is very likely due to the accumulation of human-caused greenhouse gases, such as CO_2, in the atmosphere (IPCC, 2007). This warming is occurring almost everywhere in the world which suggests a global cause rather than changes in localized weather patterns. In 2018, the Intergovernmental Panel on Climate Change (IPCC) reported with high confidence that warming due to such emissions will cause long-term changes in the climate system such as sea level rise and its associated impacts.

There are generally two separate mechanics involved in global sea level rise. The first is directly attributed to global temperature increases, which warm the oceans waters and cause them to expand. The second is attributed to the melting of ice over land which simply adds water to the oceans. Global sea level rise is likely caused by a combination of these two mechanics and can be exasperated on the local level by factors such as erosion and subsidence. The rate of sea level rise has varied throughout geologic history, and studies have shown that global temperature and sea level are strongly correlated.

Due to sea-level rise projected throughout the 21st century and beyond, coastal systems and low-lying areas will increasingly experience adverse impacts such as submergence, coastal flooding, and coastal erosion. The population and assets projected to be exposed to coastal risks as well as human pressures on coastal ecosystems will increase significantly in the coming decades due to population growth, economic development, and urbanization (IPCC, 2014). The Outer Banks are particularly vulnerable to the effects of sea level rise, due to its, coastal location, subtropical environment, low topography and tourism economy.

Warning Time: 1 – More than 24 hours

Duration: 4 – More than one week

Location

Sea level rise can occur anywhere in the two-county Outer Banks region. The Coastal Vulnerability Index (CVI), developed by United States Geological Survey (USGS), provides a preliminary overview of the relative susceptibility of the United States coast to sea level rise. The CVI is based on geomorphology, regional coastal slope, tide range, wave height, relative sea level rise, and shoreline erosion and acceleration rates. For each study area, each variable is scored on a 1-5 scale based on defined parameters, where “1” indicates low contribution to coastal vulnerability and “5” indicates high contribution to vulnerability. These scores are then aggregated into a single index through a mathematical formula. The resulting index gives an overview of where physical changes may occur due to sea-level rise.

Figure 4.7 shows the CVI for the Outer Banks region. Water front areas on the Atlantic Ocean as well as along the Currituck, Albemarle, and Pamlico Sounds are all rated moderate to very high on the CVI.

Figure 4.7 – Coastal Vulnerability Index, Outer Banks Region



Source: USGS Coastal Change Hazards Portal

Extent

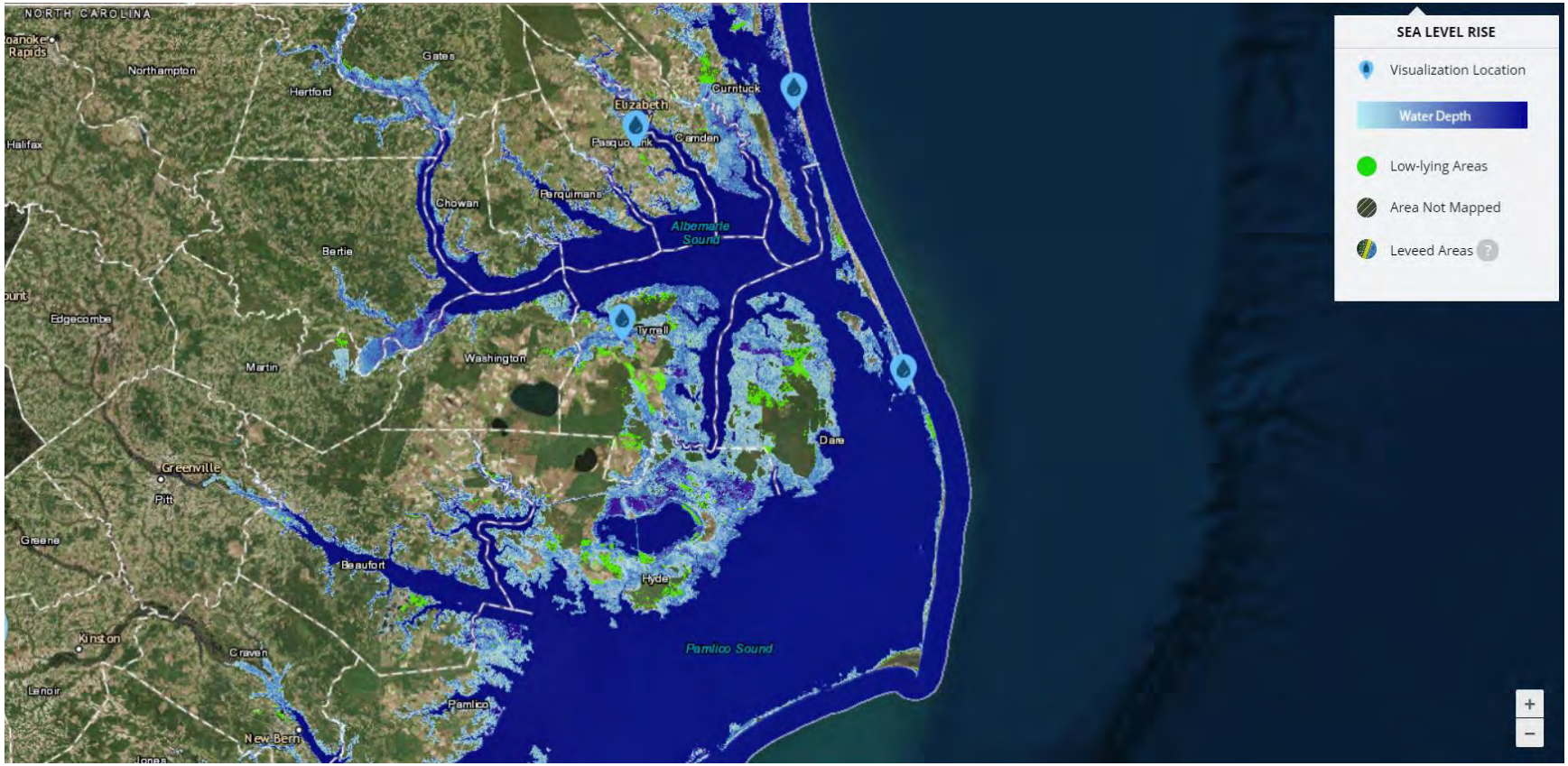
Sea level rise is measured by the number of feet of relative rise and the areas that such rise would inundate. The estimated impacts of 1-foot, 2-foot, and 3-foot, sea level rise (SLR) are shown in Figure 4.8 through Figure 4.10. The SLR estimate maps show inundation above mean higher high water (the average of each day's higher high tide line). SLR will likely affect the Atlantic coast line as well as the land adjacent to the Currituck, Albemarle, and Pamlico sounds. Much of southern Dare County will be inundated. Additionally, SLR will likely increase future risk of flooding from the other flood hazards discussed later in this plan, as more land will have a lower elevation relative to sea level. For example, with much of the barrier islands and wetlands inundated, inland areas will lose their natural protection and may become susceptible to coastal flooding with velocity wave action.

Figure 4.8 – Estimate Impact of 1 Foot SLR on Outer Banks Region



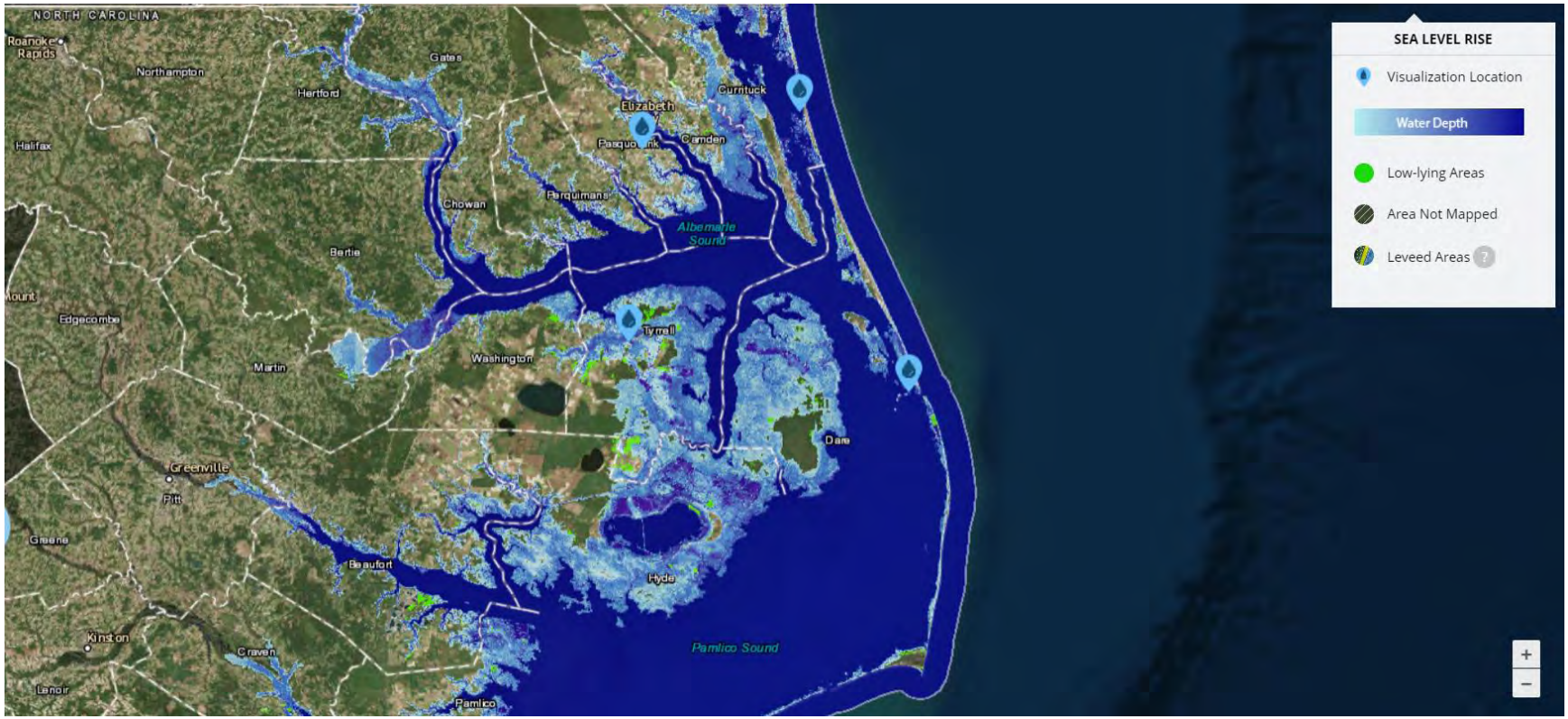
Source: NOAA Sea Level Rise Viewer

Figure 4.9 – Estimated Impact of 2 Foot SLR on Outer Banks Region



Source: NOAA Sea Level Rise Viewer

Figure 4.10 – Estimated Impact of 3 Foot SLR on Outer Banks Region



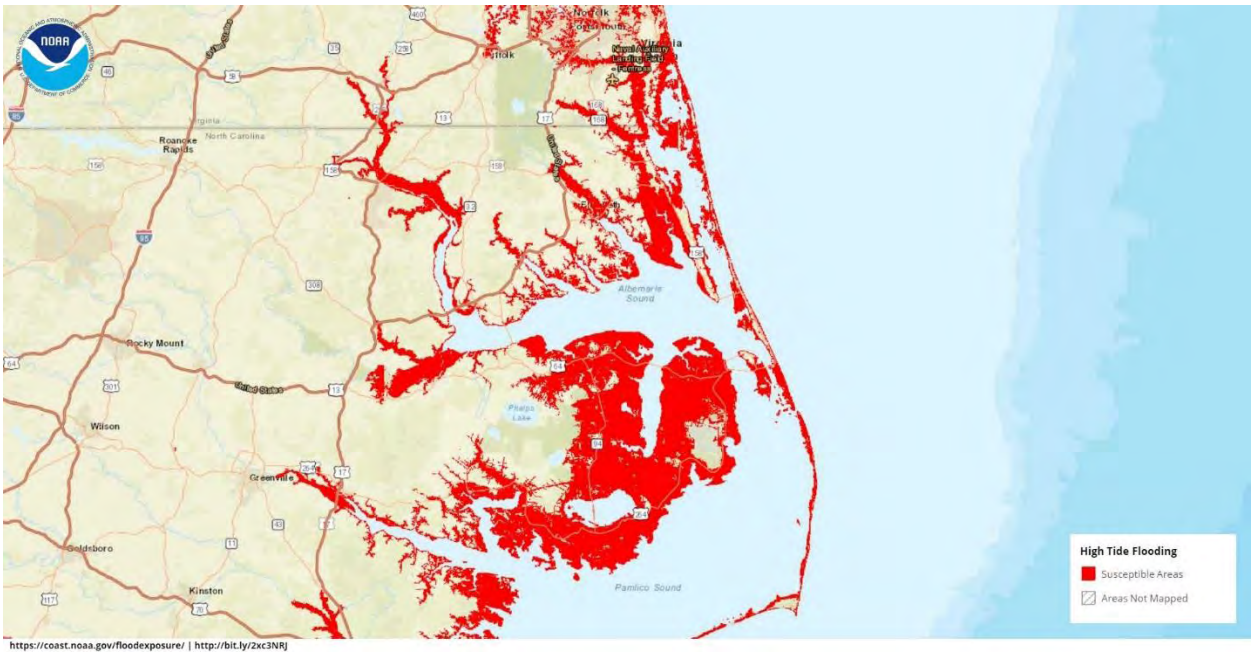
Source: NOAA Sea Level Rise Viewer

Sea level rise is a slow onset hazard, and the effects of sea level rise have not yet been fully felt. However, sea level rise has already begun to cause "clear sky" or "nuisance" flooding, which is brought on by high tidewaters rather than storm or rain events. Tidal flooding causes temporary inundation of low-lying areas during high-tide events. While tidal flooding is not caused by sea level rise itself, a 2015 tidal flooding report published by NOAA notes that tidal flood rates are steadily increasing, and daily highest tides surpass fixed elevations increasingly frequently, due in part to sea level rise. According to NOAA, annual occurrences of high tide flooding have increased 5- to 10-fold since the 1960s. Sea level rise may cause flooding to occur more frequently and last for longer durations of time. According to Climate Central, Sewell's Point, VA, in Norfolk just north of the Outer Banks, experienced 70 total coastal flood days between 2005 through 2014. Of these days, 56 percent would not have occurred without climate change and the resulting sea level rise. As sea level continues to rise, tidal flooding will continue to occur more frequently and over a greater inland area. Figure 4.11 shows areas in the Outer Banks that are susceptible to high tide flooding.

Impact: 3 – Critical

Spatial Extent: 3 – Moderate

Figure 4.11 – Areas Susceptible to High Tide Flooding, Outer Banks Region



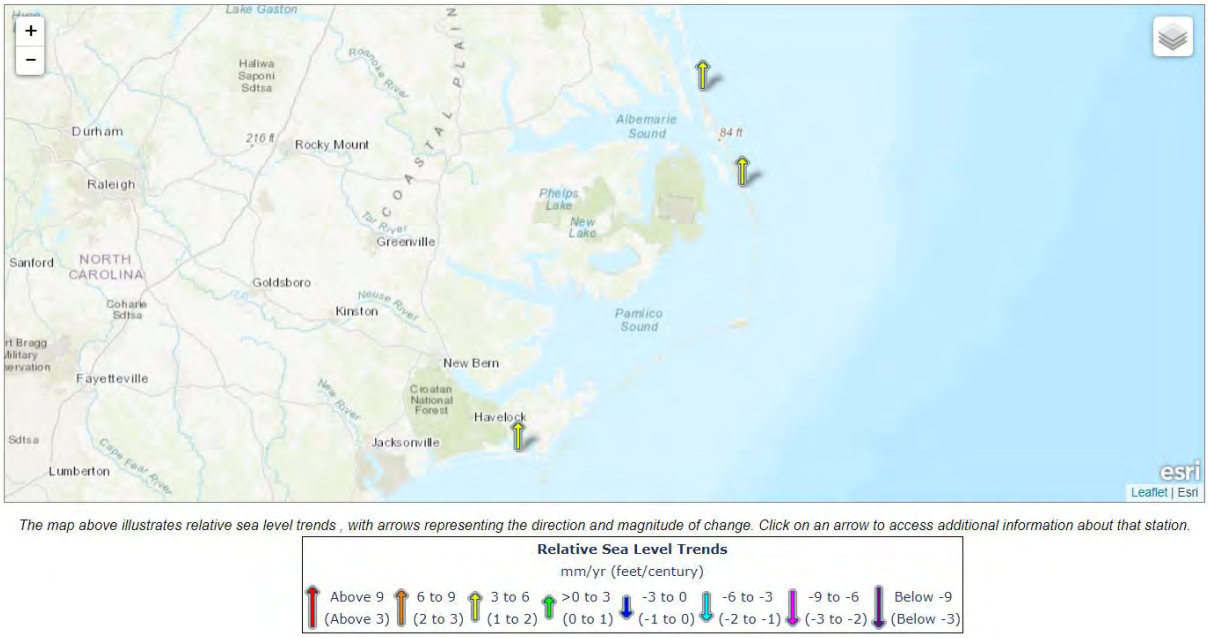
Source: NOAA Coastal Flood Exposure Mapper

Historical Occurrences

Historic trends in local MSL are best determined from tide gauge records. The Center for Operational Oceanographic Products and Services (CO-OPS) has been measuring sea level for over 150 years, with tide stations operating on all U.S. coasts. Changes in Mean Sea Level (MSL), either a sea level rise or sea level fall, have been computed at 128 long-term water level stations using a minimum span of 30 years of observations at each location. These measurements have been averaged by month to remove the effect of higher frequency phenomena (e.g. storm surge) in order to compute an accurate linear sea level trend. Figure 4.12 illustrates regional trends in sea level from NOAA. At the Duck, NC station (indicated by the top yellow arrow), the relative sea level trend is 4.62 mm/year with a 95% confidence interval of +/- 0.68 mm/year based on monthly mean sea level data from 1978 to 2018 which is equivalent to a change of

1.52 feet in 100 years. At the Oregon Inlet Marina, NC station (indicated by the middle yellow arrow), the relative sea level trend is 4.69 mm/year with a 95% confidence interval of +/- 1.16 mm/year based on monthly mean sea level data from 1977 to 2018 which is equivalent to a change of 1.54 feet in 100 years.

Figure 4.12 – Sea Level Trends, Outer Banks Region

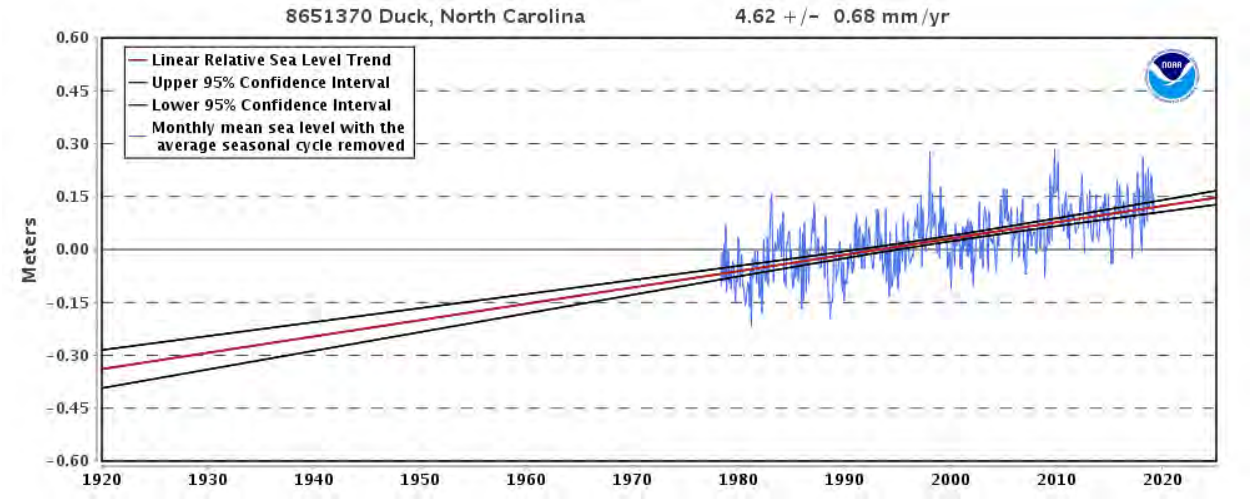


The map above illustrates relative sea level trends , with arrows representing the direction and magnitude of change. Click on an arrow to access additional information about that station.

Source: http://tidesandcurrents.noaa.gov/sltrends/sltrends.shtml

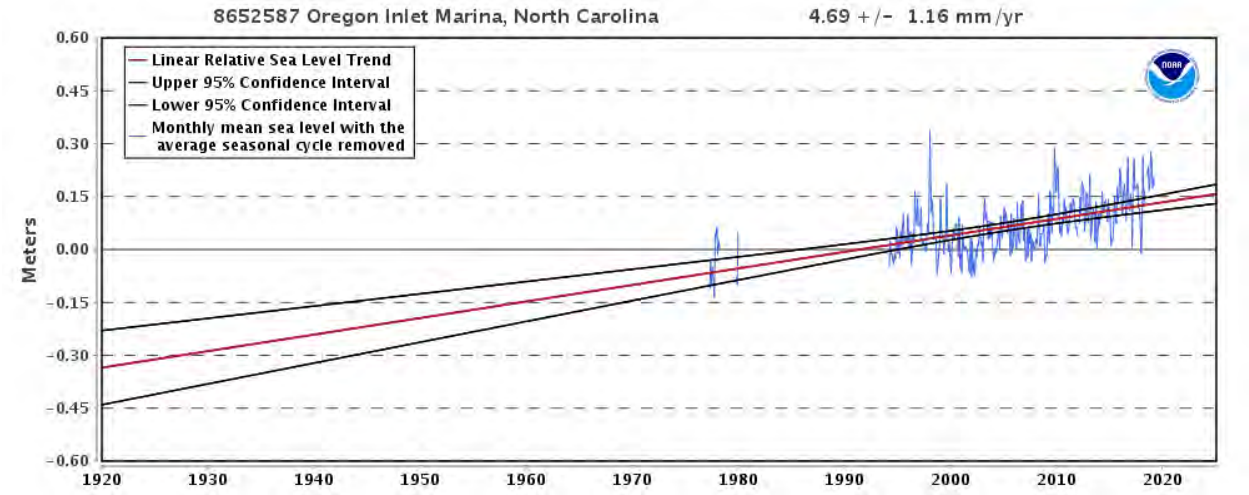
Figure 4.13 and Figure 4.14 show the monthly mean sea level at NOAA's Duck, NC and Oregon Inlet Marina, NC stations, respectively, without the regular seasonal fluctuations due to coastal ocean temperatures, salinities, winds, atmospheric pressures, and ocean currents. The long-term linear trend is also shown, including its 95% confidence interval. The plotted values are relative to the most recent Mean Sea Level datum established by CO-OPS.

Figure 4.13 – Mean Sea Level Trends, Duck, NC



Source: NOAA Tides and Currents, June 2019

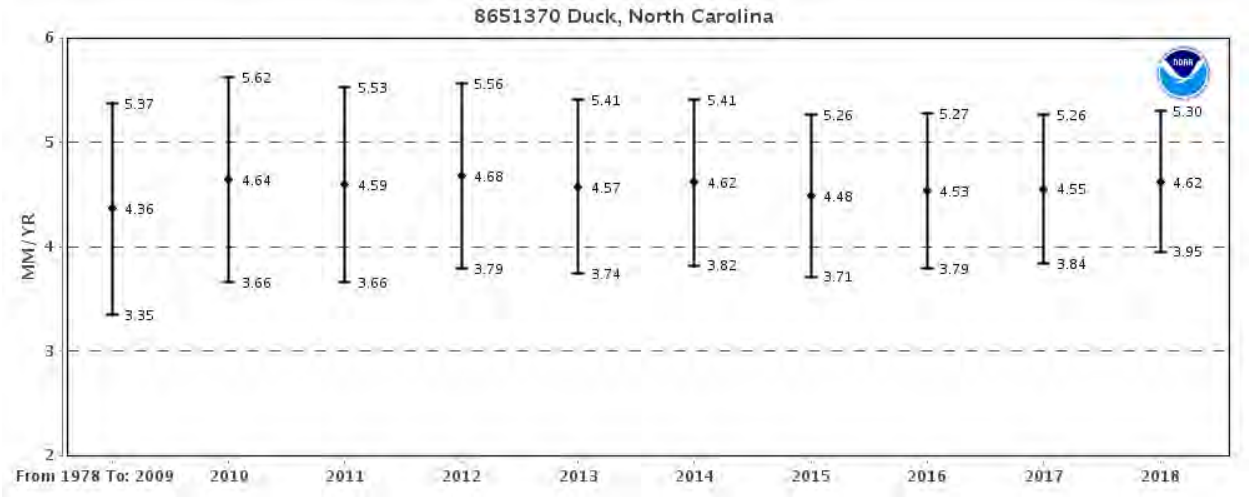
Figure 4.14 – Mean Sea Level Trends, Oregon Inlet Marina, NC



Source: NOAA Tides and Currents, June 2019

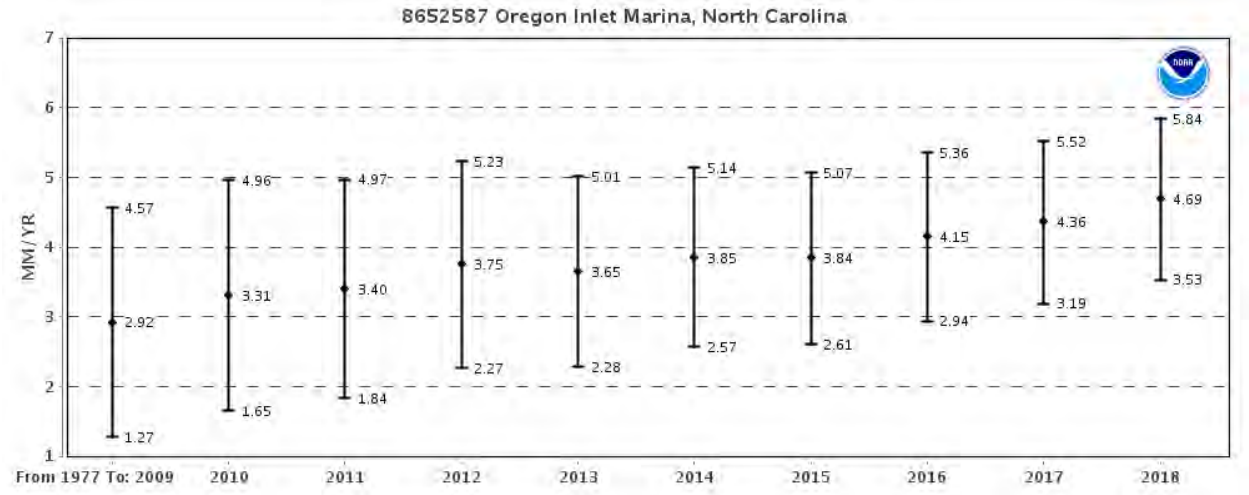
Figure 4.15 and Figure 4.16 on the following page shows this trend compared with previous mean sea level trends. The values indicate the trend of the entire data period up to the given year. As such, each year's trend estimate is more precise than previous years' estimates. The sea level trend through 2018 at the Duck tide gauge is 4.62 mm/year with a 95% confidence interval of 3.95 mm/yr. to 5.30 mm/yr. At the Oregon Inlet Marina tide gauge, the trend is 4.69 mm/yr. with a 95% confidence interval of 3.53 mm/yr. to 5.84 mm/year.

Figure 4.15 – Previous Mean Sea Level Trends for Duck, NC



Source: NOAA Tides and Currents, June 2019

Figure 4.16 – Previous Mean Sea Level Trends, Oregon Inlet Marina, NC



Source: NOAA Tides and Currents, June 2019

Probability of Future Occurrence

The U.S. Army Corps of Engineers (USACE) has provided guidance to evaluate designs over a project's life cycle in order to account for the rise of global mean sea level (USACE, 2014). The USACE guidance is based on original guidance by the National Research Council (NRC, 1987). The 1987 NRC report recommended that feasibility studies for coastal projects consider the high probability of accelerating global mean sea level (GMSL) rise and provided three different acceleration scenarios through the year 2100. The NRC committee provided an equation for calculating sea level rise and recommended "projections be updated approximately every decade to incorporate additional data."

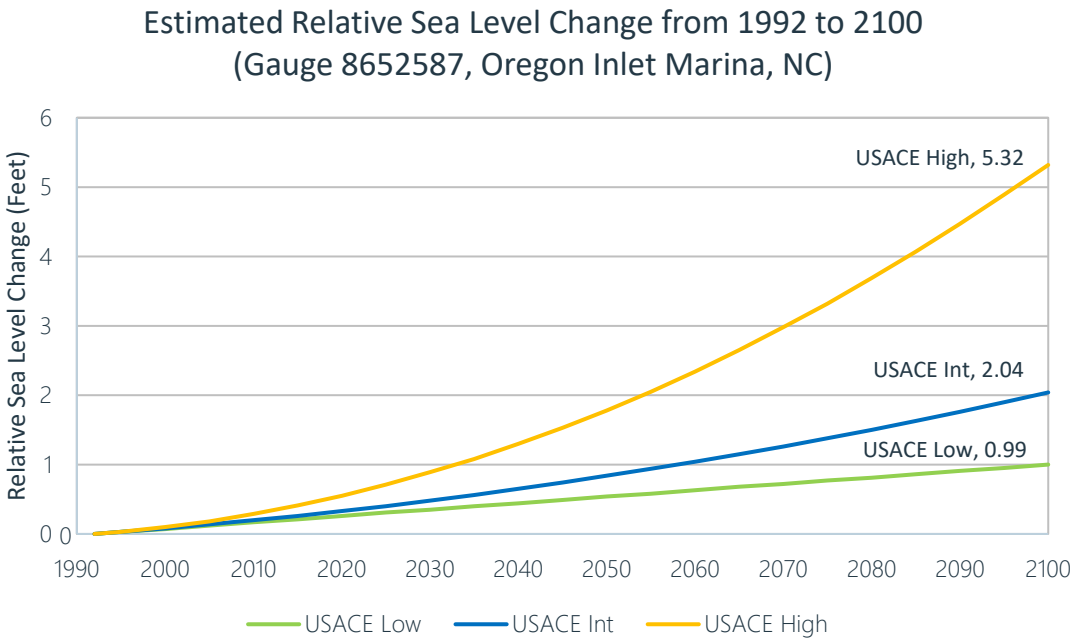
The USACE guidance adjusted the NRC equation to include the historic GMSL change rate of 1.7 mm/year as presented by the IPCC (IPCC, 2007) and the start date of 1992 (which corresponds to the midpoint of the National Tidal Datum Epoch of 1983-2001), instead of 1986 (the start date for NRC's equation). These changes resulted in values for the variable *b* being equal to 2.71E-5 for modified NRC Curve I, 7.00E-5 for modified NRC Curve II, and 1.13E-4 for modified NRC Curve III. The resulting equation is as follows:

$$E(t) = 0.0017m/yr*t + bt^2$$

In the above equation, t represents years, b is a constant, and E(t) is the relative sea-level change, in meters, as a function of t. The three updated GMSL rise acceleration scenarios are depicted in Figure 5.9 on the following page.

Based on the USACE guidance and data from the Oregon Inlet Marina, NC NOAA gauge, a projected sea level rise to be used for future planning decisions can be calculated. Figure 5.9 shows sea level rise projections for three scenarios from the USACE. The USACE Low curve uses the historic rate of sea level change as the rate, the USACE Intermediate curve uses the NRC Curve I modified by recent IPCC low emissions projections and the local rate of vertical land movement, and the USACE High curve uses the NRC Curve II modified by recent IPCC higher emissions projections and the local rate of vertical land movement. Given that the USACE Low curve does not consider further climate change, the USACE Intermediate and High curves are more likely. However, which of the curves is the more likely scenario depends on future emissions levels. Based on the more conservative estimate of the Intermediate curve, the Outer Banks Region should plan for 0.84 feet of sea level rise from 1992 levels by 2050.

Figure 4.17 – Sea Level Rise Projections for Outer Banks, NC (1992-2100)



Source: USACE, 2014

Probability: 3 – Likely

Climate Change

Sea level rise is a direct result of global climate change. Estimates for sea level rise are based on projected greenhouse gas emission levels and their associated impacts on global temperature change. Most sea level rise models do not fully account for ice melt, and therefore actual sea level rise may be significantly higher than current estimates suggest. As such, these projections contain substantial variability but are nonetheless important to consider when planning for coastal areas because they indicate where flooding can be expected should actual sea level rise meet estimated levels.

Vulnerability Assessment

Methodologies and Assumptions

Vulnerability to coastal hazards was assessed based on past occurrences nationally and internationally as well as data from NOAA, USGS, the Intergovernmental Panel on Climate Change (IPCC), and other sources.

In addition to the data presented below, the forthcoming Southeast Coastal Assessment from the United States Army Corps of Engineers (USACE) South Atlantic Division will provide supplementary data and details through a comprehensive coastal shoreline risks and needs assessment. This tool will look at four hazards (hurricanes and storms, long-term erosion, flooding, and potential sea level rise) and how they will impact population, the built environment, and the natural environment.

People

Erosion is unlikely to have any direct impact on the health or safety of individuals. However, it may cause indirect harm by weakening structures and by changing landscapes in ways that increase risk of other hazard impacts. For example, erosion of dune systems causes areas protected by those dunes to face higher levels of risk.

Rip currents pose a direct risk to human health and safety. Individuals who do not know how to recognize and avoid or escape rip currents are at risk of drowning. Since 1999, NCEI records 24 fatalities attributed to rip currents in the Region.

Sea level rise will lead to increased flooding and the associated harms to humans, such as illness, or injury or death from driving into flooded waters and drowning.

Property

Property damage due to erosion typically only results in conjunction with large storm events which also bring wind and water damages. These events can cause scour and weaken foundations, which may undermine affected buildings' structural integrity.

Rip current is unlikely to result in any property damages, though it may result in indirect damages to watercrafts by pushing them into jetties or sandbars.

The increased number of flood days and general encroachment of shoreline associated with sea level rise will likely cause property damage, although it is unclear exactly what this will look like. Homes, businesses and vehicles will be susceptible to increased water damage. Homes within the areas that may be inundated will potentially be uninhabitable. Additionally, rising seas, and associated increased flood days, can overwhelm and undermine the effectiveness of stormwater drainage system and other infrastructure, such as roads and bridges.

Environment

Erosion can change the shape and characteristics of coastal shorelines and riverine floodplains. Eroded material may clog waterways and decrease drainage capacity. Erosion can also negatively impact water quality by increasing sediment loads in waterways.

Sea level rise can have numerous negative consequences on the environment including increased erosion and all impacts associated with that. Another concern is the inundation of normally dry land, which could lead to the loss of marshes and wetlands and the positive benefits associated with those areas. These areas buffer against waves and storm surge, protect from erosion and even encourage accretion, and provide natural wildlife habitats. Finally, sea level rise may lead to saltwater intrusion as the groundwater table may also rise, potentially leading to contaminated drinking and agriculture water.

Consequence Analysis

Table 4.17 summarizes the potential negative consequences of coastal hazards.

Table 4.17 – Consequence Analysis - Coastal Hazards

Category	Consequences
Public	Rip currents may cause Injuries or fatalities. Erosion is unlikely to impact public health and safety. Sea Level Rise may cause increased flooding which may lead to illness, injury, or death. Additionally, sea level rise may cause psychological stress from loss of home, economy, and culture.
Responders	If properly trained, responders are unlikely to suffer injuries or fatalities from rip currents. Erosion is unlikely to require immediate response or rescue operations.
Continuity of Operations (including Continued Delivery of Services)	Erosion and rip tides are unlikely to impact public continuity of operations. As sea levels rise and cause more regular, chronic flooding, continuity of operations, such as delivery of services may be interrupted due to localized disruption of roads, facilities, and/or utilities.
Property, Facilities and Infrastructure	Rip current is unlikely to damage property but may result in indirect damages to watercrafts. Erosion can result in property damage if it is severe enough or if

Category	Consequences
	scour occurs that undermines the integrity of structural foundations. Sea level rise can cause damage to property as flooding becomes more regular in the short term and as sea levels continue to rise in the long term. SLR can also compromise infrastructure such as drainage systems and roads.
Environment	Rip current will not have severe environmental consequences. Erosion can increase sediment loads in waterbodies and change riverine and coastal topography. Sea level rise can lead to increased erosion, salt water intrusion, and inundation of wetlands and previous dry land.
Economic Condition of the Jurisdiction	Rip current and severe erosion can negatively impact tourist economies. Beach nourishment projects to counter erosion are extremely costly. Sea level rise can severely disrupt the economy, particularly in a region that relies so heavily on tourism.
Public Confidence in the Jurisdiction's Governance	Coastal hazards are unlikely to impact public confidence.

Hazard Summary by Jurisdiction

The following table summarizes coastal hazard risk by jurisdiction. Where priority ratings vary between erosion, rip current, and sea level rise, for all priority categories, these scores represent an average rating. Risk to coastal hazards is overwhelmingly uniform across the region. Due to the geography and tourist-based economy of the region as a whole, all jurisdictions are likely to experience similar impacts from the coastal hazards presented in this section, although there will still be some variation. For example, jurisdictions with more frequented beaches are likely to see a higher impact due to rip current or could currently be experiencing a slower rate of erosion.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	Score	Priority
Currituck County	3	3	3	2	3	2.9	H
Dare County	3	3	3	2	3	2.9	H
Duck	3	3	3	2	3	2.9	H
Kill Devil Hills	3	3	3	2	3	2.9	H
Kitty Hawk	3	3	3	2	3	2.9	H
Manteo	3	2	3	2	3	2.6	H
Nags Head	3	3	3	2	3	2.9	H
Southern Shores	3	3	3	2	3	2.9	H

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 4.18.

Table 4.18 – Drought Classifications

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.

Source: National Drought Mitigation Center

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

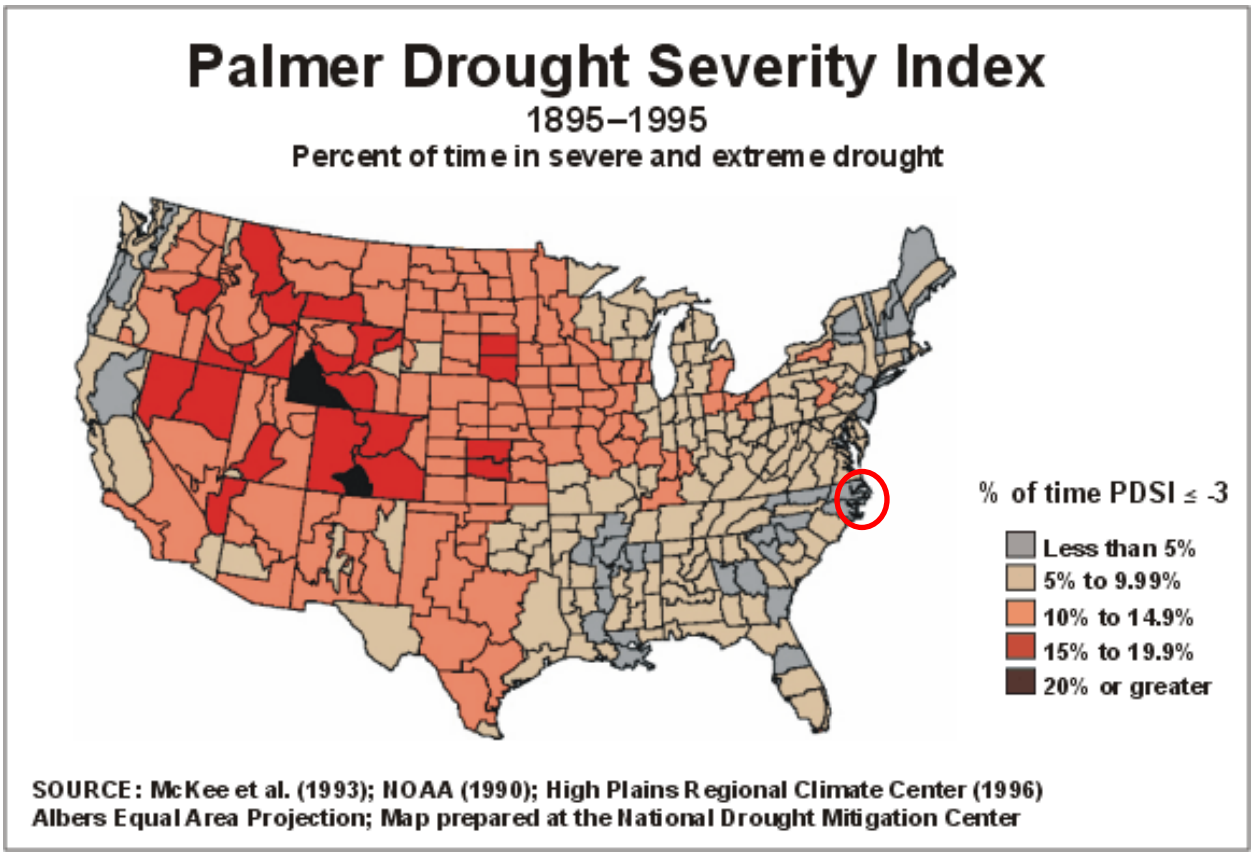
Duration: 4 – More than one week

Location

Typically, the National Weather Service looks at drought and extreme heat as episodes that impact a widespread forecast "zone," and therefore it is not common to pinpoint a specific location within a planning area that is more susceptible to these hazards than others. From this viewpoint, each county is considered uniformly at risk to drought and extreme heat. However, the most significant financial losses are likely to occur in areas that are primarily agricultural. Areas with water-dependent recreational economies are also at higher risk.

Figure 4.18 shows the Palmer Drought Severity Index (PDSI) summary map for the United States from 1895 to 1995. PDSI drought classifications are based on observed drought conditions and range from -0.5 (incipient dry spell) to -4.0 (extreme drought). As can be seen, the Eastern United States has historically not seen as many significant long-term droughts as the Central and Western regions of the country. Specifically, the Outer Banks Region was in drought less than 5% of the identified timeframe.

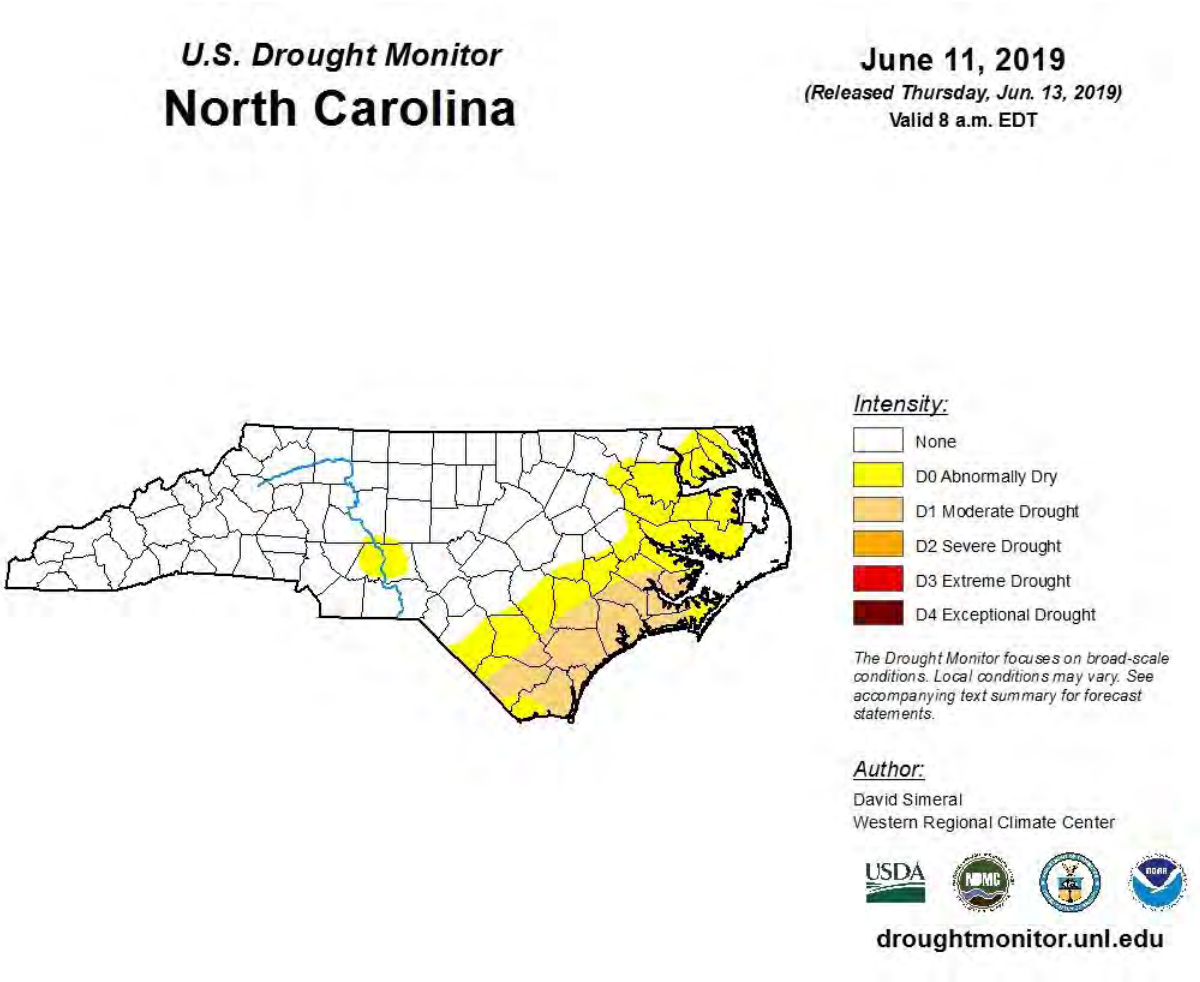
Figure 4.18 – PDSI 1895-1995, Percent of Time in Severe and Extreme Drought



Source: United States Geological Survey; Outer Banks region noted by red circle

Figure 4.19 notes the U.S. Drought Monitor's drought ratings for North Carolina as of June 11, 2019; as of that date, neither Currituck County nor Dare County were experiencing any conditions of drought. However, this map illustrates the regional nature of drought when it does occur.

Figure 4.19 – 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 4.20 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 4.20 – US Drought Monitor Classifications

Category	Description	Possible Impacts	Ranges				
			Palmer Drought Severity Index (PDSI)	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Drought Indicator Blends (Percentiles)
D0	Abnormally Dry	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

The Outer Banks Region is susceptible to any of these levels of drought. The most severe period of drought in the past 20 years occurred in the summer of 2011 and reached extreme drought across 100% of Dare County and 15% of Currituck County.

Impact: 1 – Minor

Spatial Extent: 4 – Large

Historical Occurrences

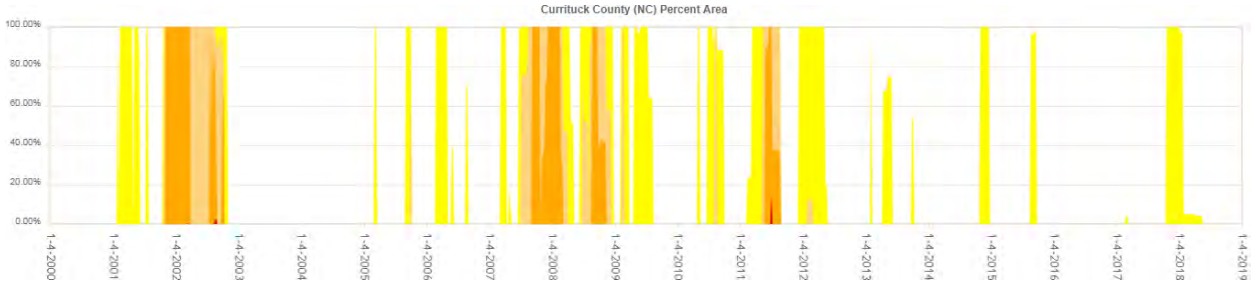
The U.S. Drought Monitor provides historical data on droughts in both Currituck and Dare Counties. The following figures show historical periods where each county was considered in some level of drought condition. The color key shown in Figure 4.20 indicates the intensity of the drought.

According to the U.S. Drought Monitor, between January 1, 2000 and December 31, 2018, Currituck County was in some level of drought condition 67% of the time, or 668 of 992 weeks. The majority of this time was spent in "abnormally dry" or "moderate" drought conditions; Currituck County recorded four weeks in "extreme" drought:

- Week of July 5, 2011 – 14.94% of county in extreme drought
- Week of August 20, 2002 – 2.28% of county in extreme drought
- Week of August 27, 2002 – 2.41% of county in extreme drought
- Week of March 12, 2002 - 0.65% of county in extreme drought

The 2002 drought lasted 55 weeks, between the week of October 16, 2001 and the week of October 29, 2002.

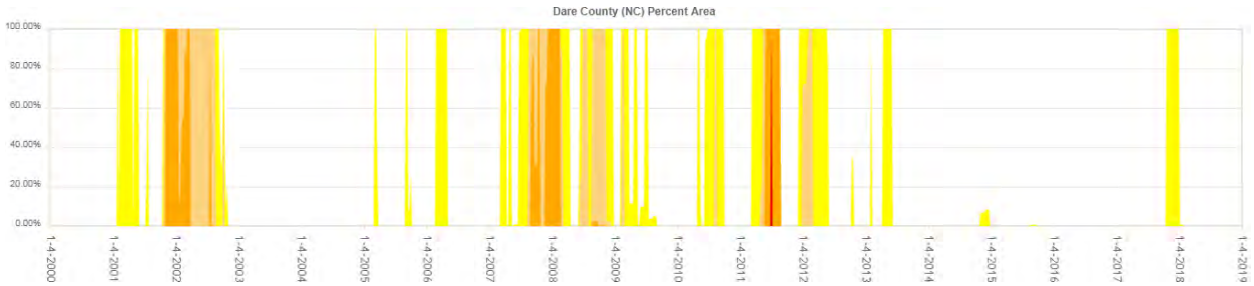
Figure 4.21 – US Drought Monitor Historical Trends – Currituck County 2000-2018



Source: U.S. Drought Monitor

According to the U.S. Drought Monitor, between January 1, 2000 and December 31, 2018, Dare County was in some level of drought condition 32% of the time, or 309 of 992 weeks. The majority of this time was spent in "abnormally dry" or "moderate" drought conditions; Dare County recorded one instance during the week of July 5, 2011 where 100% of the land area was considered in "extreme drought." This corresponded to a larger drought event lasting from March through August of 2011.

Figure 4.22 – US Drought Monitor Historical Trends – Dare County 2000-2018



Source: U.S. Drought Monitor

Probability of Future Occurrence

Based on historical occurrences, the probability that the Region will experience some level of drought is likely, with Dare County in drought 32 percent of the time during the period from 2000 through 2018 and Currituck County in drought 67 percent of the time during that same period. However, the probability of extreme drought is much lower, with only one instance of extreme drought in Dare County and four instances of extreme drought in Currituck County. Overall, drought in the Outer Banks can be considered possible.

Probability: 2 – Possible

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

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

People

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 Currituck County was $616,664, or an average of $56,060 in losses every year. There were $18,449 in recorded losses in Dare County, all occurring in 2016. Table 4.19 summarizes the crop losses due to drought in reported in the RMA system.

Table 4.19 – Crop Losses Resulting from Drought, 2007-2017, Outer Banks

Year	Determined Acres	Indemnity Amount
Currituck County		
2007	948.60	$84,250.00
2008	1,590.10	$75,505.00
2009	388.90	$18,154.00
2010	703.08	$33,932.00
2011	3,055.63	$240,606.00
2013	699.40	$55,230.00
2014	123.80	$1,534.00
2015	947.37	$71,537.10
2016	156.60	$18,449.50
2017	395.70	$17,466.00
Subtotal Currituck	**9,009.18**	**$616,663.60**
Dare County		
2016	156.60	$18,449.50
Region Total	**9,165.78**	**$635,113.10**

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 4.20 summarizes the potential negative consequences of drought.

Table 4.20 – 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.
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. Warning time, duration and spatial extent are inherent to the hazard and remain constant across jurisdictions. The majority of damages that result from drought are to crops and other agriculture-related activities as well as water-dependent recreation industries. The magnitude of the impacts is typically greater in unincorporated areas thus impacts are likely higher in Currituck County, which has also experienced more crop losses due to drought. In developed areas, the magnitude of drought is less severe, with lawns and local gardens affected and potential impacts on local water supplies during severe, prolonged drought.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	Score	Priority
Currituck County	2	2	4	1	4	2.5	H
Dare County	2	1	4	1	4	2.2	M
Duck	2	1	4	1	4	2.2	M
Kill Devil Hills	2	1	4	1	4	2.2	M

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	Score	Priority
Kitty Hawk	2	1	4	1	4	2.2	M
Manteo	2	1	4	1	4	2.2	M
Nags Head	2	1	4	1	4	2.2	M
Southern Shores	2	1	4	1	4	2.2	M

4.5.3 Earthquake

Hazard Background

Earthquake

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.

Tsunami

Per the National Oceanic and Atmospheric Administration's Tsunami Warning Centers, a tsunami is a powerful and destructive natural force. It is a series of extremely long waves, tens-to-hundreds of miles between crests, caused by a large and sudden displacement of the ocean. Tsunamis radiate outward in all directions from the disturbance and can cause dangerous coastal flooding and current for several hours to days when they reach the coast. Tsunamis are most commonly caused by earthquakes below or near the ocean floor but can also be generated by non-seismic disturbances such as landslides or certain types of weather. Much like earthquakes, scientists cannot accurately predict when a tsunami will strike, but the Tsunami Warning Centers know which earthquakes are likely to generate tsunamis and can issue a warning.

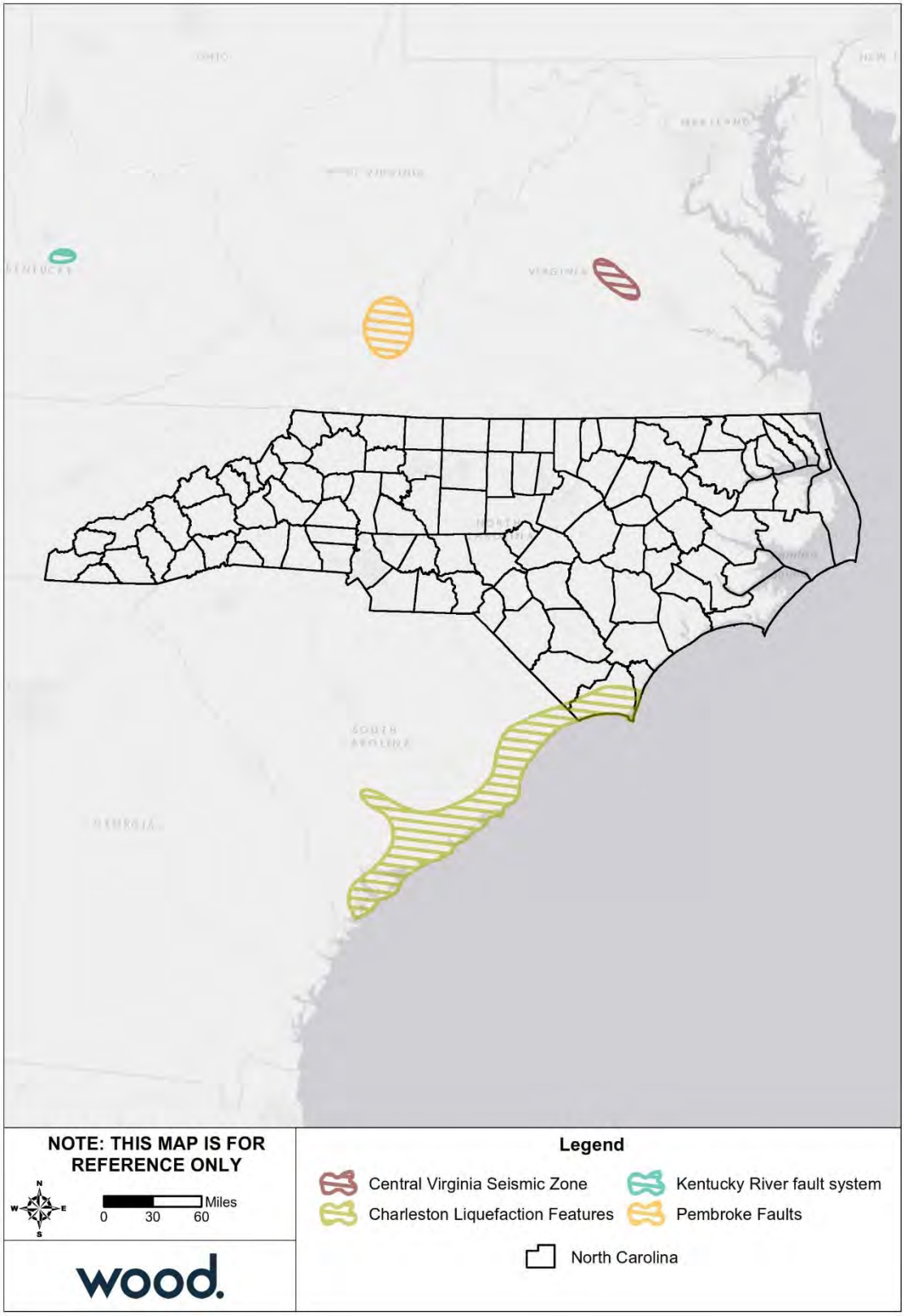
Warning Time: 4 – Less than six hours

Duration: 1 – Less than six hours

Location

Figure 4.23 reflects the Quaternary faults that present an earthquake hazard for the Outer Banks planning area based on data from the USGS Earthquake Hazards Program.

Figure 4.23 – 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

Earthquake

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 4.21. 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 4.22 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 4.21 – 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 4.22 – 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.

MMI	Richter Scale	Felt Intensity
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 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.

Tsunami

Tsunamis can be measured based on their size, speed, and number of waves, but tsunamis are generally described by their heights at the shore and the maximum runup of the tsunami waves on the land. NOAA developed and deployed DART – Deep-Ocean Assessment and Reporting of Tsunamis. DART is a tsunamograph that provides accurate, real-time data on tsunamis. There is an intensity scale – the New Tsunami Intensity Scale, which was introduced in 2001 by Papadopoulos and Umamura – but it is rarely used today.

Impact: 1 – Minor

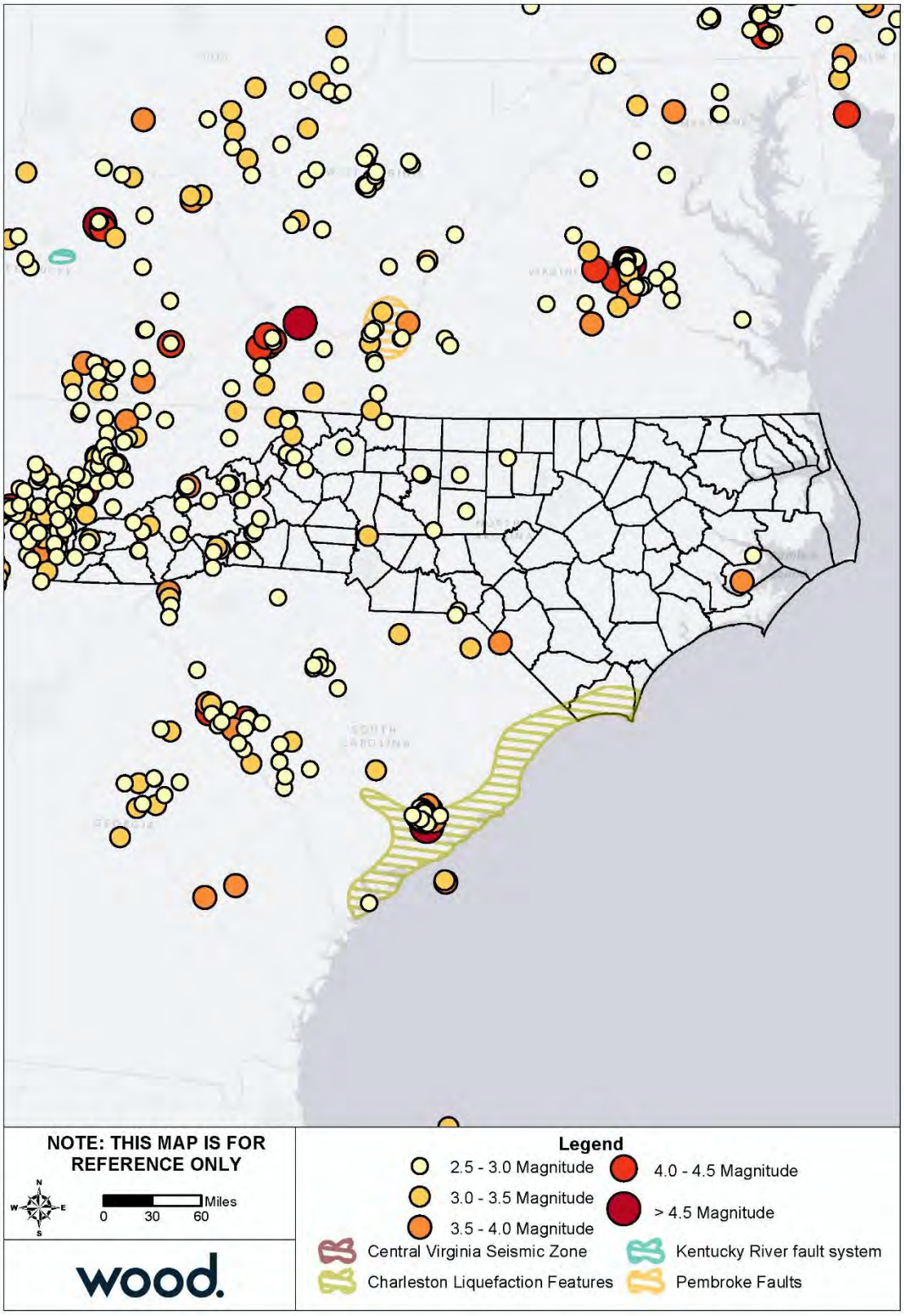
Spatial Extent: 4 – Large

Historical Occurrences

Earthquake

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 4.24 shows historical earthquakes by magnitude in relation to North Carolina and the Quaternary Faults identified by USGS. This includes events from 1973 to 2019.

Figure 4.24 – Historical Earthquakes by Magnitude, 1973-2019



Source: USGS Earthquakes Hazard Program

The above map documents all earthquakes that have occurred within North Carolina but given the long distances across which earthquake impacts can be felt, these events do not encompass all earthquakes that have affected North Carolina. USGS maintains a "Did You Feel It?" (DYFI) database to collect information from people who felt an earthquake and create maps that show what people experienced and the extent of damage. However, there are no records in the past 50 years of any felt earthquake impacts in the Outer Banks Region.

Tsunami

According to NOAA, 30 reported tsunamis that caused at least 1 death or $1 million in damage have affected the United States. Of these, none have impacted the Atlantic Coast.

Probability of Future Occurrence

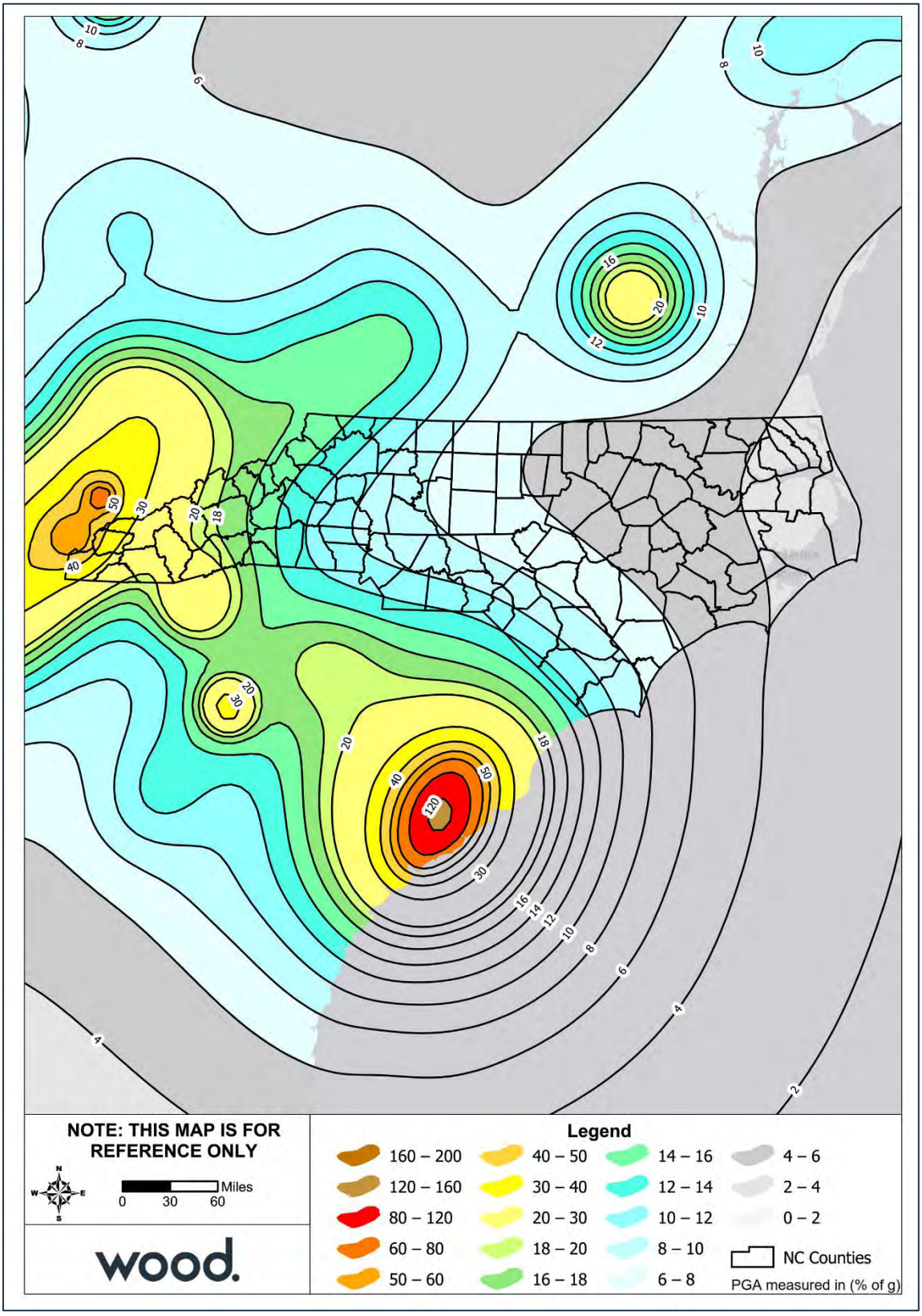
Earthquake

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

Therefore, for the given probability of exceedance, two percent, the locations shaken more frequently will have larger ground motions. The Outer Banks are located within the light gray zone representing a low peak acceleration of 0.02 to 0.04 g.

Figure 4.25 – Seismic Hazard Information for North Carolina



Source: USGS Earthquake Hazards Program

Based on this data, it can be reasonably assumed that an earthquake affecting the Outer Banks is unlikely.

Tsunami

An assessment done by the National Tsunami Hazard Mitigation Program ranks the likelihood of a tsunami event on the Atlantic Coast as very low to low. There is no subduction zone along the Atlantic Coast and earthquakes are not as large or as frequent. Underwater landslides are the most likely source of tsunami waves in the region. Per the region's previous plan, cracks have been discovered in the continental shelf off the coast of North Carolina and Virginia. Such cracks, according to NCEM, suggest instability in the continental shelf. If the sea floor falls, it could result in a tsunami.

Probability: 1 – Unlikely

Climate Change

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

Vulnerability Assessment

People

Earthquake events in the Outer Banks 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 4.23 and Table 4.24 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 4.23 – 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
Currituck									
Currituck County	23,540	0	0%	3,041	0	0%	1,329	0	0%
Dare									
Unincorporated Dare County	16,893	0	0%	2,574	0	0%	916	0	0%
Town of Duck	369	0	0%	56	0	0%	20	0	0%
Town of Kill Devil Hills	6,635	0	0%	1,011	0	0%	360	0	0%
Town of Kitty Hawk	3,270	0	0%	498	0	0%	177	0	0%
Town of Manteo	1,258	0	0%	192	0	0%	68	0	0%
Town of Nags Head	2,786	0	0%	425	0	0%	151	0	0%
Town of Southern Shores	2,695	0	0%	411	0	0%	146	0	0%
Subtotal Dare	**33,906**	**0**	0%	**5,167**	**0**	0%	**1,838**	**0**	0%
Region Total	**57,446**	**0**	0%	**8,208**	**0**	0%	**3,167**	**0**	0%

Source: NCEM Risk Management Tool

Table 4.24 – 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
Currituck									
Currituck County	23,540	5,587	23.7%	3,041	722	23.7%	1,329	315	23.7%
Dare									
Unincorporated Dare County	16,893	716	4.2%	2,574	109	4.2%	916	39	4.3%
Town of Duck	369	0	0%	56	0	0%	20	0	0%
Town of Kill Devil Hills	6,635	67	1%	1,011	10	1%	360	4	1.1%
Town of Kitty Hawk	3,270	36	1.1%	498	6	1.2%	177	2	1.1%
Town of Manteo	1,258	44	3.5%	192	7	3.6%	68	2	2.9%
Town of Nags Head	2,786	37	1.3%	425	6	1.4%	151	2	1.3%
Town of Southern Shores	2,695	2	0.1%	411	0	0%	146	0	0%
Subtotal Dare	**33,906**	**902**	**2.7%**	**5,167**	**138**	**2.7%**	**1,838**	**49**	**2.7%**
Region Total	**57,446**	**6,489**	**11.3%**	**8,208**	**860**	**10.5%**	**3,167**	**364**	**11.5%**

Source: NCEM Risk Management Tool

Property

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

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

The Outer Banks have not been impacted by an earthquake with more than a moderate intensity, so damage to the built environment is unlikely.

Table 4.25 through Table 4.26 detail the estimated buildings impacted from varying magnitudes of earthquake events.

Table 4.25 – 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
Currituck													
Currituck County	17,069	0	0%	$0	1	0%	$7	0	0%	$0	1	0%	$7
Dare													
Unincorporated Dare County	13,634	0	0%	$0	0	0%	$0	0	0%	$0	0	0%	$0
Town of Duck	2,400	0	0%	$0	0	0%	$0	0	0%	$0	0	0%	$0
Town of Kill Devil Hills	5,972	0	0%	$0	0	0%	$0	0	0%	$0	0	0%	$0
Town of Kitty Hawk	2,803	0	0%	$0	0	0%	$0	0	0%	$0	0	0%	$0
Town of Manteo	918	0	0%	$0	0	0%	$0	0	0%	$0	0	0%	$0
Town of Nags Head	4,827	0	0%	$0	0	0%	$0	0	0%	$0	0	0%	$0
Town of Southern Shores	2,496	0	0%	$0	0	0%	$0	0	0%	$0	0	0%	$0
Subtotal Dare	**33,050**	**0**	**0%**	**$0**	**0**	**0%**	**$0**	**0**	**0%**	**$0**	**0**	**0%**	**$0**
Region Total	**50,119**	**0**	**0%**	**$0**	**1**	**0%**	**$7**	**0**	**0%**	**$0**	**1**	**0%**	**$7**

Source: NCEM Risk Management Tool

Table 4.26 – 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
Currituck													
Currituck County	17,069	3,645	21.40%	$11,719	1,339	7.80%	$49,714	180	1.10%	$17,096	5,164	30.30%	$78,529
Dare													
Unincorporated Dare County	13,634	531	3.90%	$1,133	249	1.80%	$5,462	75	0.60%	$3,724	855	6.30%	$10,319
Town of Duck	2,400	0	0%	$0	26	1.10%	$195	3	0.10%	$162	29	1.20%	$357
Town of Kill Devil Hills	5,972	43	0.70%	$507	93	1.60%	$3,424	6	0.10%	$813	142	2.40%	$4,744
Town of Kitty Hawk	2,803	29	1%	$119	37	1.30%	$1,103	7	0.20%	$386	73	2.60%	$1,608
Town of Manteo	918	24	2.60%	$156	45	4.90%	$1,205	16	1.70%	$801	85	9.30%	$2,162
Town of Nags Head	4,827	37	0.80%	$1,032	79	1.60%	$4,038	9	0.20%	$300	125	2.60%	$5,370
Town of Southern Shores	2,496	2	0.10%	$32	15	0.60%	$337	1	0%	$36	18	0.70%	$405
Subtotal Dare	**33,050**	**666**	**2.02%**	**$2,979**	**544**	**1.65%**	**$15,764**	**117**	**0.35%**	**$6,222**	**1,327**	**4.02%**	**$24,965**
Region Total	**50,119**	**4,311**	**8.60%**	**$14,698**	**1,883**	**3.76%**	**$65,478**	**297**	**0.59%**	**$23,318**	**6,491**	**12.95%**	**$103,494**

Source: NCEM Risk Management Tool

Environment

An earthquake is unlikely to cause substantial impacts to the natural environment in the Outer Banks. 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 4.27 summarizes the potential negative consequences of earthquake.

Table 4.27 – Consequence Analysis - Earthquake

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

Hazard Summary by Jurisdiction

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

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	Score	Priority
Currituck County	1	1	4	4	1	1.9	L
Dare County	1	1	4	4	1	1.9	L
Duck	1	1	4	4	1	1.9	L
Kill Devil Hills	1	1	4	4	1	1.9	L
Kitty Hawk	1	1	4	4	1	1.9	L
Manteo	1	1	4	4	1	1.9	L
Nags Head	1	1	4	4	1	1.9	L
Southern Shores	1	1	4	4	1	1.9	L

4.5.4 Extreme Heat

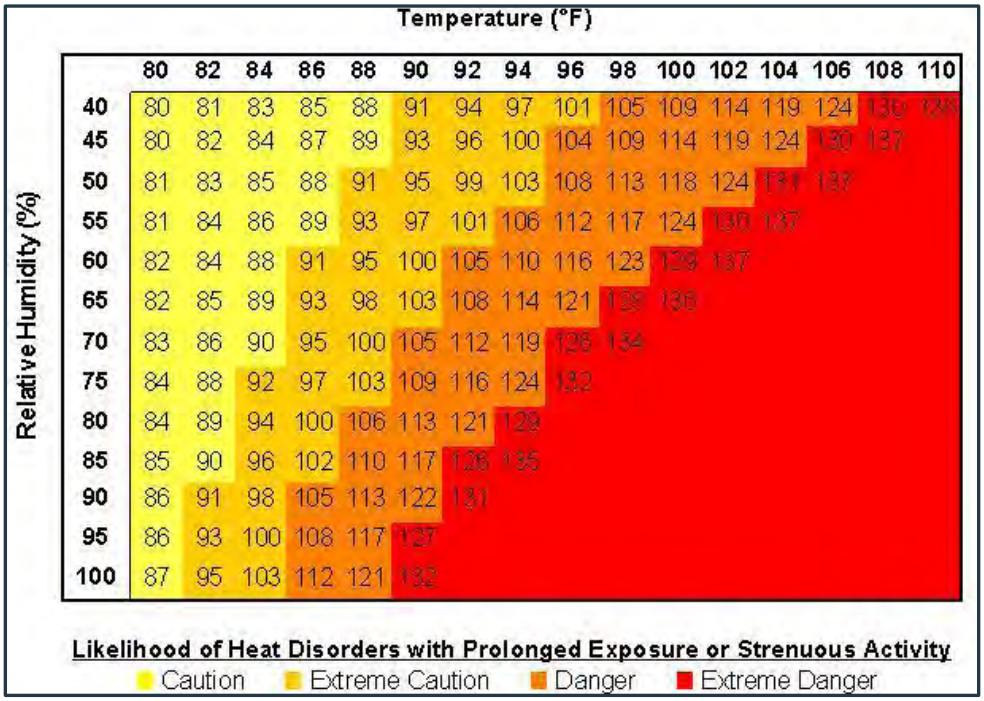
Hazard Background

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 is slowed, and the body must work extra hard to maintain a normal temperature, which can lead to death by overwork of the body. Extreme heat often results in the highest annual number of deaths among all weather-related disasters. Per Ready.gov:

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

Ambient air temperature is one component of heat conditions, with relative humidity being the other. The relationship of these factors creates what is known as the apparent temperature. The Heat Index Chart in Figure 4.26 uses both of these factors to produce a guide for the apparent temperature or relative intensity of heat conditions.

Figure 4.26 – 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 4.28 lists typical symptoms and health impacts of exposure to extreme heat.

Table 4.28 – 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 night time minimum Heat Index is 80°F or above for two or more consecutive days. A heat advisory is issued when temperatures reach 105 degrees and a warning is issued at 115 degrees.

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

Warning Time: 1 – More than 24 hours

Duration: 3 – Less than one week

Location

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

Extent

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

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

Based on data from the North Carolina Climate Office, from January 1893 through January 2019, the highest temperature recorded in Dare County was 103°F in Manteo, which occurred in August 1942.

Impact: 2 – Limited

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 NCEI reports two heat incidents occurring in the Outer Banks, both in Currituck County; these incidents caused no injuries, fatalities, property damage or crop damage. The following event narratives are provided in the NCEI Storm Events Database:

July 21, 2011 – An extended period of excessive heat and humidity occurred across most of northeast North Carolina from July 21st to July 23rd. High temperatures ranged from 96 to 103 degrees during the afternoons, with heat index values ranging from 110 to 119. Overnight lows only fell into the lower 70s to lower 80s.

July 5, 2012 – High Pressure centered just to the west of the Middle Atlantic Region produced hot and humid weather over northeast North Carolina from July 5th through 8th. High temperatures ranged from the mid-90s to lower 100s, and low temperatures ranged from the mid-70s to lower 80s across the area.

Heat index records maintained by the North Carolina Climate Office indicate that the Region regularly experiences heat index temperatures above 100°F. Table 4.29 – Historical Heat Index Counts, Dare County Airport (KMQI) 2000-2018Table 4.29 and Table 4.30 provide counts of heat index values by threshold recorded from 2000-2018 at the Dare County Airport weather station (KMQI) and from 2004-2018 at the First Flight Airport weather station (KFFA), respectively, used as indicators for the Outer Banks overall. Counts are provided as the number of hours in a given year where the heat index reached or exceeded 100°F.

Table 4.29 – Historical Heat Index Counts, Dare County Airport (KMQI) 2000-2018

Year	Heat Index Value				Total
	100-104°F	105-109°F	110-114°F	≥115°F	
2000	0	0	0	0	0
2001	49	3	1	0	53
2002	84	69	13	5	171
2003	75	18	3	1	97
2004	109	35	10	1	155
2005	68	86	20	10	184
2006	76	26	16	3	121
2007	53	24	7	11	95
2008	22	3	0	0	25
2009	46	0	0	0	46
2010	148	56	22	8	234
2011	64	17	6	0	87
2012	63	26	1	0	90
2013	10	1	0	0	11
2014	11	1	0	0	12
2015	49	12	0	0	61
2016	101	53	7	0	161
2017	36	9	0	0	45
2018	19	0	0	0	19
Sum	**1083**	**439**	**106**	**39**	**1667**
Average	**57**	**23**	**6**	**2**	**88**

Source: North Carolina Climate Office, Heat Index Climatology Tool

Table 4.30 – Historical Heat Index Counts, First Flight Airport (KFFA) 2004-2018

Year	Heat Index Value				Total
	100-104°F	105-109°F	110-114°F	≥115°F	
2004	0	0	0	0	0
2005	48	19	7	0	74
2006	132	41	27	14	214
2007	52	16	11	10	89
2008	51	12	3	0	66
2009	26	0	0	0	26
2010	82	44	13	0	139
2011	12	8	1	0	21
2012	28	2	0	0	30
2013	4	0	0	0	4
2014	17	1	0	0	18
2015	72	43	8	1	124
2016	148	105	53	28	334
2017	34	6	0	0	40
2018	8	0	0	0	8
Sum	**714**	**297**	**123**	**53**	**1187**
Average	**48**	**20**	**8**	**4**	**79**

Source: North Carolina Climate Office, Heat Index Climatology Tool

Probability of Future Occurrence

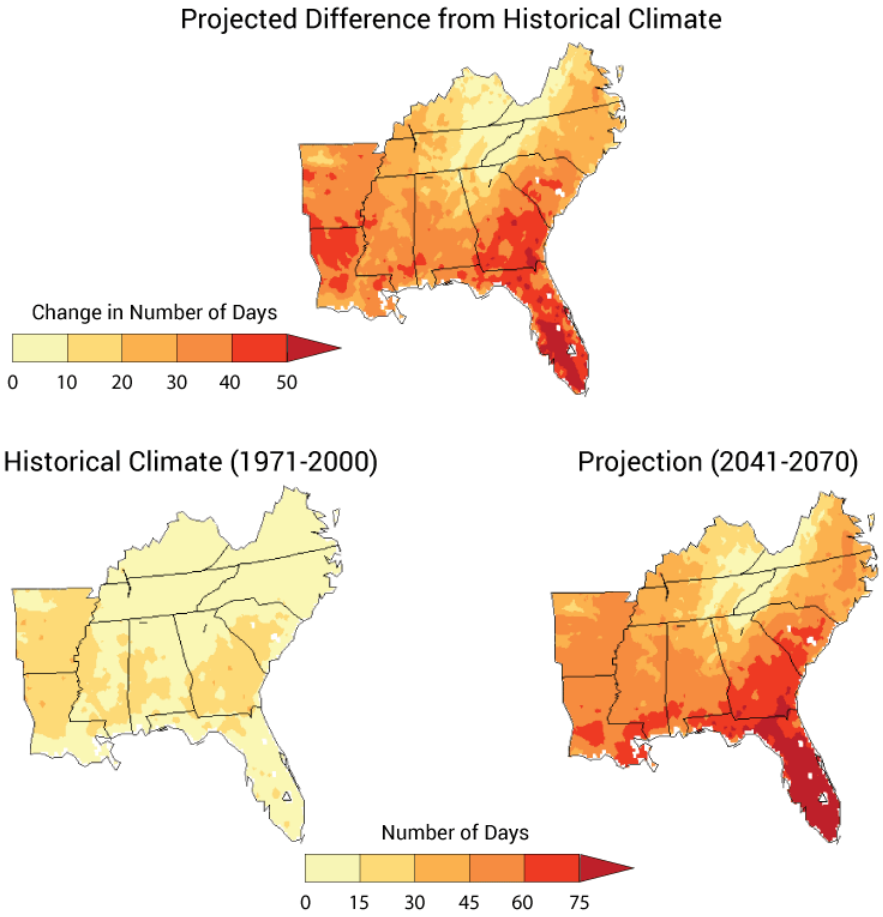
Data was gathered from the North Carolina State Climate Office's Heat Index Climatology Tool using the Dare County Airport and the First Flight Airport weather stations as approximations for the Outer Banks. Based on 19 and 15 years of available data, respectively, the Region averages 79-88 hours per year with heat index temperatures above 100°F. Heat index temperatures surpassed 100°F every year with the exception of 2000 at the Dare County Airport and 2004 at the First Flight Airport; this occurred for at least 10 hours per year at the Dare County Airport station and at least 4 hours per year at the First Flight Airport station.

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 Outer Banks 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 4.27.

Figure 4.27 – Projected Change in Number of Days Over 95°F



Source: NOAA NCDC from 2014 National Climate Assessment

Vulnerability Assessment

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.

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 agricultural losses. Between 2007-2017, the sum of claims paid for crop damage due to heat in Currituck County was $32,392, or an average of $2,944.73 in losses every year. Table 4.19 summarizes the crop losses due to drought in reported in the RMA system.

Table 4.31 – Crop Losses Resulting from Heat, 2007-2017

Year	Determined Acres	Indemnity Amount
Currituck		
2010	44.12	$3,563.00
2012	429.60	$28,829.00
Total	**473.72**	**$32,392.00**

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 4.32 summarizes the potential negative consequences of extreme heat.

Table 4.32 – Consequence Analysis - Extreme Heat

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

Hazard Summary by Jurisdiction

The following table summarizes extreme heat hazard risk by jurisdiction. Extreme heat risk does not vary significantly by jurisdiction.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	Score	Priority
Currituck County	4	2	4	1	3	3	H
Dare County	4	2	4	1	3	3	H
Duck	4	2	4	1	3	3	H
Kill Devil Hills	4	2	4	1	3	3	H
Kitty Hawk	4	2	4	1	3	3	H
Manteo	4	2	4	1	3	3	H
Nags Head	4	2	4	1	3	3	H
Southern Shores	4	2	4	1	3	3	H

4.5.5 Flood

Hazard Background

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

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

Sources and Types of Flooding

Flooding in the Outer Banks Region can be coastal or localized.

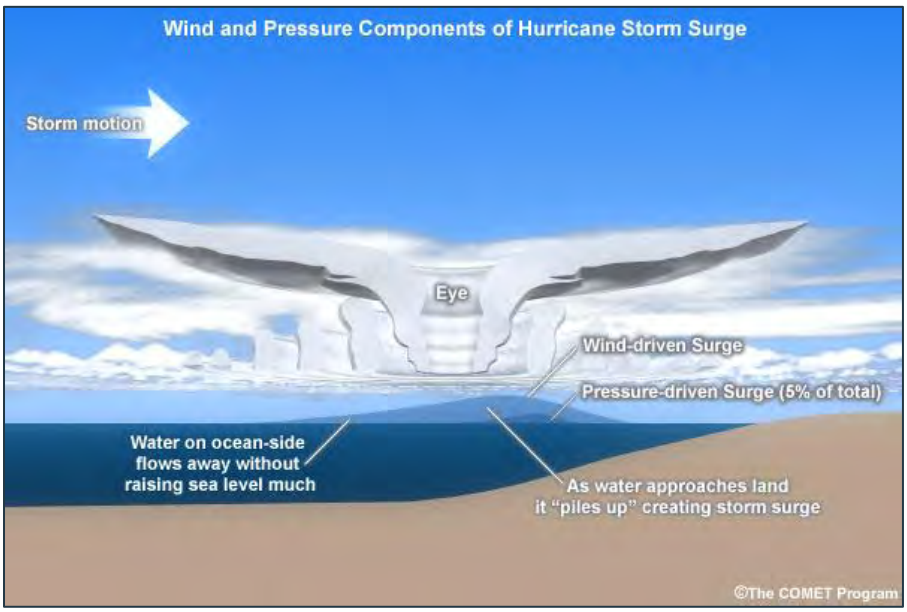
Coastal Flooding

All lands bordering the coast along the Atlantic Ocean and in low-lying coastal plains are susceptible to tidal effects and flooding. Coastal land such as sand bars, barrier islands and deltas provide a buffer zone that helps protect human life and real property relative to the sea much as floodplains provide a buffer zone along rivers and other bodies of water. Coastal floods usually occur because of abnormally high tides or tidal waves, storm surge and heavy rains in combination with high tides, and tropical storms and hurricanes. Nor'easters have also been found to contribute significantly to the overall storm-surge elevation in both Dare and Currituck Counties.

Storm Surge: Water that is pushed toward the shore by the force of the winds swirling around the storm as shown in Figure 4.28. This advancing surge combines with the normal tides to create the hurricane storm tide, which can increase the mean water level to heights impacting roads, homes and other critical infrastructure. In addition, wind driven waves are superimposed on the storm tide. This rise in water level can cause severe flooding in coastal areas, particularly when the storm tide coincides with the normal high tides.

The maximum potential storm surge for a location depends on several different factors. Storm surge is a very complex phenomenon because it is sensitive to the slightest changes in storm intensity, forward speed, size (radius of maximum winds-RMW), angle of approach to the coast, central pressure (minimal contribution in comparison to the wind), and the shape and characteristics of coastal features such as bays and estuaries. Other factors which can impact storm surge are the width and slope of the continental shelf and the depth of the ocean bottom. A narrow shelf, or one that drops steeply from the shoreline and subsequently produces deep water close to the shoreline, tends to produce a lower surge but higher and more powerful storm waves. The Outer Banks region has a narrow continental shelf, with mile-deep waters generally only 20-30 miles off the coast.

Figure 4.28 – Components of Hurricane Storm Surge



Source: NOAA/The COMET Program

Wind-driven surge generated in the Atlantic Ocean and pushed into Pamlico and Albemarle Sounds and other waters is a primary source of flooding in the Region. The wave action associated with storm surge can be even more damaging than the high water. The areas susceptible to surge flooding are summarized from each county's FIS as follows:

- **Currituck County:** Surge propagates from the Albemarle Sound into the North River and Currituck Sound.
- **Dare County:** Surge propagates from the Albemarle and Pamlico Sounds into the Alligator River, Croatan Sound, Currituck Sound, Davis Channel, East Lake, Old House Channel, Roanoke Sound, and South Lake.

During storm events in the Outer Banks, storm surge does not only occur on the Atlantic coast. It is not unusual for storm surge inundation to occur on the Sound Side of Outer Banks communities, as mentioned in the FIS. Surge side inundation can occur on the Currituck, Albemarle, and Pamlico Sounds. This was demonstrated in October 2019 when Tropical Storm Michael entered the sound and led to rapid sound side flooding equivalent to flood levels seen during Hurricane Matthew.

The Sea, Lake and Overland Surges from Hurricanes (SLOSH) model is a computerized numerical model developed by the National Weather Service to estimate storm surge heights resulting from historical, hypothetical, or predicted hurricanes by taking into account the atmospheric pressure, size, forward speed, and track data. These parameters are used to create a model of the wind field which drives the storm surge. The SLOSH model consists of a set of physics equations which are applied to a specific locale's shoreline, incorporating the unique bay and river configurations, water depths, bridges, roads, levees and other physical features. The model creates outputs for all different storm simulations from all points of the compass. Each direction has a MEOW (maximum envelope of water) for each category of storm (1-5), and all directions combined result in a MOMs (maximum of maximums) set of data.

NOAA SLOSH maps are provided in Section 4.4.6. to illustrate potential storm surge inundation resulting from each category of hurricane. However, the HMPC has noted that these models do not fully illustrate the potential impacts of sound side surge.

Inland Flooding:

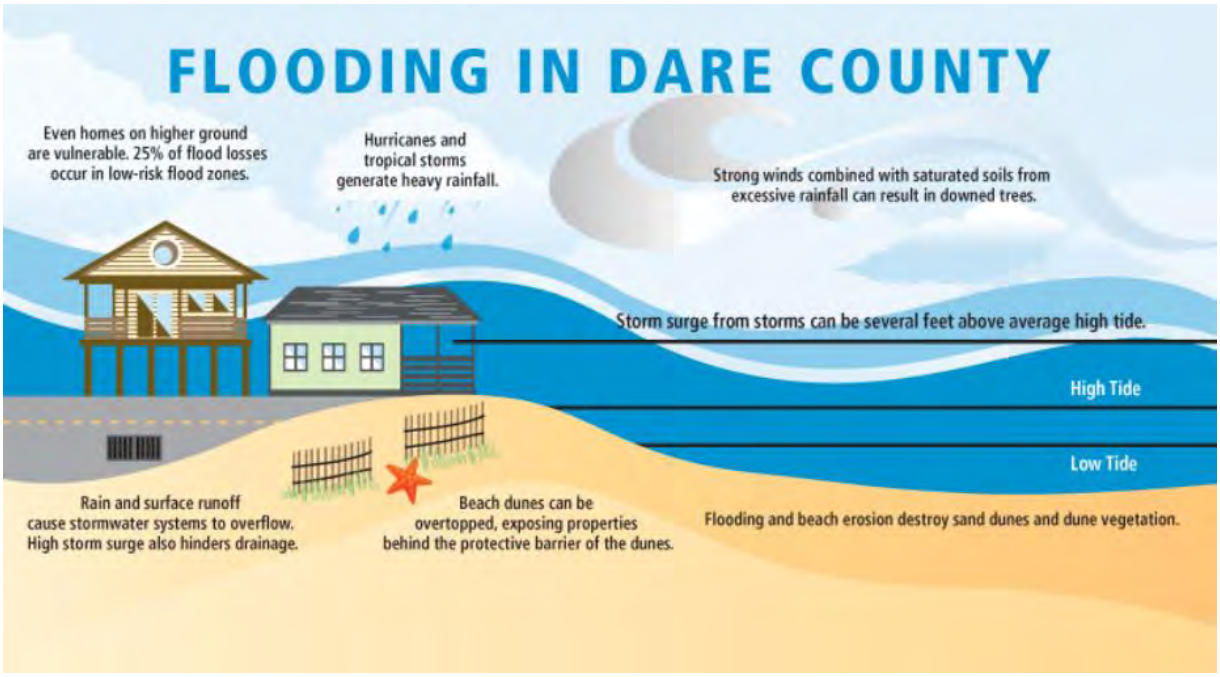
Coastal flooding and storm surge are not the only cause of flooding in the Outer Banks region. Inland flooding in the Region consists of flash flooding and localized stormwater flooding caused by intense rainfall. All land in the region, including land outside of the Special Hazard Flood Area (SFHA), is susceptible to inland flooding. The barrier islands, though not considered "inland" areas, can still experience these types of inland flooding. Between 20 and 25% of all repetitive loss properties are located outside of the SFHA. In fact, communities in the Outer Banks have taken to using the slogan, "Low Risk is not No Risk" to emphasize this fact. The vast majority of the Outer Banks Region, with the exception of a small portion of northern Currituck County, has coastal flood maps that only account for surge events and overtopping from surge. However, the entire Region is still susceptible to flooding from rainfall even though these risks are not accounted for on FEMA Flood Insurance Rate Maps (FIRMs). The HMPC noted the importance of educating the public of these risks and encouraging property owners in moderate and low risk flood zones outside the Special Flood Hazard Area (SFHA) to purchase flood insurance against these other sources of flooding.

Flash Flooding: A flash flood occurs when water levels rise at an extremely fast rate as a result of intense rainfall over a brief period, possibly from slow-moving intense thunderstorms and sometimes combined with saturated soil or impermeable surfaces. Flash flooding can happen in Special Flood Hazard Areas (SFHAs) as delineated by the National Flood Insurance Program (NFIP) and can also happen in areas not associated with floodplains. Flash flood hazards caused by surface water runoff are most common in urbanized areas, where greater population density generally equates to more impervious surface (e.g., pavement and buildings) which increases the amount of surface water generated.

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.

Stormwater/Localized Flooding: Smaller scale flooding separate from coastal or riverine flooding that can occur anywhere in a community, including areas outside of the SFHA. It can occur as the result of significant amounts of rainfall over a longer time frame. This flooding, sometimes called "nuisance flooding," often occurs in low-lying areas after a heavy rain and can occur as a result of excessive runoff from increased impervious surface area, poor drainage, inadequate drainage infrastructure, clogged culverts, or obstructed drainageways, among other causes. Additionally, rain and surface runoff can cause stormwater systems to overflow. As rain falls for extend periods of time, the ground becomes saturated, and rain accumulates faster than the soils can absorb it. In the Outer Banks, this type of stormwater flooding is further complicated by the region's low elevations, flat topography, and high groundwater table. In areas of particularly flat topography, rain can pond and leave behind areas of standing water even when flood waters have subsided.

While localized flooding does not involve the destructive wave energy of coastal flooding, it is nonetheless a chronic problem that can cause significant damage. The repetitive damage caused by such flooding can add up. Sewers may back up, yards can be inundated, and homes, businesses and vehicles can be flooded. Drainage and sewer systems not design to carry the capacity currently needed to handle increased storm runoff can cause water to back into basements and damage mechanical systems. These impacts, and other localized flooding impacts, can create public health and safety concerns.



Source: Dare County Planning Department (https://www.darenc.com/departments/planning/flood-maps-status/flooding-in-dare-county)

Flash and 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.
- **High Groundwater Tables and Natural Topography** – The unique topography of portions of the barrier island creates a natural "bowl" in which water collects in low-lying areas between the primary dune system and sound side features such as the maritime forest. Additionally, the high groundwater table means that there is limited storage for rainfall in these areas, and ponding can easily occur after periods of frequent or prolonged rainfall.

Flooding and Floodplains

A floodplain, as shown in Figure 4.29 and Figure 4.30, is flat or nearly flat land adjacent to a stream, river, or body of water that experiences occasional or periodic flooding. In riverine floodplains, 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. In coastal floodplains, zones are distinguished by wave heights. 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 4.29 – Characteristics of a Riverine Floodplain

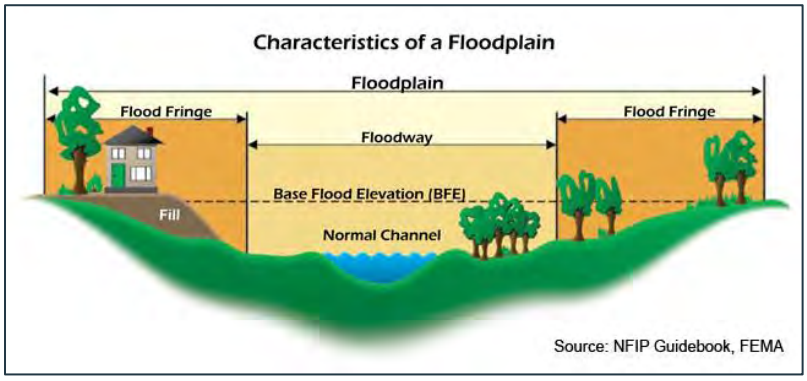
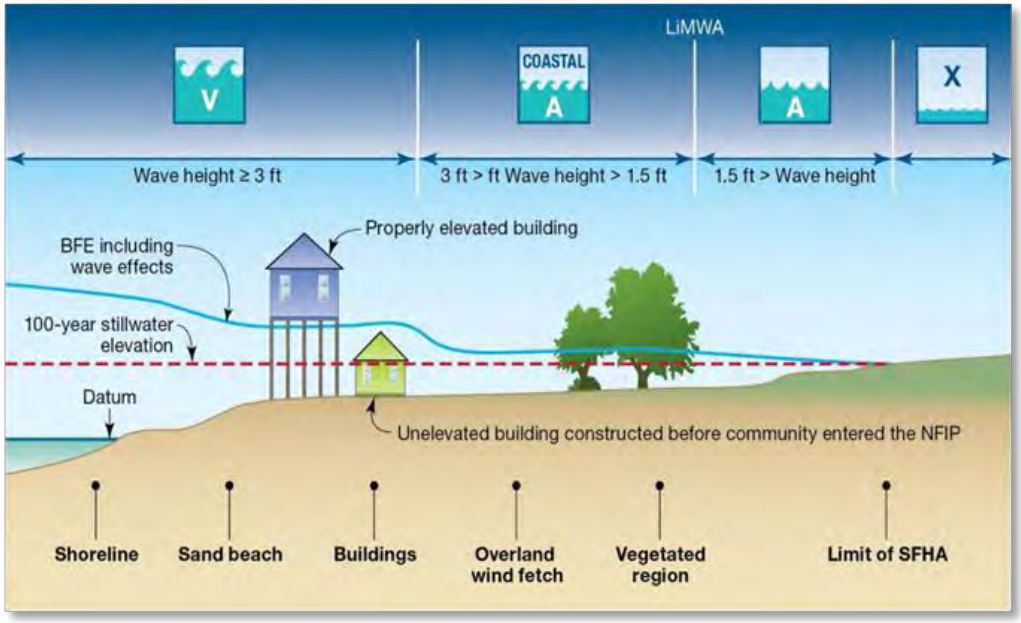


Figure 4.30 – Characteristics of a Coastal Floodplain



Source: FEMA

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 one 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. Flooding can also occur outside of mapped floodplains, especially local stormwater flooding, as discussed above. 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 such as an increase in impervious surface, can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are 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

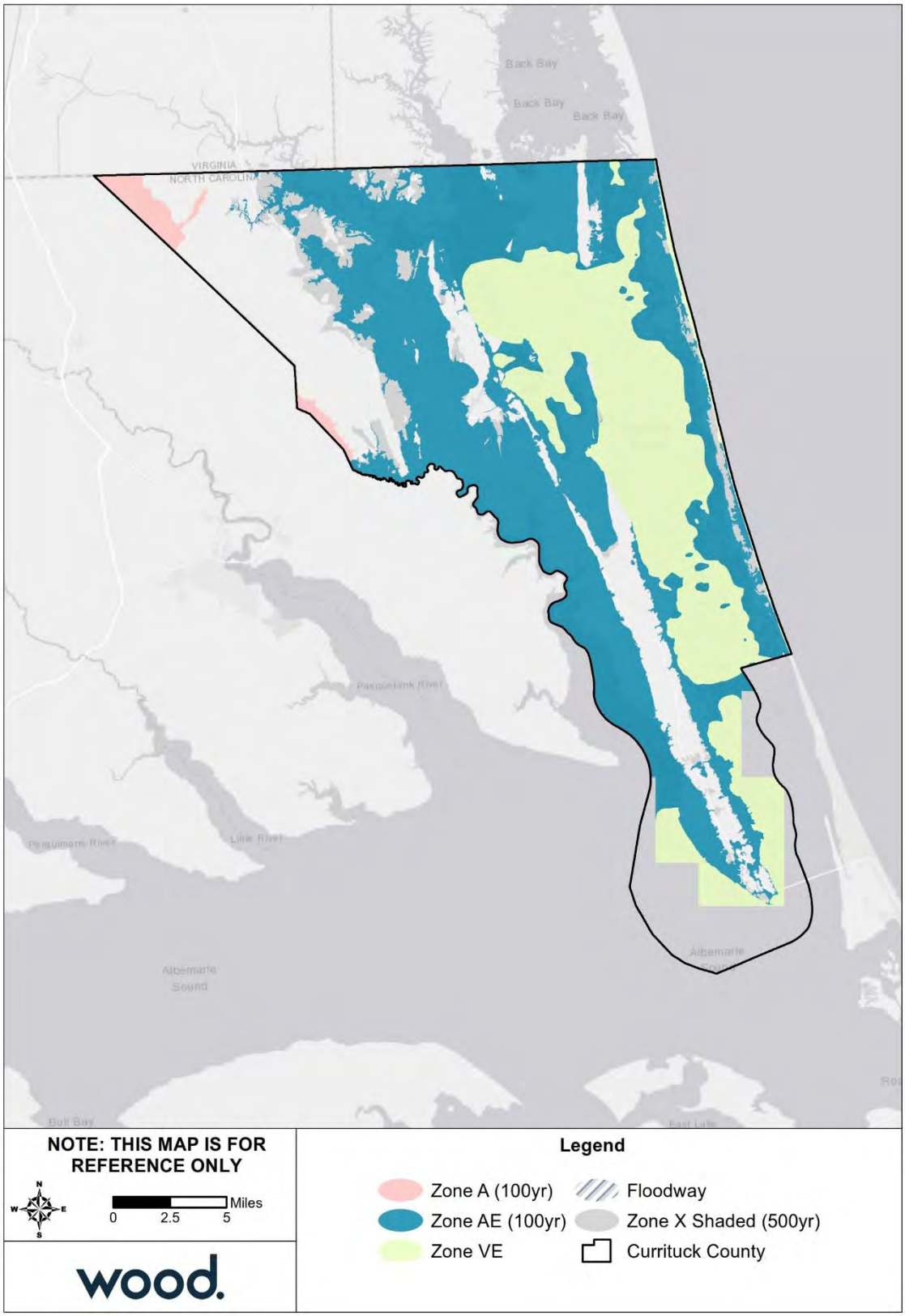
Duration: 3 – Less than 1 week

Location

Figure 4.31 and Figure 4.32 reflect the 2006 mapped flood insurance zones for Currituck and Dare Counties, respectively. It should be noted that Currituck County has a new 2018 effective FIRM and Dare County has a preliminary FIRM that will go effective on June 19, 2020; however, the 2006 FIRMs are used for the sake of this risk assessment because the data in NCEM's IRISK database references the 2006 FIRMs. For reference, the new effective flood insurance zones for Currituck County are reflected in Figure 4.33. The new maps show a significant decline in high risk zones; the HMPC has expressed concerns that these changes greatly underestimate risk.

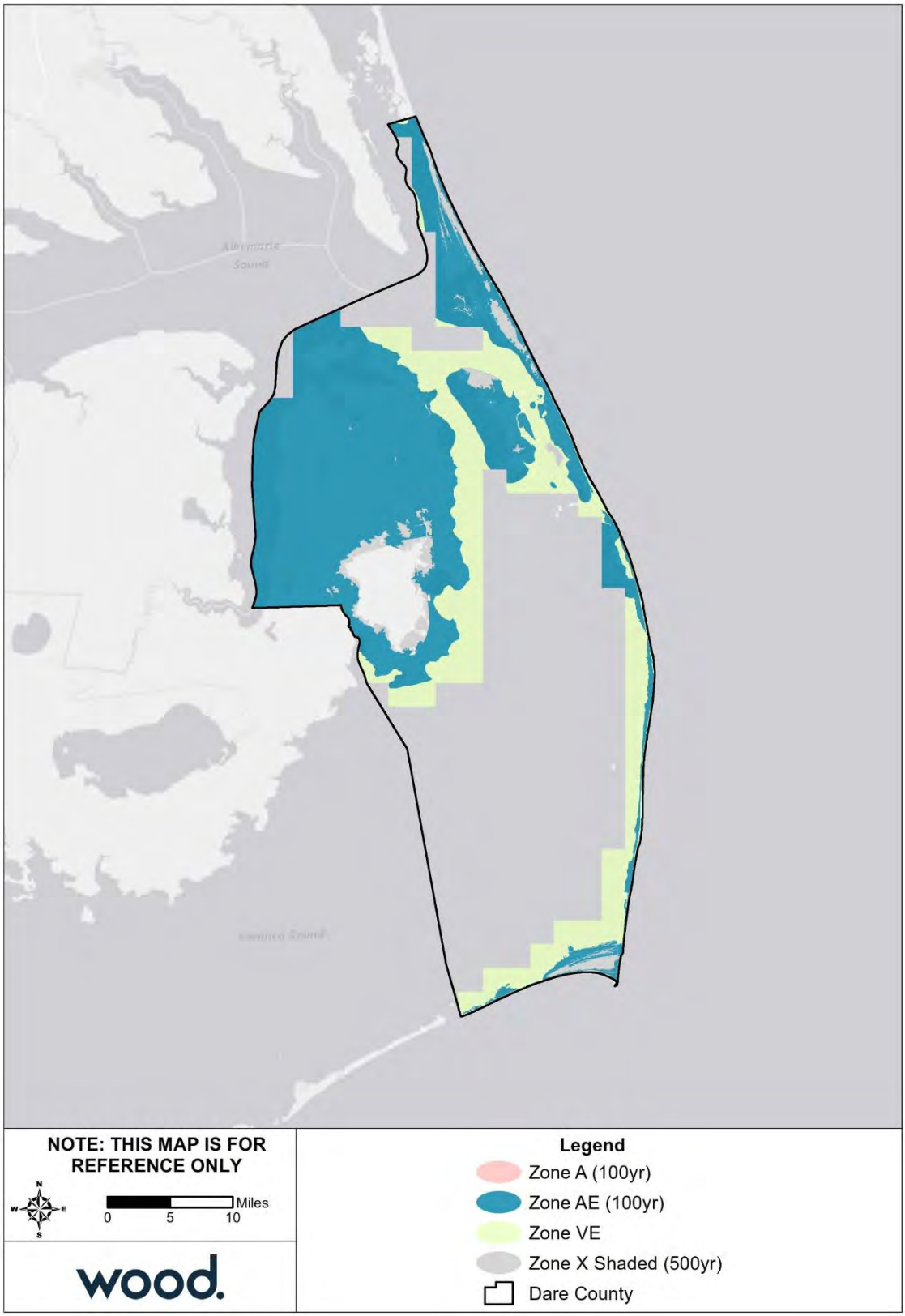
To educate residents that flooding can happen anywhere, Currituck and Dare County have begun a "Low Risk" is not "No Risk" outreach initiative. Figure 4.34 and Figure 4.35 portray each county's effective flood data in terms of the risk level of the flood zones.

Figure 4.31 – FEMA Flood Hazard Areas in Currituck County, 2006



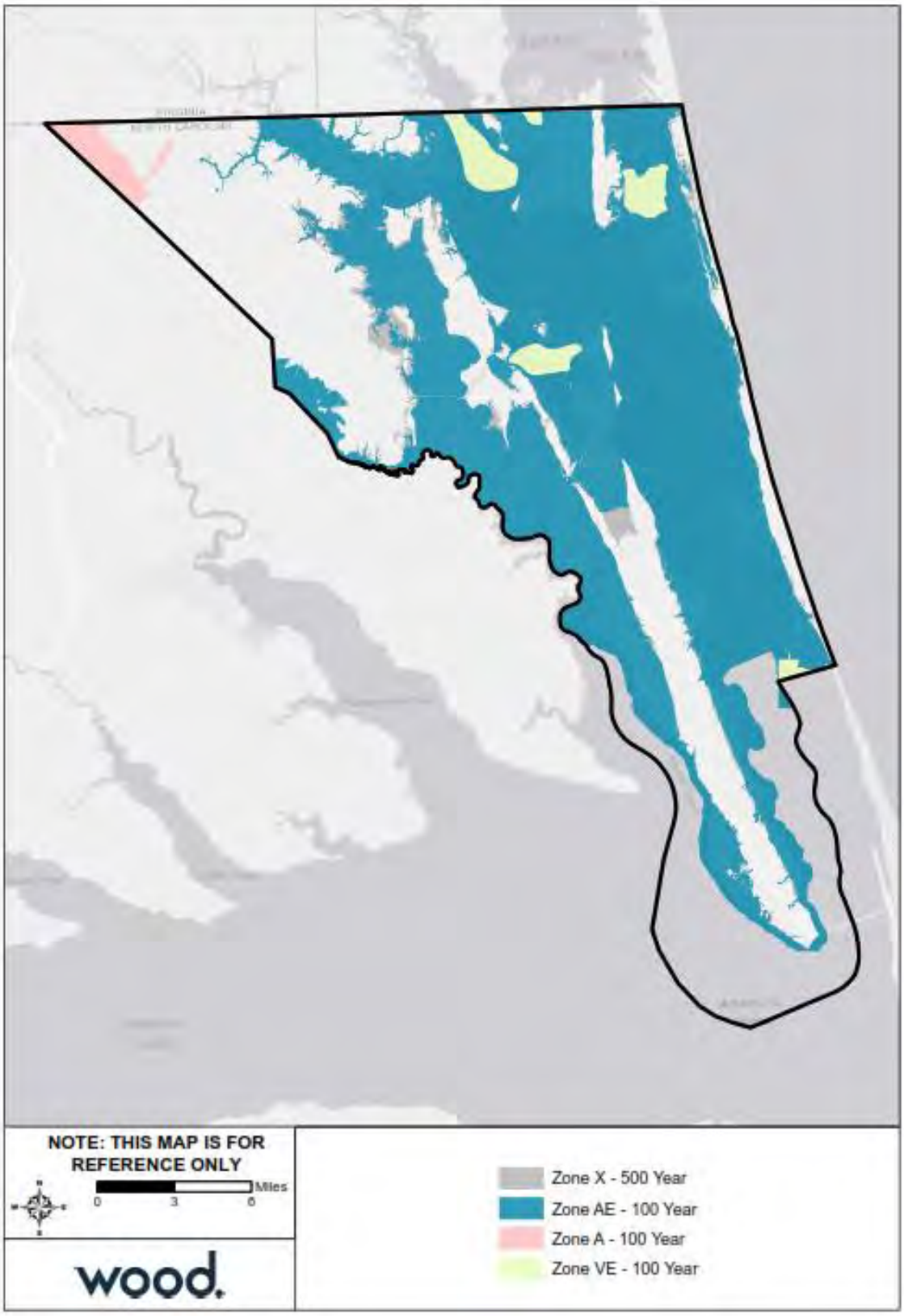
Source: FEMA 2006 DFIRM via NC FRIS

Figure 4.32 – FEMA Flood Hazard Areas in Dare County, 2006



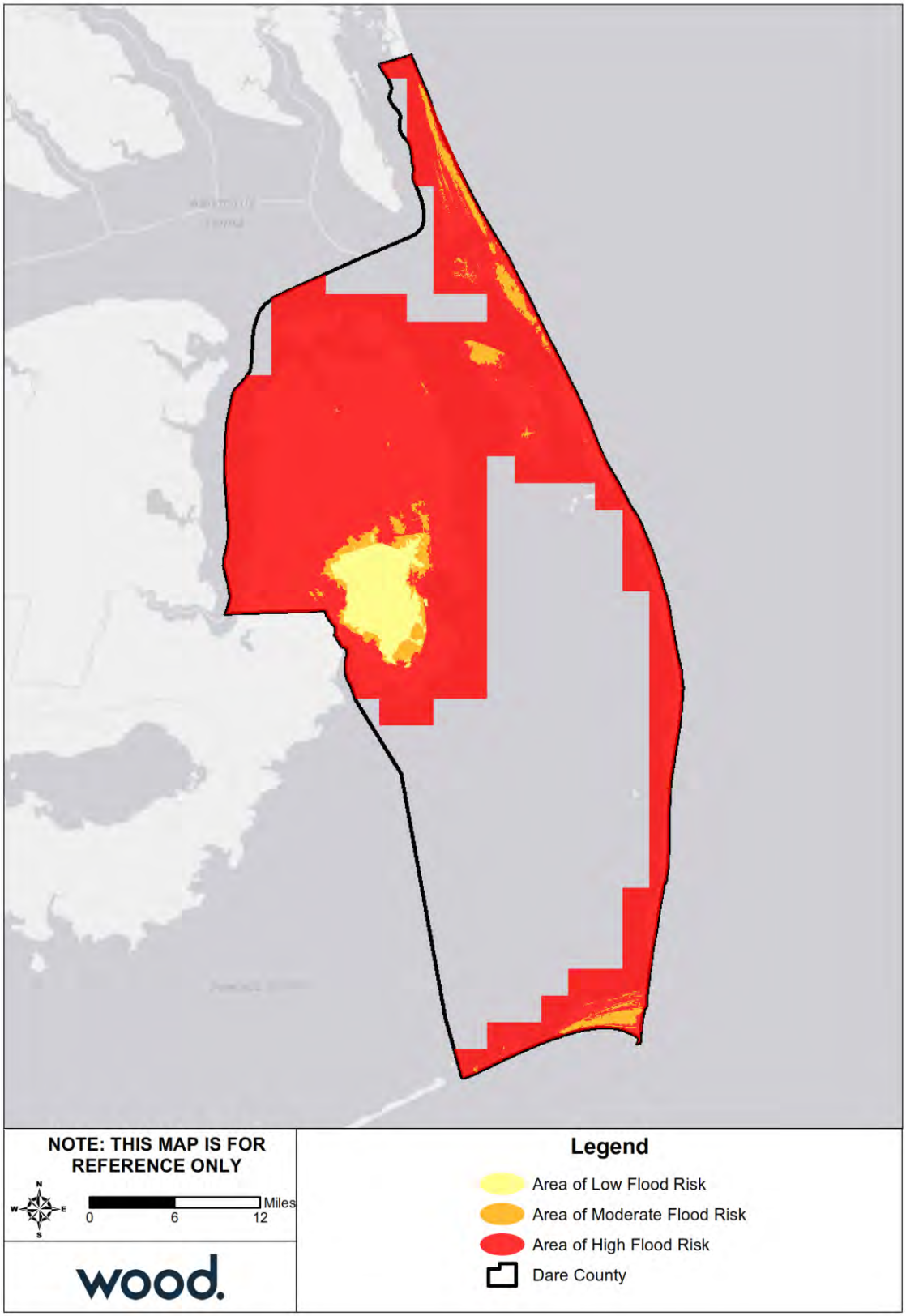
Source: FEMA 2006 DFIRM via NC FRIS

Figure 4.33 – FEMA Flood Hazard Areas in Currituck County, 2018



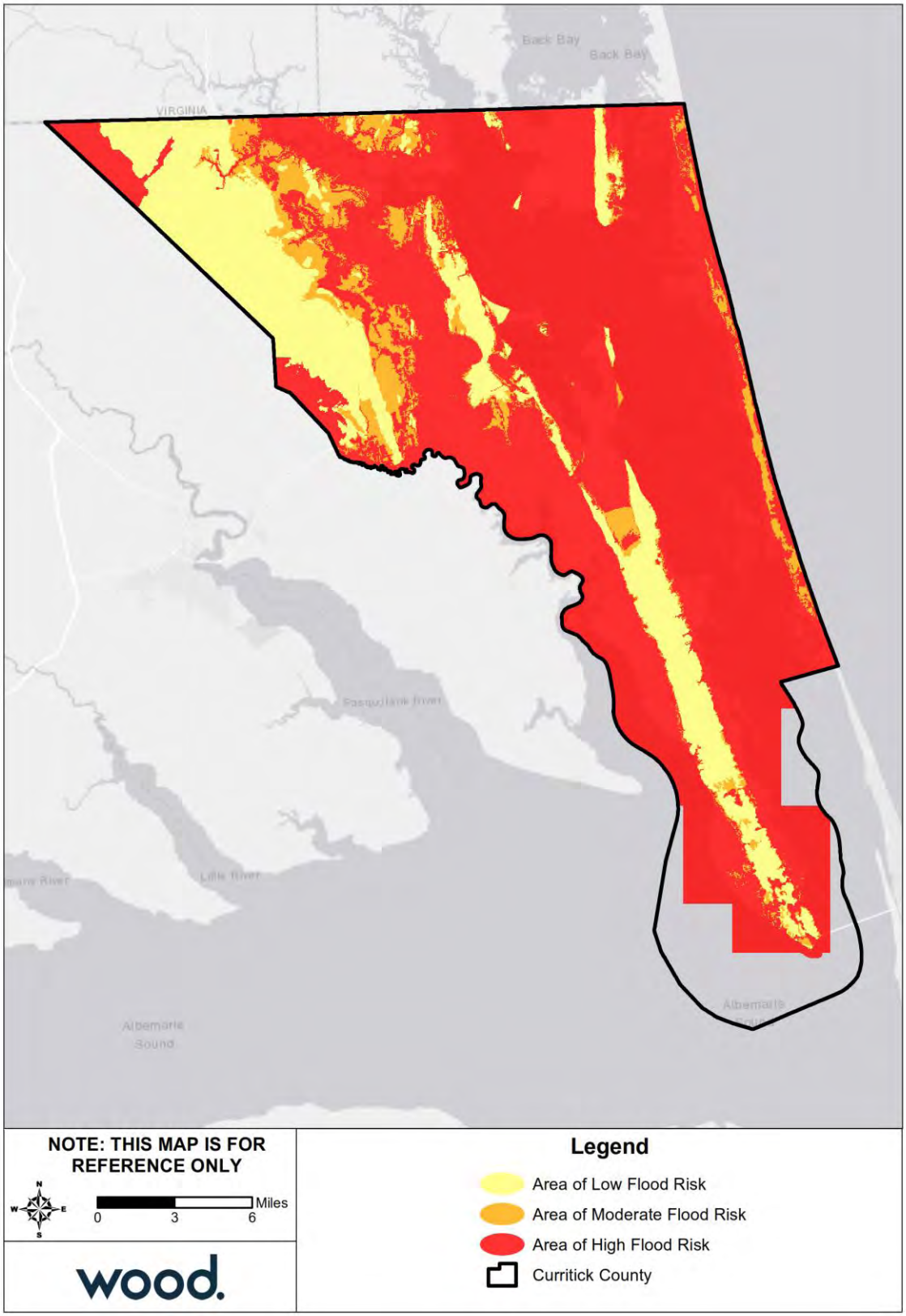
Source: FEMA Effective DFIRM via NC FRIS

Figure 4.34 – Flood Risk Levels in Dare County, 2006



Source: FEMA 2006 DFIRM via NC FRIS

Figure 4.35 – Flood Risk Levels in Currituck County, 2018



Source: FEMA Effective DFIRM via NC FRIS

Extent

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

Regulated floodplains are illustrated on inundation maps called Flood Insurance Rate Maps (FIRMs). It is the official map for a community on which FEMA has delineated both the Special Flood Hazard Areas (SFHAs) and the risk premium zones applicable to the community. SFHAs represent the areas subject to inundation by the 100-year flood event. Structures located within the SFHA have a 26-percent chance of flooding during the life of a standard 30-year mortgage. Flood prone areas were identified within Currituck and Dare Counties using the Effective FIRMs, dated May 2, 2006. Table 4.33 summarizes the flood insurance zones identified by the Digital FIRM (DFIRM).

Table 4.33 – Mapped Flood Insurance Zones within the Outer Banks

Zone	Description
A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas, no depths or base flood elevations are shown within these zones.
AE	AE Zones, also within the 100-year flood limits, are defined with BFEs that reflect the combined influence of stillwater flood elevations and wave effects less than 3 feet. The AE Zone generally extends from the landward VE zone limit to the limits of the 100-year flood from coastal sources, or until it reaches the confluence with riverine flood sources. The AE Zones also depict the SFHA due to riverine flood sources, but instead of being subdivided into separate zones of differing BFEs with possible wave effects added, they represent the flood profile determined by hydrologic and hydraulic investigations and have no wave effects. The Coastal AE Zone is differentiated from the AE Zone by the Limit of Moderate Wave Action (LiMWA) and includes areas susceptible to wave action between 1.5 to 3 feet.
AO	Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet. Average flood depths derived from detailed hydraulic analyses are shown in this zone. Mandatory flood insurance purchase requirements and floodplain management standards apply.
VE	Zone VE is the flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Whole-foot Base Flood Elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.
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 .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.

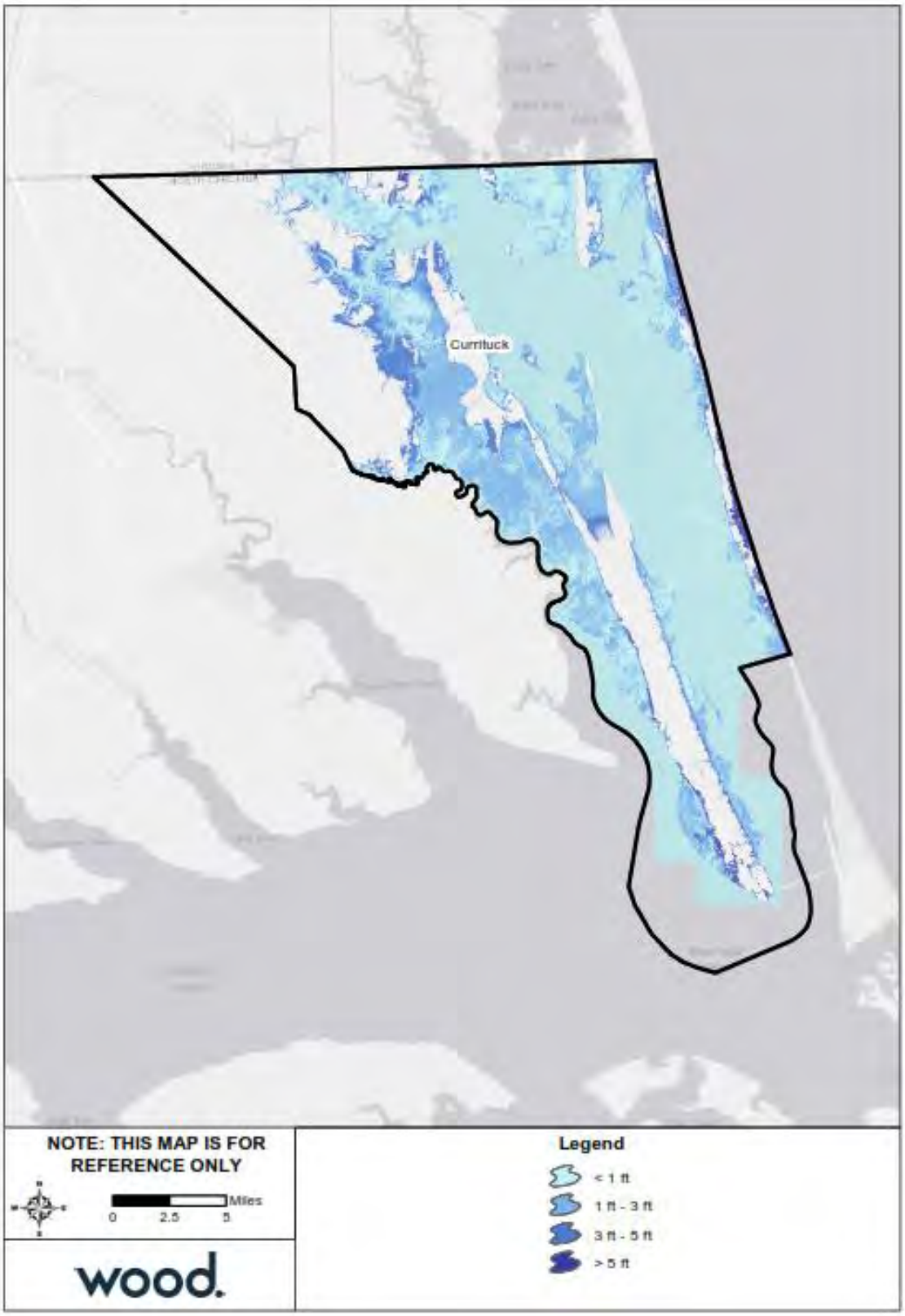
Approximately 70% of Currituck County and 50% of Dare County falls within the SFHA. Overall, more than 55% of the Region faces high flood risk, and areas outside the SFHA still face moderate and low risk of flooding. Table 4.34 provides a summary by county of the Region's total area by flood zone on the effective DFIRM. Figure 4.36 and Figure 4.37 show the depth of flooding predicted from a 1% annual chance flood. Figure 4.38 shows the flood depth for Currituck based on the 2018 DFIRM.

Table 4.34 – Flood Zone Acreage in the Outer Banks by County

Flood Zone	Acreage	Percent of Total (%)
Currituck County		
Zone A	4,294.32	1.51%
Zone AE	123,599.50	43.44%
Zone VE	70,531.84	24.79%
Zone X (500-year)	15,108.54	5.31%
Zone X (Unshaded)	51,271.99	18.02%
Open Water	19,716.44	6.93%
Subtotal	**284,522.63**	--
Dare County		
Zone A	25.20	0.00%
Zone AE	268,267.60	34.13%
Zone VE	126,595.90	16.11%
Zone X (500-year)	20,904.54	2.66%
Zone X (Unshaded)	21,814.31	2.78%
Open Water	348,447.40	44.33%
Subtotal	**786,054.95**	--
Outer Banks Region Total		
Zone A	4,319.52	0.40%
Zone AE	391,867.10	36.60%
Zone VE	197,127.74	18.41%
Zone X (500-year)	36,013.08	3.36%
Zone X (Unshaded)	73,086.30	6.83%
Open Water	368,163.84	34.39%
Total	**1,070,577.58**	--

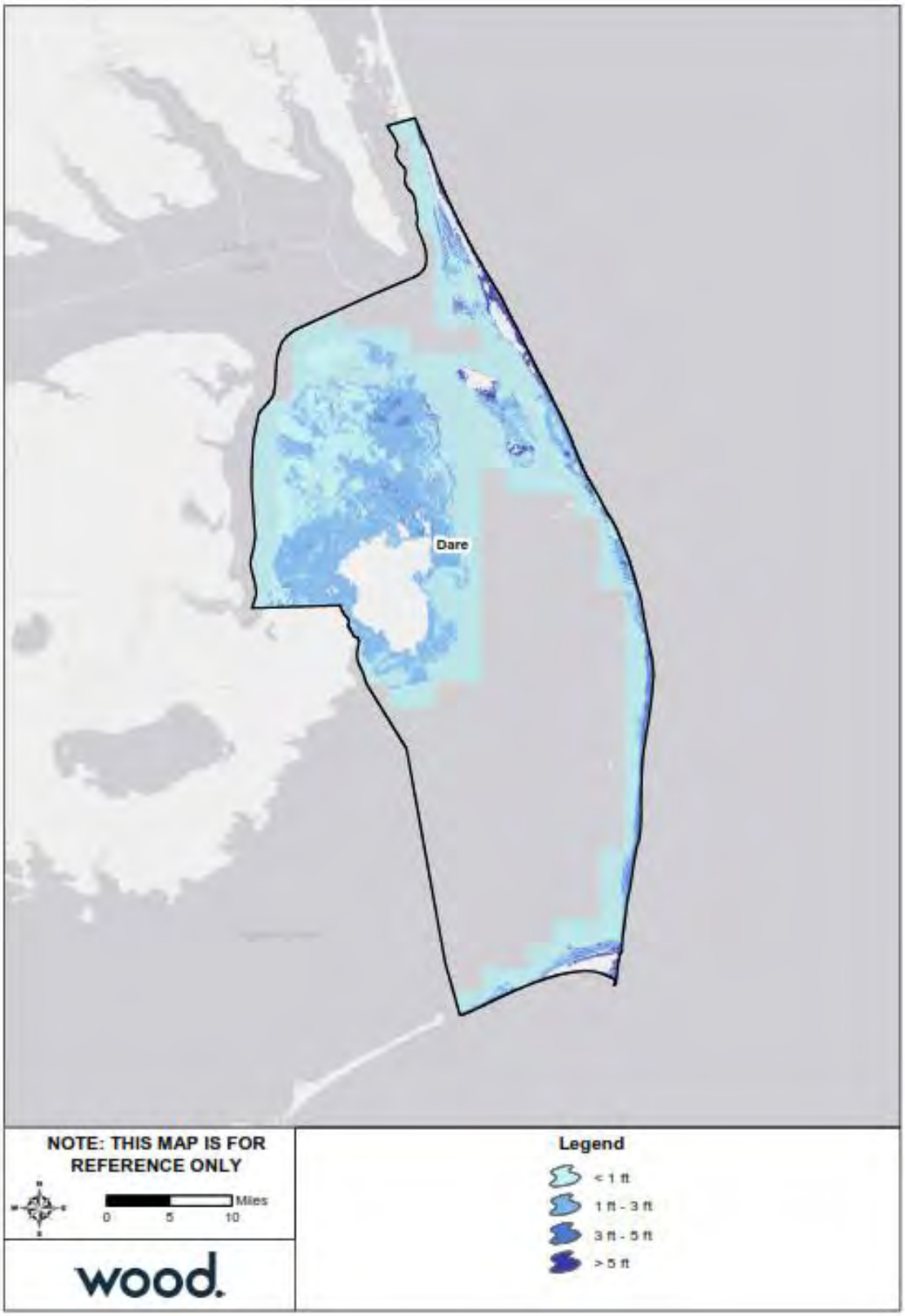
Source: FEMA 2006 DFIRM

Figure 4.36 – Flood Depth, 100-Year Floodplain, 2006, Currituck County



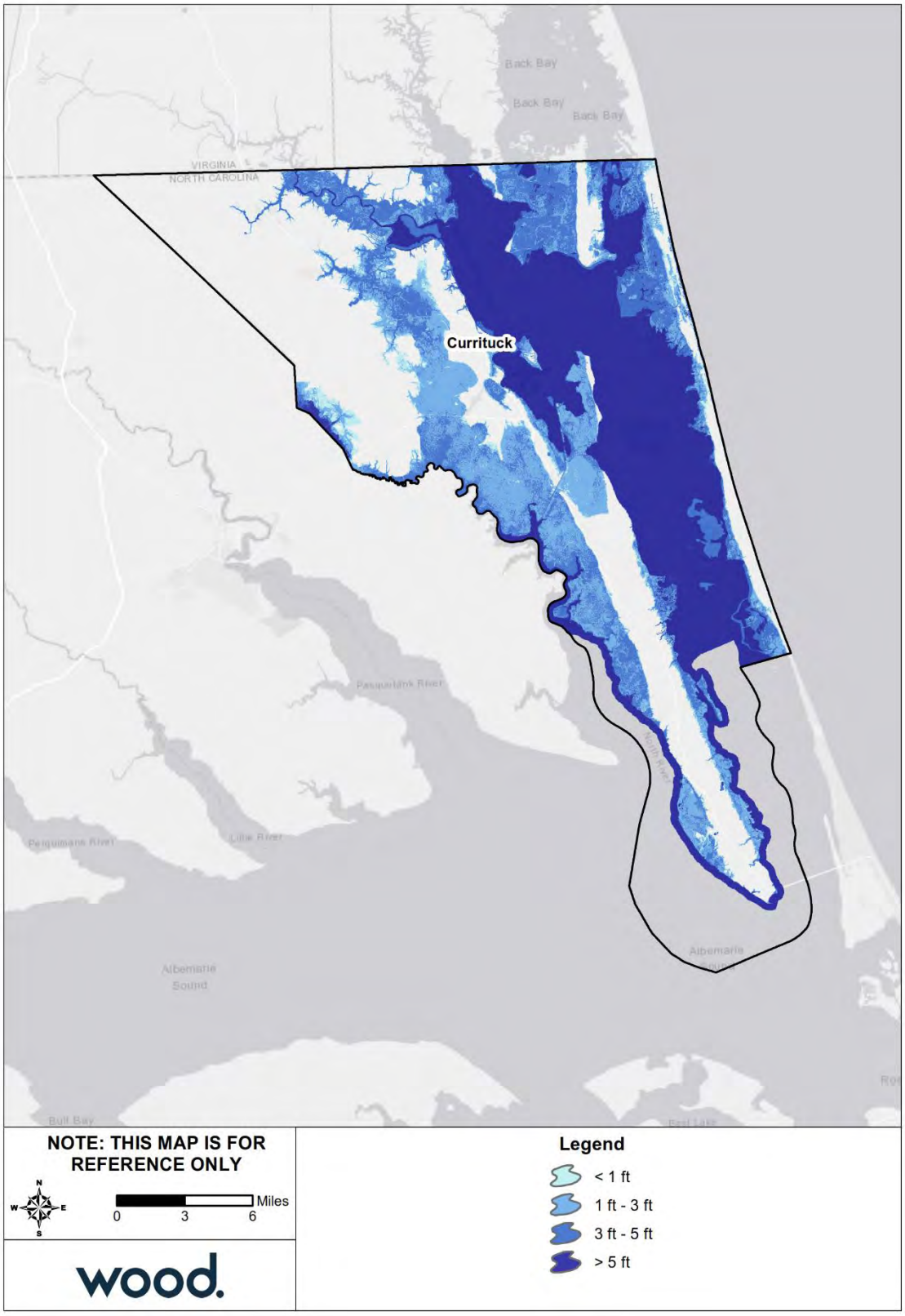
Source: FEMA 2006 DFIRM

Figure 4.37 – Flood Depth, 100-Year Floodplain, 2006, Dare County



Source: FEMA 2006 DFIRM

Figure 4.38 – Flood Depth, 100-Year Floodplain, 2018, Currituck County



Source: FEMA 2018 DFIRM

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 exposed to flooding equaling or exceeding the base flood 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.

More than half of the planning area is considered to be within areas of high flood risk, defined as the SFHA on FEMA Flood Insurance Rate Maps. However, while the 100-year flood is the basis for floodplain management under the NFIP, that does not mean that properties outside the SFHA are not at risk of flooding. The remained of the planning areas is subject to moderate and low flood risk. Low risk is not no risk; areas outside the SFHA may still be flooded by heavy rain events and/or more severe coastal floods.

Impact: 3 – Critical

Spatial Extent: 4 – Large

Historical Occurrences

Table 4.35 details the historical occurrences of flooding identified from 1999 through 2018 by NCEI Storm Events database. 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 HMPC felt that these counts were a considerable underestimate of actual occurrences. Additionally, the HMPC decided not to include the reported property damage estimates from these events because the estimates were considered significantly lower than actual losses and the HMPC did not want to misrepresent the severity of flood risk to the Region. Flooding due to storm surge is excluded from this summary. Details on storm surge events can be found in Section 4.5.6.

Table 4.35 – NCEI Records of Flooding, 2007-2018

Type	Event Count	Deaths/Injuries
Currituck		
Coastal Flood	7	0/0
Flash Flood	3	0/0
Flood	8	0/0
Heavy Rain	17	0/0
Dare		
Coastal Flood	19	0/0
Flash Flood	11	0/0
Flood	5	0/0
Heavy Rain	1	0/0
Total	**71**	**0/0**

Source: NCEI

According to NCEI, 71 recorded flood events affected the planning area from 1999 to 2018 causing an estimated $19,335,000 in property damage, with no fatalities, injuries, or crop damage.

Table 4.36 provides a summary of this historical information by location. It is important to note that many of the events attributed to the county are countywide or cover large portions of the county. Similarly, though some events have associated starting location identified, the event may have covered a larger area including multiple jurisdictions. Still, this list provides an indication of areas that may be particularly flood prone. Again, the HMPC decided not to include the reported property damage estimates from these events because the estimates were considered significantly lower than actual losses and the HMPC did not want to misrepresent the severity of flood risk to the Region.

Table 4.36 – Summary of Historical Flood Occurrences by Location, 1999-2018

Location	Event Count
Currituck	
Countywide	1
Currituck	6
Currituck Co Airport	1
Eastern Currituck (Zone)	6
Grandy	2
Knotts Is	2
Moyock	7
Point Harbor	2
Poplar Branch	2
Sligo	3
Snowden	2
Western Currituck (Zone)	2
Subtotal Currituck	**50**
Dare	
Cape Hatteras	2
Duck	1
Eastern Dare (Zone)	31
Kill Devil Hills	2
Kill Devil Hills Arp	6
Kitty Hawk	2
Manteo	2
Nags Head	2
Rodanthe	1
Western Dare (Zone)	1
Subtotal Carteret	**48**
Region Total	**71**

Source: NCEI

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

November 22, 2006 – An intense low-pressure system off the North Carolina coast combined with an upper level cutoff low to provide very strong winds, heavy rains of 4 to 8 inches, and moderate to severe coastal flooding during times of high tide. Tidal departures were 4 to 5 feet above normal during the event. Route 12 was flooded with overwash in many areas. Significant coastal flooding was reported across Outer Banks Dare county, mainly for areas north of Buxton. Water levels of 4 to 6 feet above normal reported with significant beach erosion and ocean overwash. Several homes from Rodanthe to Nags Head were severely damaged with several condemned.

November 3, 2007 – The extratropical remnant low pressure of former Hurricane Noel moved northeast well offshore of the Carolina coast on November 2nd. Although the center of the low remained well off the coast, strong winds and moderate coastal flooding occurred across eastern North Carolina. Wind gusts of 40 to 60 mph were reported along the coast from Cape Lookout north. Water level rises of 3 to 4 feet above normal produced coastal flooding along the northern Outer Banks. Ocean overwash and coastal flooding was reported from Cape Hatteras north along the Outer Banks. Eight single family dwellings in Nags Head reported property damage. Eight ocean front properties on the north end of Rodanthe sustained severe beach erosion and some damage. Thirty-three private beach accesses were damaged near Nags Head. Highway 12 near Rodanthe was flooded with 4 to 5 feet of water closing the road for several hours. Total reported property damage for Dare county was estimated to be 72,000 dollars.

November 12, 2009 - An intense Nor'easter produced moderate to severe coastal flooding across much of the Outer Banks, causing over $11.5 million in damages. Significant ocean over-wash and coastal flooding developed over the northern Outer Banks. The large waves from the storm continued to batter the Outer Banks for several days after the storm system moved away.

Several streets, homes and businesses were flooded in low lying areas of Currituck County close or directly exposed to the Currituck Sound. Moyock experienced the heaviest flooding due to rising Sound waters, with 3 flooded neighborhoods and flood waters entering some homes. The peak tide height at Duck was 7.20 feet, which was 3.22 feet above the astronomical tide. Numerous streets, homes and businesses were flooded in low lying areas of the county close or directly exposed to the Atlantic Ocean, especially in the Corolla and Carova Beach areas. There was also severe beach erosion and loss of protective dunes. Areas from Buxton north to Duck had several episodes of coastal flooding, mainly during the high tide cycle. Overall 4 homes were destroyed, 61 had major damage and 465 had minor damage. Highway 12 was severely flooded and destroyed near Rodanthe due to the ocean over-wash.

October 4, 2015 – Large breaking waves due to strong onshore winds and large swells from distant Hurricane Joaquin produced significant beach erosion, ocean over wash and coastal flooding. There was also some flooding for sound side areas of Hatteras Island due to high water levels in the Pamlico Sound. 51 residences and businesses had minor to moderate damage producing 590,000 dollars in damages.

October 8-9, 2016 – Hurricane Matthew moved northeast offshore of the North Carolina coast late on October 8th through October 9th. Widespread heavy rain developed on October 8th and continued through early on October 9th as Matthew approached and moved offshore of the coast. Rainfall ranged from 7 to 11 inches in the Outer Banks, and was reported at 10.73 inches at Point Harbor, leading to numerous creeks and streams to be out of their banks and causing significant flash flooding. Numerous roads were impassable or closed for several days, and many homes and businesses were impacted. In Kill Devil Hills and Nags Head, water was 2 to 3 feet deep on roads and several homes and businesses flooded with up to 2 feet of water in some.

March 4, 2018 – Strong low pressure passed just to the north of eastern North Carolina on March 2nd then continued to deepen while only slowly moving offshore March 3rd and 4th. This system produced very strong west winds as it passed just to the north of the area and then gusty north winds for several days as it lingered well to the northeast. These winds produced high water levels over the eastern portion of the Pamlico Sound producing significant sound-side flooding of Outer Banks Dare County. Water levels reached 2 to 3 feet above ground level in spots flooding and closing some roads. Water reached a few residences and businesses with up to one foot of inundation reported. Areas most impacted extended from Rodanthe south to Hatteras Village including beach front property in the Avon area. Many sand dunes, some up to 30 feet, were destroyed. Ocean over-wash flooded portions of Highway 12 with water 2 to 3 feet deep with over 1 foot of sand and debris, closing it for long periods of time.

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.

The SFHA and the Shaded X zone indicate areas of high and moderate risk according to FEMA guidelines; however, this does not mean that flood risk is limited to these areas. There is still potential to flooding in the unshaded X-Zone which means that Low risk is not no risk.

While exposure to flood hazards varies across jurisdictions, all jurisdictions have high risk flood hazard areas and the entire planning area faces some level of flood risk. Based on past occurrences and HMPC input concerning known risk areas and additional flood hazard sources beyond the coastal flood as depicted on FIRMs, the likelihood of flooding is considered highly likely for all jurisdictions.

Probability: 4 – Highly Likely

Climate Change

According to the 2018 North Carolina Hazard Mitigation Plan, changing climate and weather patterns, environmental conditions, and urban and rural development may affect the frequency and intensity of flooding. The increased likelihood of extreme precipitation events due to climate change will result in greater risks of flash flooding and impacts from stormwater runoff. The plan notes that even though there may be less precipitation overall in the long term leading to more frequent drought events, the rainfall that does occur will likely be more intense, and flooding impacts may intensify as a result.

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 4.37 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 4.37 – NFIP Entry Dates

Jurisdiction	NFIP Entry Date
Town of Duck	10/06/78
Town of Kill Devil Hills	05/04/73
Town of Kitty Hawk	10/01/83
Town of Manteo	01/05/83
Town of Nags Head	11/10/72

Jurisdiction	NFIP Entry Date
Town of Southern Shores	05/13/72
Unincorporated Currituck County	11/01/84
Unincorporated Dare County	10/06/78

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

Pre-FIRM structures are those built before a community's NFIP entry date, while those built after the entry date are post-FIRM. However, because only year built data was available for buildings rather than exact construction dates, the following methodology was used to estimate the number of pre-FIRM buildings. If the NFIP entry date for a given community is between January and June, buildings constructed the same year as the entry date are considered to be post-FIRM (e.g., if the NFIP entry date is 02/01/1991, buildings constructed in 1990 and before are pre-FIRM. Buildings constructed from 1991 to the present are post-FIRM.). If the NFIP entry date is between July and December, then the following year applies for the year-built cut-off (e.g., if the NFIP entry date is 12/18/2007, buildings constructed in the year 2007 and before are pre-FIRM, 2008 and newer are post-FIRM).

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

In addition to the data presented below, the forthcoming Southeast Coastal Assessment from the United States Army Corps of Engineers (USACE) South Atlantic Division will provide supplementary data and details through a comprehensive coastal shoreline risks and needs assessment. This tool will look at four hazards (hurricanes and storms, long-term erosion, flooding, and potential sea level rise) and how they will impact population, the built environment, and the natural environment, which may be useful in future hazard risk assessments.

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 fatalities. Individuals face particularly high risk when driving through flooded streets. According to NCEI records, however, there have been no deaths in the Outer Banks caused by flood events.

Table 4.38 details the population at risk from the 1% annual chance flood event, according to data from the NCEM IRISK database. Note that development and population growth have occurred since the original analysis for the IRISK dataset was performed, therefore actual population at risk is likely higher.

Table 4.38 – 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
Currituck									
Unincorporated Currituck County	23,540	5,459	23.2%	3,041	705	23.2%	1,329	308	23.2%
Dare									
Unincorporated Dare County	16,893	7,500	44.4%	2,574	1,143	44.4%	916	407	44.4%
Town of Duck	369	36	9.8%	56	5	8.9%	20	2	10%
Town of Kill Devil Hills	6,635	1,701	25.6%	1,011	259	25.6%	360	92	25.6%
Town of Kitty Hawk	3,270	1,082	33.1%	498	165	33.1%	177	59	33.3%
Town of Manteo	1,258	840	66.8%	192	128	66.7%	68	45	66.2%
Town of Nags Head	2,786	746	26.8%	425	114	26.8%	151	40	26.5%
Town of Southern Shores	2,695	492	18.3%	411	75	18.2%	146	27	18.5%
Subtotal Dare	**33,906**	**12,397**	**36.6%**	**5167**	**1,889**	**36.6%**	**1,838**	**672**	**36.6%**
Region Total	**57,446**	**17,856**	**31.1%**	**8208**	**2,594**	**31.6%**	**3,167**	**980**	**30.9%**

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

Table 4.40 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings across all jurisdictions by sector. Commercial facilities are the sector most at risk to flood damages.

Vulnerability of CIKR as well as High Potential Loss Properties, where applicable, can be found by jurisdiction in each community's annex to this plan.

Table 4.39 – 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
Currituck															
Unincorporated Currituck County	17,069	1,484	8.7%	3,577	21%	$48,721,328	79	0.5%	$903,272	4	0%	$107,252	3,660	21.4%	$49,731,852
Dare															
Unincorporated Dare County	13,634	2,428	17.80%	5,675	41.60%	$76,057,333	412	3%	$13,101,770	45	0.30%	$2,635,307	6,132	45%	$91,794,409
Town of Duck	2,400	22	0.90%	226	9.40%	$7,940,469	22	0.90%	$1,149,557	2	0.10%	$201,274	250	10.40%	$9,291,300
Town of Kill Devil Hills	5,972	592	9.90%	1,446	24.20%	$16,004,240	67	1.10%	$1,744,194	1	0%	$22,782	1,514	25.40%	$17,771,216
Town of Kitty Hawk	2,803	405	14.40%	855	30.50%	$12,475,945	49	1.70%	$1,354,691	7	0.20%	$449,188	911	32.50%	$14,279,824
Town of Manteo	918	316	34.40%	507	55.20%	$12,761,855	85	9.30%	$6,094,794	6	0.70%	$89,804	598	65.10%	$18,946,454
Town of Nags Head	4,827	415	8.60%	1,181	24.50%	$22,298,071	155	3.20%	$5,908,165	9	0.20%	$1,022,923	1,345	27.90%	$29,229,159
Town of Southern Shores	2,496	97	3.90%	448	17.90%	$3,545,497	6	0.20%	$80,401	0	0%	$0	454	18.20%	$3,625,897
Subtotal Dare	**33,050**	**4,275**	**12.93%**	**10,338**	**31.28%**	**$151,083,410**	**796**	**2.41%**	**$29,433,572**	**70**	**0.21%**	**$4,421,278**	**11,204**	**33.90%**	**$184,938,259**
Region Total	**50,119**	**5,759**	**11.49%**	**13,915**	**27.76%**	**$199,804,738**	**875**	**1.75%**	**$30,336,844**	**74**	**0.15%**	**$4,528,530**	**14,864**	**29.66%**	**$234,670,111**

Source: NCEM Risk Management Tool

Table 4.40 – Critical Infrastructure and Key Resources Buildings at Risk to Flood Events by Sector

Sector	Buildings at Risk	Estimated Damages
Banking and Finance	10	$327,509
Commercial Facilities	746	$30,153,088
Communications	4	$22,052
Critical Manufacturing	75	$1,265,650
Defense Industrial Base	1	$1,490
Emergency Services	10	$649,267
Energy	4	$698,943
Food and Agriculture	53	$229,109
Government Facilities	35	$1,163,683
Healthcare and Public Health	7	$235,198
Transportation Systems	66	$1,582,493
Water	1	$1,227
Region Total	**1,012**	**$36,329,709**

Source: NCEM Risk Management Tool

To supplement this assessment from IRISK, current parcel data was evaluated to identify recent development in the floodplain that was not included in the IRISK database. Building footprints provided by IRISK were compared to parcel data from each county. Any instance where there was no building footprint, but the parcel reported an improved value within the SFHA is reported in the table below. This summary provides context for how IRISK exposure and vulnerability numbers may differ from current conditions.

Table 4.41 summarizes the recently developed parcels within the SFHA as well as the improved value of these parcels. It also provides the total number of improved parcels no included in IRISK to understand how much of total development has occurred within the SFHA. Approximately 45% of all parcels included in this analysis have been developed within the SFHA.

Table 4.41 – Parcel Development in SFHA Not Included in IRISK, as of November 2019

Jurisdiction	Improved Parcel Count	Improved Parcel Count within SFHA	Total Improved Value within SFHA
Currituck County			
Unincorporated Currituck County	3,399	1,463	$303,181,700
Dare County			
Duck	78	29	$10,632,000
Kill Devil Hills	416	55	$20,722,600
Kitty Hawk	221	110	$18,652,800
Manteo	131	83	$16,219,400
Nags Head	288	93	$20,035,500
Southern Shores	167	70	$17,113,500
Unincorporated Dare County	945	660	$152,695,400
Region Total	**5,645**	**2,563**	**$559,252,900**

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

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 March 2019 NFIP records, there are a total of 1,666 repetitive loss properties within the Outer Banks Region, of which 1,234 are insured. There are 197 properties on the list classified as severe repetitive loss properties. A severe repetitive loss property is classified as such if it has four or more separate claim payments of more than $5,000 each (including building and contents payments) or two or more separate claim payments (building only) where the total of the payments exceeds the current value of the property.

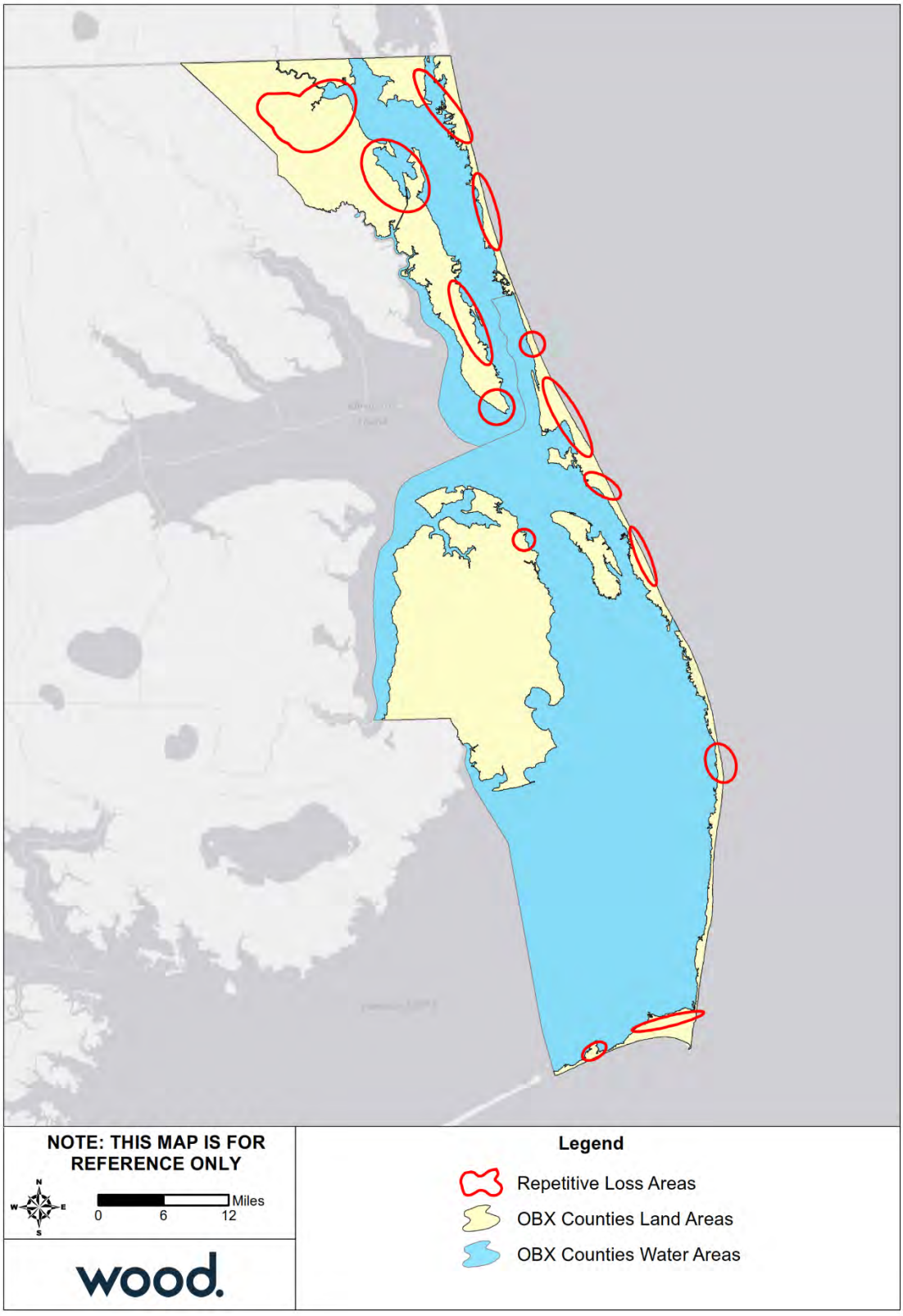
Table 4.42 summarizes repetitive loss properties by jurisdiction as identified by FEMA through the NFIP. Figure 4.39 shows the general areas where repetitive losses have occurred throughout the Region.

Table 4.42 – Repetitive Loss Properties by Jurisdiction, March 2019

Jurisdiction	RL Property Count	Occupancy Type		Total Losses	% Insured	Total Amount of Claims Payments	Average Claim Payment	SRL Count
		Residential	Commercial					
Currituck County	185	183	2	559	83.2%	$9,162,879.01	$49,529.08	23
Dare County	654	582	72	2,107	72.6%	$45,359,449.15	$69,356.96	50
Duck	20	17	3	50	90.0%	$1,124,200.89	$62,455.61	2
Kill Devil Hills	155	149	6	478	78.1%	$9,341,109.42	$60,265.22	18
Kitty Hawk	340	334	6	1,131	77.6%	$17,707,014.72	$52,079.46	48
Manteo	49	33	16	119	89.8%	$3,577,754.98	$73,015.41	5
Nags Head	249	233	16	1,061	59.0%	$20,667,910.06	$83,003.65	51
Southern Shores	14	14	0	29	78.6%	$401,032.74	$28,645.20	0
Total	**1,666**	**1,545**	**121**	**5,534**	**74.1%**	**$107,341,350.97**	**$59,793.82**	**197**

Source: FEMA/ISO, March 2019
RL = Repetitive Loss; SRL = Severe Repetitive Loss

Figure 4.39 – Repetitive Loss Areas



Source: FEMA/ISO

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 4.43 summarizes the potential detrimental consequences of flood.

Table 4.43 – 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. Due to the coastal geography of the region, flood risk due to storm surge, high tide flooding, flash flooding, and stormwater flooding is uniform across the region. All included jurisdictions have at least 50% of their land area in the SFHA and thus exposed to a high risk of flooding; given that other sources of flooding and other levels of flooding may occur beyond these areas, the spatial extent was considered large for all jurisdictions. All communities also face a uniform probability of flooding.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	Score	Priority
Currituck County	4	3	4	3	3	3.5	H
Dare County	4	3	4	3	3	3.5	H
Duck	4	3	4	3	3	3.5	H
Kill Devil Hills	4	3	4	3	3	3.5	H
Kitty Hawk	4	3	4	3	3	3.5	H
Manteo	4	3	4	3	3	3.5	H
Nags Head	4	3	4	3	3	3.5	H
Southern Shores	4	3	4	3	3	3.5	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 tornados.

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 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. Hurricanes are given a classification based on the Saffir-Simpson Scale; this scale is reproduced in Table 4.44.

The greatest potential for loss of life related to a hurricane is from the storm surge. As described in Section 4.5.5, storm surge is water that is pushed toward the shore by the force of the winds swirling around the storm. This advancing surge combines with the normal tides to create the hurricane storm tide, which can increase the mean water level to heights impacting roads, homes and other critical infrastructure.

Damage during hurricanes may also result from spawned tornados and inland flooding associated with heavy rainfall that usually accompanies these storms. Hurricane Floyd, for example, was at one time a Category 4 hurricane racing towards the North Carolina coast. As far inland as Raleigh, more than 100 miles from the coast, communities were preparing for winds exceeding 100 miles per hour. Floyd then made landfall as a Category 2 hurricane and caused the worst inland flooding disaster in North Carolina's history. Rainfall amounts exceeded 20 inches in certain locales and 67 counties sustained damages.

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

Nor'easters are known for dumping heavy amounts of rain and snow, producing hurricane-force winds, and creating high surf that causes severe beach erosion and coastal flooding. There are two main components to a nor'easter: (1) a Gulf Stream low-pressure system (counter-clockwise winds) generated off the southeastern U.S. coast, gathering warm air and moisture from the Atlantic, and pulled up the East Coast by strong northeasterly winds at the leading edge of the storm; and (2) an Arctic high-pressure

system (clockwise winds) which meets the low-pressure system with cold, arctic air blowing down from Canada. When the two systems collide, the moisture and cold air produce a mix of precipitation and have the potential for creating dangerously high winds and heavy seas. As the low-pressure system deepens, the intensity of the winds and waves increase and can cause serious damage to coastal areas as the storm moves northeast.

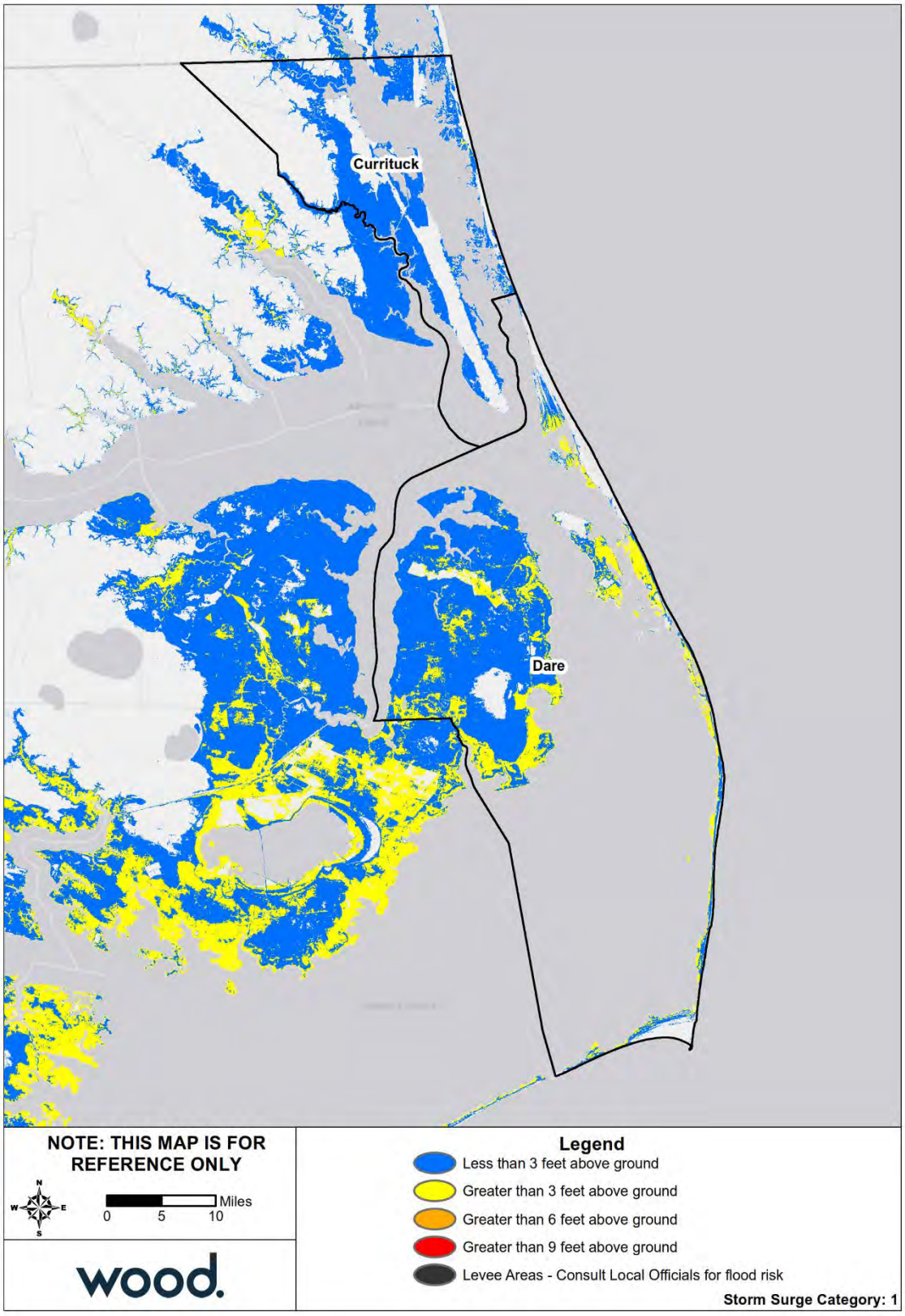
Warning Time: 1 – More than 24 hours

Duration: 3 – Less than one week

Location

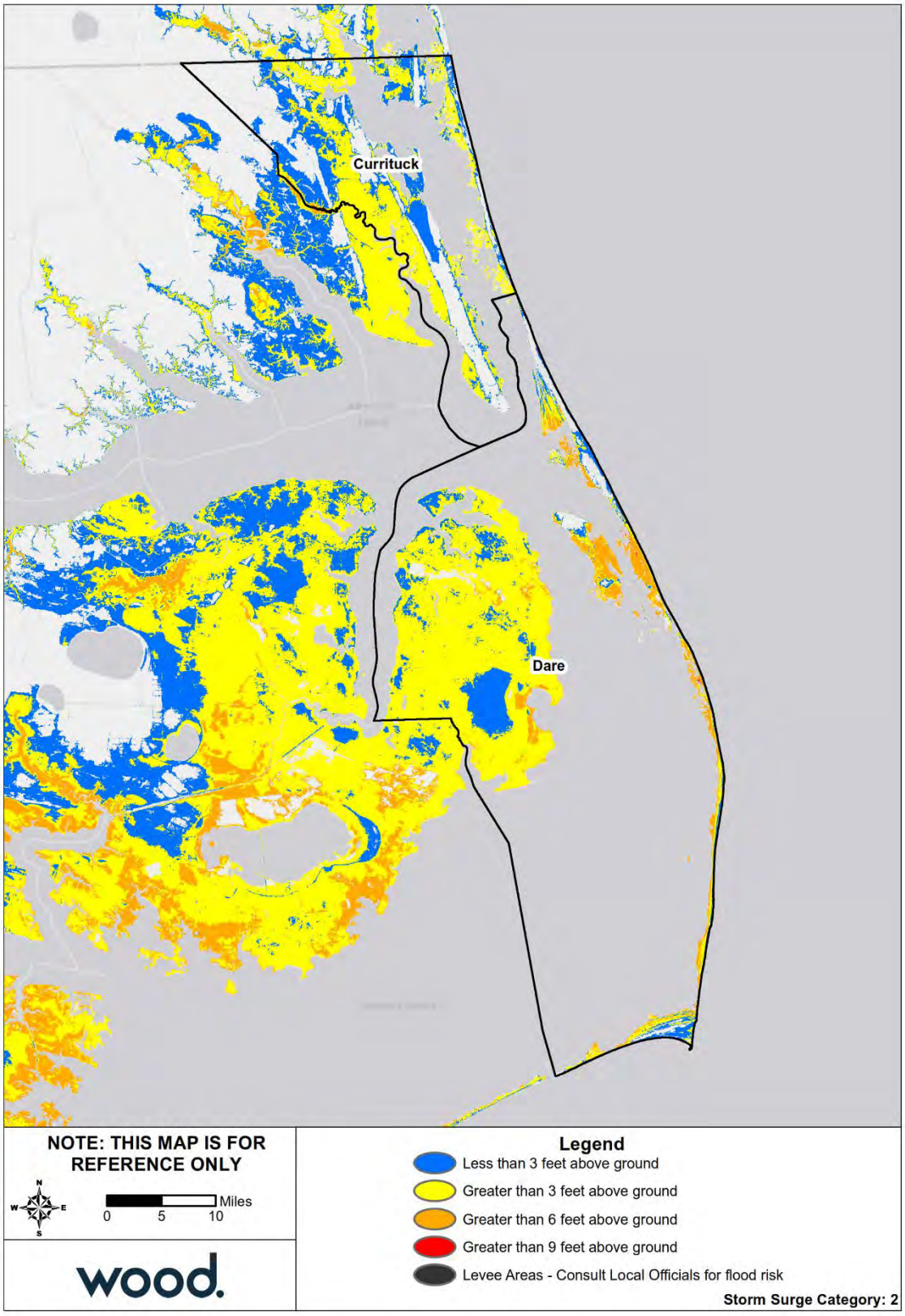
Hurricanes and tropical storms can impact all of the Outer Banks Region. Wind impacts can affect the region uniformly, while storm surge impacts are more limited, affecting areas along coastal and sound-side shorelines and reaching further inland depending on the height of the surge. Figure 4.40 through Figure 4.44 show the estimated extent of surge by storm category according to NOAA SLOSH data. As described in Section 4.4.5, the SLOSH model is a computerized numerical model developed by the National Weather Service to estimate storm surge heights resulting from historical, hypothetical, or predicted hurricanes by taking into account the atmospheric pressure, size, forward speed, and track data. The model creates outputs for all different storm simulations from all points of the compass. Each direction has a MEOW (maximum envelope of water) for each category of storm (1-5), and all directions combined result in a MOMs (maximum of maximums) set of data. Note that the MOM does not illustrate the storm surge that will occur from any given storm but rather the full potential extent of surge from all possible storms.

Figure 4.40 – Category 1 Storm Surge Inundation



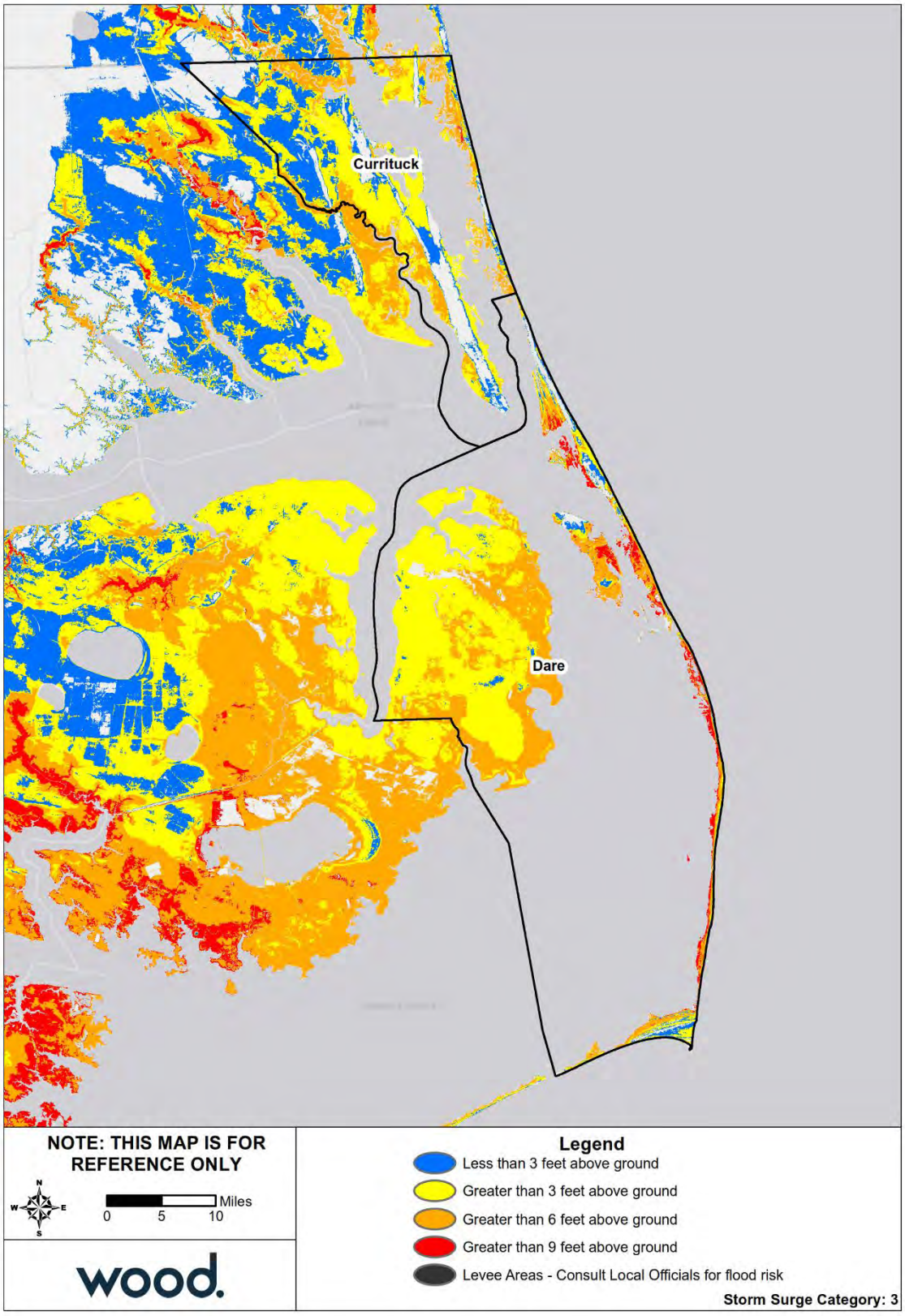
Source: NOAA National Storm Surge Hazard Maps – Version 2

Figure 4.41 – Category 2 Storm Surge Inundation



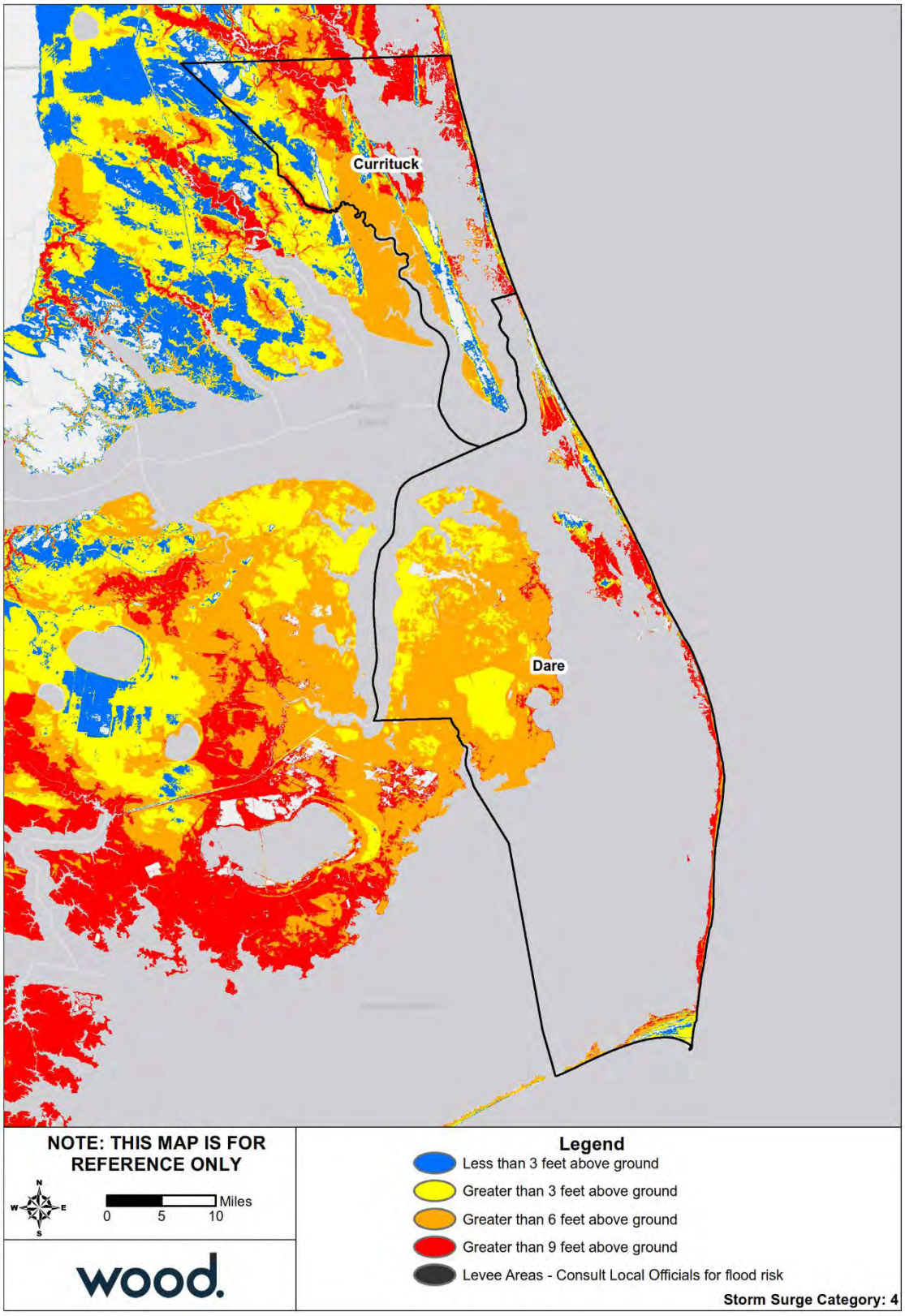
Source: NOAA National Storm Surge Hazard Maps – Version 2

Figure 4.42 – Category 3 Storm Surge Inundation



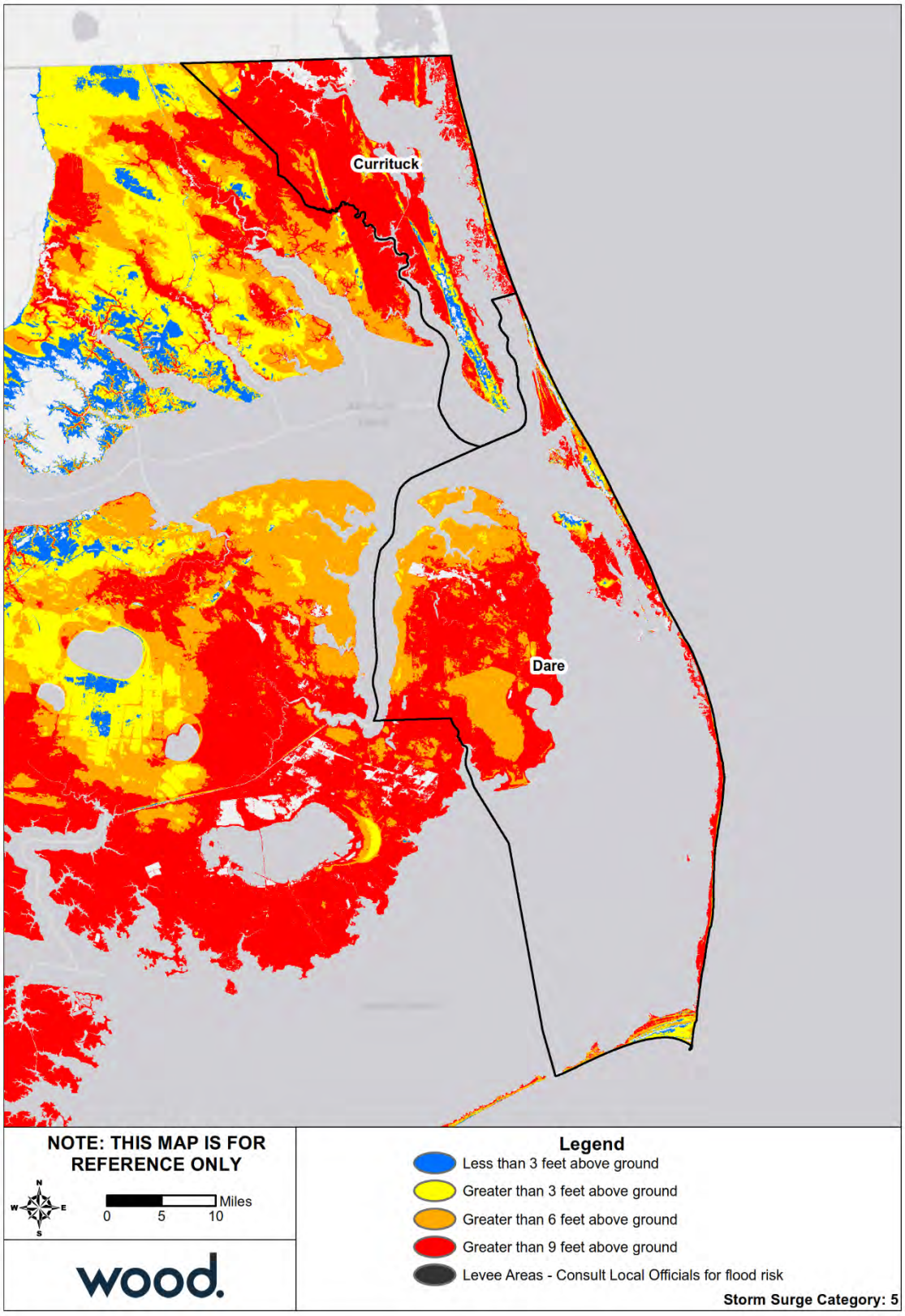
Source: NOAA National Storm Surge Hazard Maps – Version 2

Figure 4.43 – Category 4 Storm Surge Inundation



Source: NOAA National Storm Surge Hazard Maps – Version 2

Figure 4.44 – Category 5 Storm Surge Inundation



Source: NOAA National Storm Surge Hazard Maps – Version 2

Extent

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

Hurricane force winds can extend outward by about 35 miles from the eye of a small hurricane to more than 150 miles from the center of a large hurricane. Tropical storm force winds may extend even further, up to approximately 300 miles from the eye of a large hurricane. In general, the front right quadrant of a storm, relative to its direction of movement, is the most dangerous part of the storm. Wind speeds are highest in this area due to the additive impact of the atmospheric steering winds and the storm winds.

Hurricane intensity is further classified by the Saffir-Simpson Scale, detailed in Table 4.44, which rates hurricane intensity on a scale of 1 to 5, with 5 being the most intense.

Table 4.44 – 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 4.45 describes the damage that could be expected for each category of hurricane. Damage during hurricanes may also result from spawned tornados, storm surge, and inland flooding associated with heavy rainfall that usually accompanies these storms.

Table 4.45 – 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

Located on the coast, both Dare and Currituck counties are susceptible to every category of hurricane.

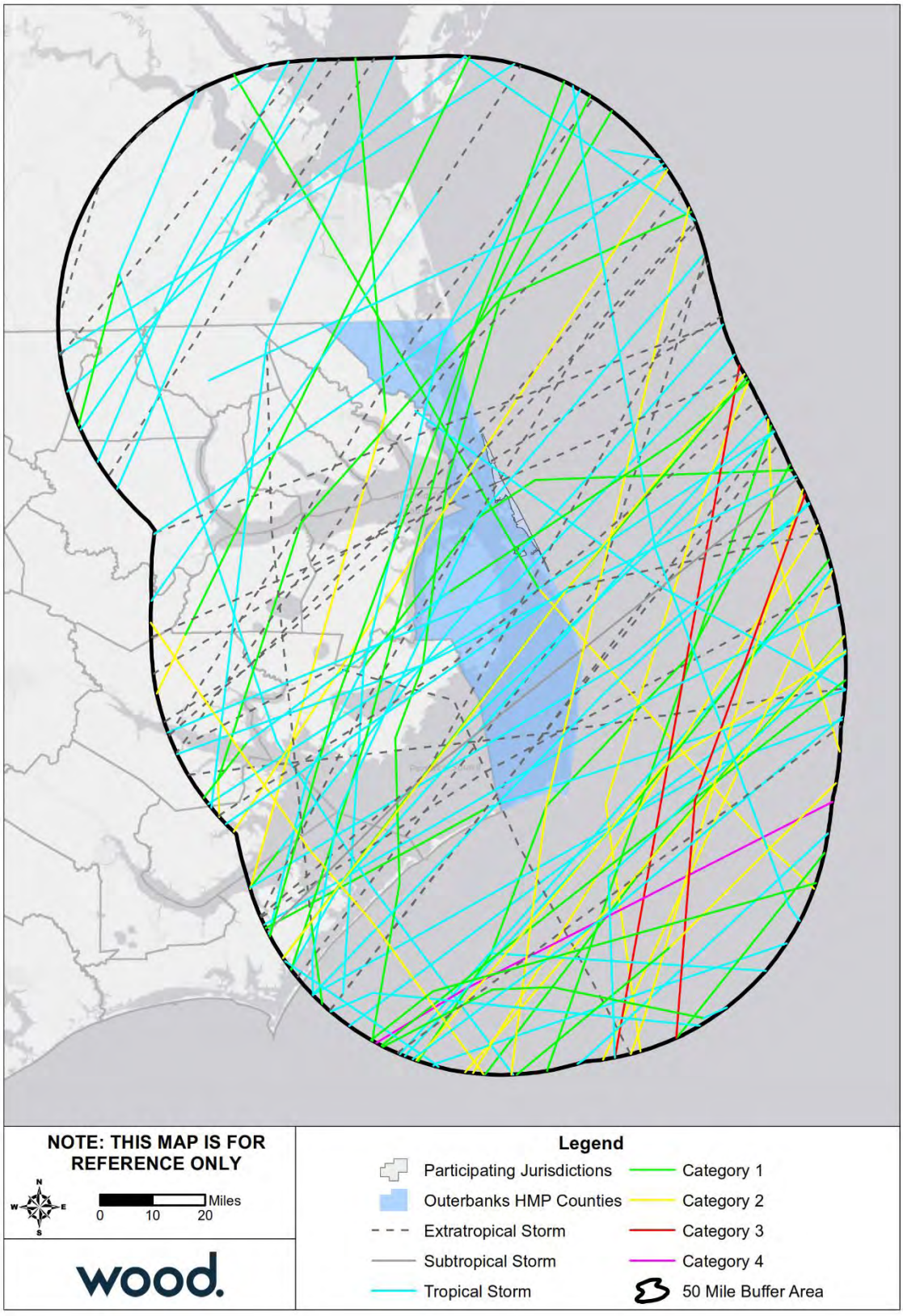
Impact: 4 – Catastrophic

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, 96 hurricanes and tropical storms have passed within 50 miles of the Outer Banks Region since 1900. These storm tracks are shown in Figure 4.45. The date, storm name, storm category, and maximum wind speed of each event are detailed in Table 4.46.

Figure 4.45 – Tropical Cyclone Tracks Passing within 50 Miles of the Outer Banks Region, 1900-2016



Source: NOAA Office of Coastal Management

Table 4.46 – Tropical Cyclone Tracks Passing within 50 Miles of the Outer Banks Region, 1900-2016

Date	Storm Name	Max Storm Category*	Max Wind Speed (mph)
Unnamed	10/13/1900	Extratropical Storm	40
Unnamed	7/11/1901	Category 1	81
Unnamed	9/18/1901	Tropical Storm	40
Unnamed	6/29/1907	Extratropical Storm	58
Unnamed	5/29/1908	Category 1	75
Unnamed	7/31/1908	Category 1	81
Unnamed	9/1/1908	Tropical Storm	52
Unnamed	8/28/1910	Extratropical Storm	46
Unnamed	10/20/1910	Tropical Storm	63
Unnamed	6/15/1912	Extratropical Storm	40
Unnamed	5/17/1916	Extratropical Storm	46
Unnamed	8/24/1918	Category 1	75
Unnamed	8/26/1924	Category 2	104
Unnamed	9/17/1924	Extratropical Storm	46
Unnamed	9/30/1924	Extratropical Storm	69
Unnamed	12/2/1925	Extratropical Storm	75
Unnamed	9/12/1930	Category 1	92
Unnamed	9/16/1932	Extratropical Storm	58
Unnamed	8/23/1933	Category 2	104
Unnamed	9/16/1933	Category 2	109
Unnamed	9/3/1934	Tropical Storm	46
Unnamed	9/8/1934	Category 1	92
Unnamed	9/6/1935	Tropical Storm	58
Unnamed	9/18/1936	Category 2	98
Unnamed	7/31/1937	Tropical Storm	63
Unnamed	10/11/1942	Extratropical Storm	52
Unnamed	9/14/1944	Category 3	121
Unnamed	10/20/1944	Extratropical Storm	52
Unnamed	6/26/1945	Category 1	75
Unnamed	7/6/1946	Tropical Storm	52
Unnamed	10/10/1946	Extratropical Storm	40
Unnamed	9/25/1947	Extratropical Storm	40
Unnamed	8/24/1949	Category 2	104
Barbara	8/14/1953	Category 1	92
Unnamed	5/29/1954	Tropical Storm	46
Carol	8/31/1954	Category 2	109
Connie	8/12/1955	Category 2	98
Ione	9/19/1955	Category 2	104
Flossy	9/27/1956	Extratropical Storm	58
Unnamed	10/18/1956	Extratropical Storm	52
Helene	9/27/1958	Category 4	138
Cindy	7/10/1959	Tropical Storm	46
Unnamed	8/2/1959	Tropical Storm	46
Brenda	7/30/1960	Tropical Storm	63
Donna	9/12/1960	Category 2	98
Unnamed	9/14/1961	Tropical Storm	40
Alma	8/28/1962	Category 1	75
Cleo	9/1/1964	Tropical Storm	46

Date	Storm Name	Max Storm Category*	Max Wind Speed (mph)
Dora	9/14/1964	Tropical Storm	58
Isbell	10/16/1964	Category 1	75
Doria	9/16/1967	Tropical Storm	63
Gladys	10/20/1968	Category 1	81
Camille	8/20/1969	Tropical Storm	52
Gerda	9/9/1969	Category 1	81
Doria	8/27/1971	Tropical Storm	63
Agnes	6/22/1972	Tropical Storm	52
Hallie	10/27/1975	Tropical Storm	52
Bret	7/1/1981	Tropical Storm	58
Dennis	8/20/1981	Tropical Storm	69
Subtrop: Unnamed	6/19/1982	Subtropical Storm	69
Diana	9/14/1984	Tropical Storm	58
Gloria	9/27/1985	Category 2	104
Kate	11/22/1985	Tropical Storm	52
Charley	8/18/1986	Category 1	81
Bob	8/19/1991	Category 2	109
Danielle	9/25/1992	Tropical Storm	63
Emily	8/31/1993	Category 3	115
Allison	6/6/1995	Extratropical Storm	46
Arthur	6/19/1996	Tropical Storm	46
Bertha	7/13/1996	Category 1	75
Josephine	10/8/1996	Extratropical Storm	52
Danny	7/24/1997	Tropical Storm	46
Bonnie	8/27/1998	Category 1	86
Earl	9/4/1998	Extratropical Storm	58
Dennis	9/4/1999	Tropical Storm	69
Floyd	9/16/1999	Category 2	104
Irene	10/18/1999	Category 2	109
Helene	9/24/2000	Tropical Storm	46
Gustav	9/11/2002	Tropical Storm	63
Kyle	10/12/2002	Tropical Storm	46
Isabel	9/18/2003	Category 2	104
Alex	8/3/2004	Category 2	98
Charley	8/14/2004	Tropical Storm	69
Gaston	8/31/2004	Tropical Storm	40
Ophelia	9/15/2005	Category 1	81
Alberto	6/14/2006	Extratropical Storm	40
Ernesto	9/1/2006	Extratropical Storm	46
Barry	6/3/2007	Extratropical Storm	46
Gabrielle	9/9/2007	Tropical Storm	58
Cristobal	7/20/2008	Tropical Storm	52
Irene	8/27/2011	Category 1	86
Andrea	6/7/2013	Extratropical Storm	46
Arthur	7/4/2014	Category 2	98
Colin	6/7/2016	Extratropical Storm	52
Hermine	9/3/2016	Extratropical Storm	69
Matthew	10/9/2016	Category 1	81

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

The above list of storms is not an exhaustive list of hurricanes that have affected the Outer Banks Region. Several storms, including Hurricane Sandy, have passed further than 50 miles away from the Outer Banks Region yet had strong enough wind or rain impacts to affect the region. Storms with hurricane and tropical storm force winds that impacted the Outer Banks Region are recorded in NCEI across four zones: Eastern Dare, Western Dare, Eastern Currituck, and Western Currituck. During the 20-year period from 1999 through 2018, NCEI records 57 hurricane and tropical storm reports across 27 separate days. These events are summarized in Table 4.47 by storm. All death, injury, and damage records were combined from all zones. Where property damage estimates were broken out by type, NCEI reports only the value of wind-related damages.

Table 4.47 – Recorded Hurricane and Tropical Storm Winds in Currituck and Dare Counties, 1999-2018

Date	Storm	Deaths/ Injuries	Property Damage	Crop Damage
8/30 – 9/1/1999	Hurricane Dennis	0/0	$12,010,000	$0
9/14 – 9/15/1999	Hurricane Floyd	0/0	$4,300,000	$4,300,000
10/16 – 10/17/1999	Hurricane Irene	0/0	$8,000	$0
9/10/2002	Tropical Storm Gustav	0/0	$57,000	$0
9/17 – 9/18/2003	Hurricane Isabel	0/0	$347,700,000	$0
8/3/2004	Hurricane Alex	0/0	$2,500,000	$0
8/14/2004	Tropical Storm Charley	0/0	$125,000	$50,000
9/13/2005	Hurricane Ophelia	0/0	$100,000	$0
8/31/2006	Tropical Storm Ernesto	0/0	$60,000	$0
9/5 – 9/6/2008	Tropical Storm Hanna	0/0	$30,000	$0
9/2 – 9/3/2010	Hurricane Earl	0/0	$172,000	$0
8/26 – 8/27/2011	Hurricane Irene	0/0	$16,000,000	$15,500,000
10/28/2012	Hurricane Sandy	0/0	$1,000,000	$0
6/6/2013	Tropical Storm Andrea	0/0	$0	$0
7/3 – 7/4/2014	Hurricane Arthur	0/0	$680,000	$0
9/2/2016	Hurricane Hermine	0/0	$5,415,000	$0
10/8/2016	Hurricane Matthew	0/0	$0	$0
9/13/2018	Hurricane Florence	0/0	$0	$0
10/11/2018	Hurricane Michael	0/0	$0	$0
Total		**0/0**	**$390,157,000**	**$19,850,000**

Source: NCEI

The HMPC felt that the damage estimates reported by NCEI were underreported and drastically diminished the severity of the hazard, particularly in light of personal experiences with these particular storms. Additionally, the HMPC wanted to include Nor'easters that have also caused significant damage to the Region. Because of this, Dare County provided damage reports compiled from community data following noteworthy storms. The data, summarized in Table 4.48, represents damages attributed to wind and water, which explains some variation from NCEI. Note that this data does not include impacts to Currituck County.

Table 4.48 – Dare County Storm Damage Reports

Date	Storm	Property Damage
9/17 – 9/18/2003	Hurricane Isabel	$3,320,000
9/13/2005	Hurricane Ophelia	$19,500
8/31/2006	Tropical Storm Ernesto	$44,500

Date	Storm	Property Damage
11/22/2006	Thanksgiving Storm, 2006	$2,073,400
11/2/2007	Hurricane Noel	$72,500
10/18 – 10/19/2008	Oct 2008 Coastal Storm	$1,687,800
11/11 – 11/14/2009	November 2009 Nor'easter	$5,788,174
9/2 – 9/3/2010	Hurricane Earl	$536,600
8/26 – 8/27/2011	Hurricane Irene	$53,975,960
10/28/2012	Hurricane Sandy	$13,221,440
7/3 – 7/4/2014	Hurricane Arthur	$2,167,750
10/3 – 10/5/2015	October 2015 Coastal Storm	$591,000
9/2/2016	Hurricane Hermine	$5,517,030
10/8/2016	Hurricane Matthew	$42,602,709
9/13/2018	Hurricane Florence	$502,500
3/2 – 3/6/2018	March 2018 Coastal Storm	$4,318,265
10/11/2018	Hurricane Michael	$7,306,538
	Total	**$143,745,626**

Source: Dare County

The following event narratives come from both NCEI and Dare County Damage Reports.

August 30 – September 1, 1999 – Hurricane Dennis, a minimal Category II Hurricane approached the coast of North Carolina on August 30th. When the storm was 75 miles south of Cape Hatteras it was downgraded to a Category I Hurricane and then to a tropical storm when it was 105 miles west of Cape Hatteras. The beach erosion and storm tide effects of Hurricane Dennis were on the Outer Banks. The hurricane approached eastern North Carolina during one of the highest astronomical tides of the month. The dune structure on Hatteras Island was breeched in numerous locations. That included the loss of a 3000-thousand-foot-long section of Highway 12 just north of Buxton and a new inlet along the Core Banks. Dennis also swallowed six homes along the northern Outer Banks in Rodanthe. The town of Nags Head estimated their dune loss at $16.5 million.

Ocean storm surges were 3 to 4 feet above normal. Many reported this was the highest water levels they had ever seen. The most damaging winds were found along the Outer Banks. For almost a week after Tropical Storm Dennis made landfall, associated rain fell on our inland counties. This allowed most of the rivers to rise above flood stage which set the stage for the next hurricane, Hurricane Floyd and its associated record flooding. The greatest rainfall occurred over Carteret, southern Craven, Outer Banks Hyde, and Outer Banks Dare County. Doppler radar estimates were near 6 to 8 inches with isolated areas of 8 to 10.

September 14-15, 1999 – Hurricane Floyd caused massive record flooding across inland sections of eastern North Carolina. At one time Floyd was classified as a category 4 hurricane on the Saffir/Simpson scale and will likely be categorized as one of the nation's most costly hurricanes in the 20th century. By the evening of September 14th, the entire North Carolina coast was under a hurricane watch and at midnight up-graded to a hurricane warning. That same night the first outer rainbands began affecting eastern North Carolina and in turn, reports of flooding began filtering into the National Weather Service office in Morehead City/Newport (MHX). At least 40 official shelters were open across the county warning area. Hurricane Floyd made landfall on the morning of September 16th near North Topsail Beach as a category 2 hurricane. The eye moved northeast over Jacksonville, New Bern, Washington, Plymouth and continued over the eastern shores of Virginia. As the hurricane moved over the eastern coast of North Carolina, it accelerated and weakened. The peak offshore wind report was 96 mph at Duck Pier.

Severe weather and rainfall preceded landfall. By Wednesday night September 16th, 20 tornado warnings had been issued with over half being verified. Estimates were near 6 to 10 inches with isolated areas of 12 to 15 inches. Extreme flooding was experienced across most counties. Unbelievable numbers of homes were covered with water and over half a million customers throughout the county warning area were without power. Unofficially the flooding from Hurricane Floyd has been compared to a 500-year flood.

September 17-18, 2003 – Hurricane Isabel made landfall early in the afternoon on September 18th as a category two hurricane across Core Banks in extreme eastern Carteret county. Isabel moved north northwest near 20 mph across eastern North Carolina during the afternoon. Areas mainly near and east of the storm center experienced significant wind and storm surge effects. Major ocean overwash and beach erosion occurred along the North Carolina Outer Banks where waves up to 20 feet accompanied a 6 to 8-foot storm surge. Almost 350 million dollars in damage occurred in Dare county alone where several thousand homes and businesses, several piers, and sections of Highway 12 were damaged or washed away.

Wind damage was more significant across Hyde, Washington, Tyrell, Martin, and the Outer Banks counties where wind gusts of around 100 mph occurred. Hurricane force winds resulted in structural damage to homes. Numerous trees and power lines were downed across these areas resulting in a loss of electricity for several weeks in some locations. The highest sustained wind speed recorded was 73 mph at Duck. The highest gusts recorded were 97 mph at Elizabeth City, 92 mph at Duck, and 74 mph at Elizabeth City. Mandatory evacuations were ordered for parts of Currituck county, with approximately several thousand persons evacuated and housed in numerous shelters across coastal northeast North Carolina. The unusually large wind field uprooted many thousands of trees, downed many power lines, damaged hundreds of houses, and snapped thousands of telephone poles and cross arms. Hundreds of roads, including major highways, were blocked by fallen trees. Local power companies reported many thousands of customers were without power. Duck water levels peaked at 7.8 feet MLLW before data was lost. Abd the lowest sea level pressure recorded was 984 mb at Duck. Isabel will be remembered for the greatest wind and storm surge in the region since Hazel in 1954, and the 1933 Chesapeake-Potomac Hurricane. Also, Isabel will be remembered for the extensive power outages in northeast North Carolina, and permanent change to the landscape from all the fallen trees and storm surge.

According to the Dare County preliminary damage report from September 19, 2003, Dare County suffered significant property damage and erosion from wave action during the storm. The hardest hit area was Hatteras Village, which was initially inaccessible by road due to a breech on NC 12. An aerial survey, and brief ground assessment indicated extensive damage to properties. Numerous homes and businesses were moved off of their foundations, or totally destroyed. Some residents reported four feet of ocean water in homes located well off of the oceanfront.

November 11-14, 2009 – The nor'easter that lingered over the Outer Banks in November 2009 resulted in coastal property damage, flooding of roadways and ground elevation structures, and extensive beach erosion. Most of the oceanfront damage from Duck south to Buxton was caused by wave action and loss of protective dunes. Flooding of roadways and ground elevation structures was due to a combination of heavy rains, and ocean overwash. Portions of NC 12 north of Rodanthe buckled due to loss of protective dunes over the extended days of punishing high tides. Hatteras village experienced soundside flooding but fortunately was spared property damage. Some scouring of dunes occurred in the Frisco area but also without property loss

Three residences in Kill Devil Hills and Nags Head were destroyed in this storm and an additional 312 structures, mostly residences, were damaged. Most of the damaged residences were single family rental properties, with generally minor damage to heat pumps, decks, stairs, and pools. The residences with major damage include those that remained in the tide and those that sustained major structural damage.

Seventy one of the structures with both minor and major damage were uninhabitable. Two motels in Buxton sustained major damage and several other businesses and town properties reported minor damage.

August 26-27, 2011 – Hurricane Irene made landfall during the morning of the 27th, near Cape Lookout, as a large category 1 hurricane on the Saffir/Simpson Hurricane Wind Scale. Due to the large size of the hurricane, strong damaging winds, major storm surge, and flooding rains were experienced across much of eastern North Carolina. Several destructive tornados occurred during the evening of the 26th associated with the hurricane.

Across Eastern Dare County, maximum wind gusts from 63 to 88 mph were recorded resulting in numerous trees and power-lines down with extensive power outages and structural damage. The highest surge was 7 to 10 feet on the sound-side from Buxton to Rodanthe and the highest ocean-side surge of 9.5 feet was recorded at Hatteras Village. In Currituck, a 3 to 4-foot surge was observed on the eastern shore of the county adjacent to the Currituck Sound. Surge resulted in extensive damage, flooding of structures, and caused many dune breaches and damage to Highway 12. Mandatory evacuations were ordered for all visitors and residents on the 24th and 25th.

Much of Dare County suffered significant soundside flooding from storm surge, with some areas reporting up to five feet of water in structures. Many vehicles were also flooded. Minor oceanfront and oceanside damage was reported, but no area of the county was spared from damage.

September 2, 2016 – Hurricane Hermine made landfall in the Big Bend area of Florida during the early morning hours on September 2nd, and moved northeast along the Southeastern United States on the 2nd. Hermine weakened slightly to Tropical Storm strength and crossed through Eastern North Carolina during the late evening on September 2nd, and exited off the North Carolina coast near Duck during the morning of September 3rd.

Tropical Storm Hermine produced significant impacts across Outer Banks Dare county. Strong north winds developed during the morning and early afternoon of September 3rd as Hermine moved northeast of the region. Winds of 60 to 70 mph were common over Hatteras Island with a peak gust of 84 mph recorded at the Duck Pier. These strong winds led to structural damage to several homes and businesses as well as sporadic power outages across North Carolina. These strong winds also pushed water from the Pamlico sound onshore leading to moderate to major sound-side storm surge of 2 to 4 feet above ground level. This storm surge flooded many homes and businesses with significant damage to some. The highest surge values of 3 to 4 feet were observed between Buxton and Hatteras Village. On the ocean side moderate beach erosion and ocean over wash was observed damaging roads and a few homes. Very heavy rain led to some flash flooding over the Hatteras Village area and an EF0 tornado also damaged a couple cabins in the Hatteras Village community. Overall damage was estimated at 5.4 million dollars over Outer Banks Dare county with most of this caused by storm surge flooding.

In addition to wind impacts, the Outer Banks Region has experienced storm surge from hurricane and tropical storm events. Table 4.49 summarizes all recorded storm surge events from NCEI between 1999 and 2018. These events caused over $55 million in property damage. Narrative records on storm surge impacts are provided below.

October 8, 2016 – Hurricane Matthew affected all areas of Dare County, causing significant and wide spread flooding -mostly from heavy rains, wide spread damage due to high winds, and wide spread power outages. Many areas that are not normally flooded experienced flooding due to the amount of rain brought by the storm. Roughly 13% of improved properties countywide suffered some level of property damage as a result of this storm. The areas with the highest concentration of properties suffering major damage were Frisco and Hatteras Village, where A significant number of properties suffered major damage

from severe soundside flooding and flooding from excessive rainfall. Water levels in some living areas in Hatteras village were reported at 5 feet and above and most commercial properties suffered major flood damage. Some marinas also suffered damage to their infrastructure.

Damage throughout the rest of the county was attributed to wind, which included missing shingles and siding, and water, both surge and excessive rainfall. In the Town of Manteo, areas that typically do not see flooding were flooded due to the amount of rain that fell. In Nags Head, commercial businesses on NC 12 from Bonnett Street to Eighth Street and in the Gallery Row area were hit particularly hard. Portions of NC 12 were covered with over three feet of water. Water dependent structures such as piers, docks, and bulkheads experienced heavy damage and in some cases were completely destroyed.

Table 4.49 – Recorded Storm Surge Events in the Outer Banks Region, 1999-2018

Date	Location	Deaths/ Injuries	Property Damage	Crop Damage
3/6/2001	Manteo	0/0	$0	$0
4/10/2003	Eastern Currituck (Zone)	0/0	$0	$0
3/10/2004	Eastern Dare (Zone)	0/0	$10,000	$0
4/3/2005	Eastern Dare (Zone)	0/0	$0	$0
4/15/2005	Eastern Dare (Zone)	0/0	$50,000	$0
5/6/2005	Eastern Dare (Zone)	0/0	$0	$0
9/9/2007	Eastern Dare (Zone)	0/0	$0	$0
7/20/2008	Eastern Dare (Zone)	0/0	$0	$0
10/19/2008	Eastern Dare (Zone)	0/0	$10,000	$0
9/2/2010	Eastern Dare (Zone)	0/0	$380,000	$0
8/26/2011	Western Dare (Zone)	0/0	$1,000,000	$0
8/26/2011	Eastern Dare (Zone)	0/0	$40,000,000	$0
10/28/2012	Eastern Dare (Zone)	0/0	$13,000,000	$0
6/6/2013	Eastern Dare (Zone)	0/0	$0	$0
7/3/2014	Eastern Dare (Zone)	0/0	$1,500,000	$0
	Total	**0/0**	**$55,950,000**	**$0**

Source: NCEI

March 10, 2004 – Significant overwash was reported north of Rodanthe during the late evening hours on the 10th continuing into the early morning hours on the 11th, resulting in the closure of Highway 12. Several homes near Kill devil hills received minor damage from flooding.

April 3, 2005 – Moderate sound-side flooding occurred across northern portions of the Outer Banks near Oregon Inlet during the early morning hours of Sunday, April 3rd. Highway 12 was closed for several hours with one foot of water reported over the road.

May 6, 2005 – An unseasonable and strong Nor'easter buffeted the North Carolina coast with damaging wind gusts, torrential rain, high surf, and coastal flooding. Winds were sustained as high as 45 to 55 mph with wind gusts to 80 mph across coastal counties of Eastern North Carolina. Water levels rose four to six feet above normal along Pamlico Sound. Storm total rainfall amounts ranged from 4 to 7 inches. During the peak of storm, the Diamond buoy reported 20 foot waves. Moderate beach erosion was reported along the Outer Banks. In Dare County, the public reported sound-side flooding with one foot of water on Highway 12 near Frisco.

August 26, 2011 – Hurricane Irene made landfall during the morning of the 27th, near Cape Lookout, as a large category 1 hurricane on the Saffir/Simpson Hurricane Wind Scale. Due to the large size of the hurricane, strong damaging winds, major storm surge, and flooding rains were experienced across much of eastern North Carolina. Wind gusts from 60 to 70 mph resulted in a 5 foot sound-side storm surge in

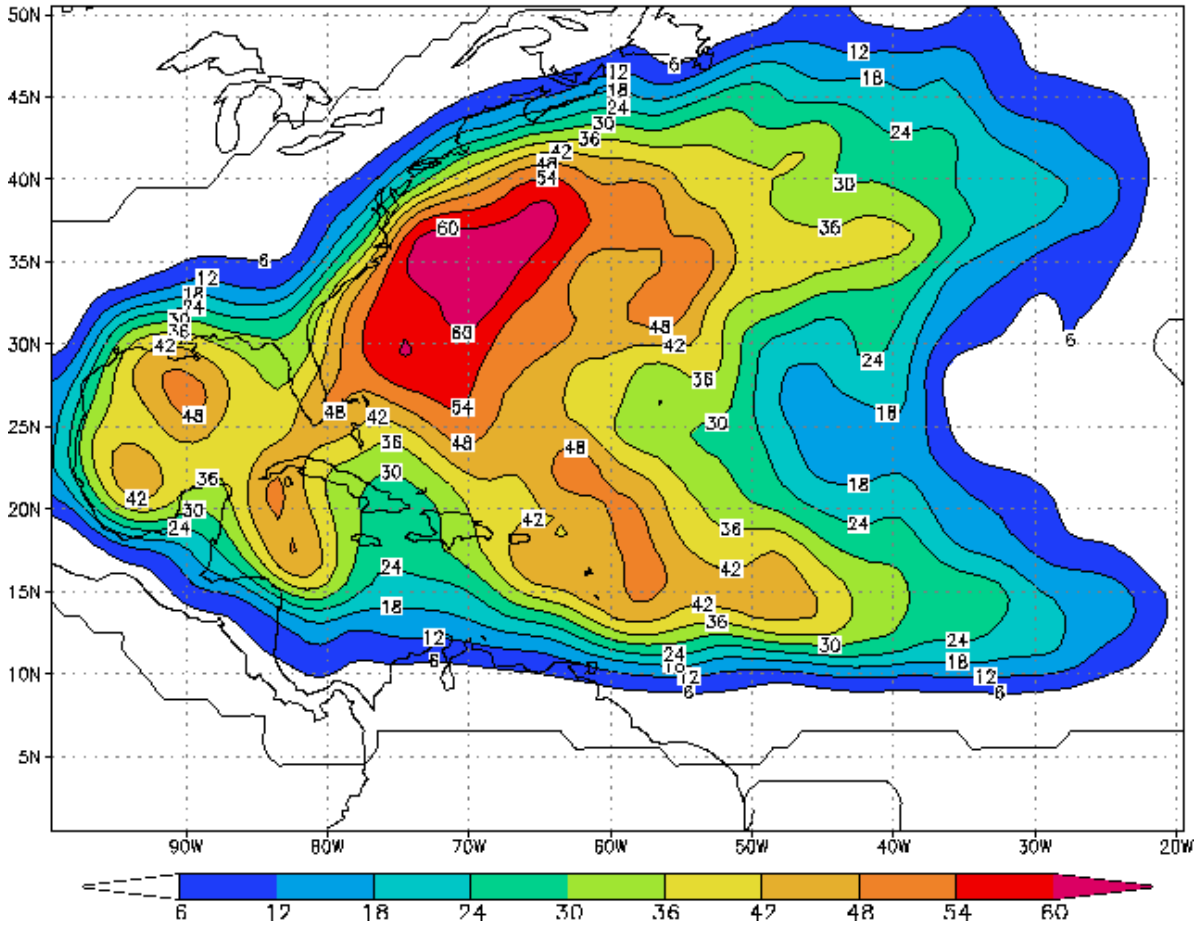
Manteo. In eastern Dare County, wind gusts from 63 to 88 mph resulted in extensive structural damage. The highest surge was 7 to 10 feet on the sound-side from Buxton to Rodanthe and the highest ocean-side surge of 9.5 feet was recorded at Hatteras Village. The storm surge resulted in extensive damage to structures along the coast along with many dune breaches and damage to Highway 12.

October 28, 2012 – Hurricane Sandy was one of the largest hurricanes on record to affect eastern North Carolina. The main impacts were from a sound-side storm surge of 4 to 6 feet along portions of the Outer Banks and southern portions of the Pamlico Sound, and an ocean-side surge along the Dare County Outer Banks from Hatteras north to Kitty Hawk. Damages from surge were estimated near 13 million dollars with the main damages occurring along U.S. 158 north of Oregon Inlet in Kitty Hawk where Highway 12 was destroyed and had to be closed. 58 homes were left uninhabitable with eight completely destroyed from Hatteras north to Rodanthe. The highest storm surge measured, 3.94 feet, was recorded sound-side at the USCG Station in Hatteras on the 29th. An NWS storm surge team estimated the highest surge, 8.5 feet, ocean-side at Buxton. Large breaking waves on top of the surge resulted in moderate to major beach erosion and over-wash along the coast from Duck to Hatteras. A large section of Highway 12 north of Rodanthe was closed due to extensive Damage to the road, caused by wave action and ocean over-wash.

Probability of Future Occurrence

Figure 4.46 shows, for any particular location, the chance of a hurricane or tropical storm affecting the area sometime during the Atlantic hurricane season. The figure was created by the National Oceanic and Atmospheric Administration's (NOAA) Hurricane Research Division, using data from 1944 to 1999 and shows the number of times a storm or hurricane was located within approximately 100 miles of a given spot in the Atlantic basin. Per this data, there is approximately a 42-48% chance of a hurricane occurring near the Outer Banks Region in any given year.

Figure 4.46 – Empirical Probability of a Named Hurricane or Tropical Storm



Source: National Oceanic and Atmospheric Administration, Hurricane Research Division

On average, North Carolina experiences a hurricane approximately once every two years. Per historical records, in the 20-year period from 1999 through 2018, the Outer Banks Region was impacted by 19 separate hurricane and tropical storm events; property and/or crop damages were reported for 15 of these events. Based on these historical data, it can be reasonably concluded that there is a 50 to 75 percent chance of a hurricane or tropical storm impacting the Region in any given year.

Hazards previously discussed, such as sea level rise, and coastal and estuarine erosion, can amplify impacts of hurricanes and related hazards, such as coastal and sound side storm surge.

Probability: 3 – Likely

Climate Change

North Carolina's coastal location makes it a prime target for hurricane landfalls, and changing climate and weather conditions may increase the number and frequency of future hurricane events. Hurricanes and other coastal storms may result in increased flooding, injuries, deaths, and extreme property loss. According to the US Government Accountability Office, national storm losses from changing frequency and intensity of storms is projected to increase anywhere from $4-6 billion in the near future.

According to NOAA, weather extremes will likely cause more frequent, stronger storms in the future due to rising surface temperatures. NOAA models predict that while there may be less frequent, low-category

storm events (Tropical Storms, Category 1 Hurricanes), there will be more, high-category storm events (Category 4 and 5 Hurricanes) in the future. This means that there may be fewer hurricanes overall in any given year, but when hurricanes do form, it is more likely that they will become large storms that can create massive damage.

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.

In addition to the data presented below, the forthcoming Southeast Coastal Assessment from the United States Army Corps of Engineers (USACE) South Atlantic Division will provide supplementary data and details through a comprehensive coastal shoreline risks and needs assessment. This tool will look at four hazards (hurricanes and storms, long-term erosion, flooding, and potential sea level rise) and how they will impact population, the built environment, and the natural environment.

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

General damages to property are both direct (what the winds associated with hurricanes physically destroy) and indirect, which focuses on additional costs, damages and losses attributed to secondary hazards spawned by the hurricane, or due to the damages caused by the storm. Depending on the size and strength of the hurricane, associated winds are capable of damaging and eventually destroying almost anything. Construction practices and building codes can help maximize structures' resistance to damage.

Secondary impacts of damage due to hurricane winds 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 impacts of a hurricane put tremendous strain on a community. In the immediate aftermath of a hurricane, the focus is on emergency services.

Table 4.50 through Table 4.54 detail buildings at risk and provide damage estimates across all jurisdictions for the 25-, 50-, 100-, 300-, and 700-year hurricane wind events. All scenarios impacted the same number of buildings but with varying severity of damage.

The damage estimates for the 100-year hurricane wind event totals $1,270,192,419, which equates to a loss ratio of 12.9 percent. The loss ratio is the damage estimate divided by the total potential exposure (i.e., total of improved and contents value for all buildings in the planning area), displayed as a percentage of value at risk. FEMA considers loss ratios greater than 10% to be significant and an indicator a community may have more difficulties recovering from an event.

Table 4.50 – Buildings at Risk from 25-Year Hurricane 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
Currituck													
Unincorporated Currituck County	17,069	15,016	88%	$23,557,679	1,407	8.2%	$5,425,360	198	1.2%	$1,061,272	16,621	97.4%	$30,044,312
Dare													
Unincorporated Dare County	13,634	12,452	91.3%	$38,424,938	644	4.7%	$2,175,194	152	1.1%	$807,710	13,248	97.2%	$41,407,843
Town of Duck	2,400	2,105	87.7%	$8,168,961	53	2.2%	$133,197	4	0.2%	$100,723	2,162	90.1%	$8,402,881
Town of Kill Devil Hills	5,972	5,380	90.1%	$5,983,774	309	5.2%	$2,767,233	18	0.3%	$82,608	5,707	95.6%	$8,833,615
Town of Kitty Hawk	2,803	2,501	89.2%	$4,262,277	179	6.4%	$804,446	11	0.4%	$17,983	2,691	96%	$5,084,707
Town of Manteo	918	764	83.2%	$8,879,098	124	13.5%	$816,719	29	3.2%	$145,431	917	99.9%	$9,841,248
Town of Nags Head	4,827	4,268	88.4%	$25,243,809	293	6.1%	$3,360,247	30	0.6%	$385,569	4,591	95.1%	$28,989,625
Town of Southern Shores	2,496	2,436	97.6%	$5,075,822	33	1.3%	$58,719	8	0.3%	$19,709	2,477	99.2%	$5,154,249
Subtotal Dare	**33,050**	**29,906**	**90.5%**	**$96,038,679**	**1,635**	**5.0%**	**$10,115,755**	**252**	**0.8%**	**$1,559,733**	**31,793**	**96.2%**	**$107,714,168**
Region Total	**50,119**	**44,922**	**89.6%**	**$119,596,358**	**3,042**	**6.1%**	**$15,541,115**	**450**	**0.9%**	**$2,621,005**	**48,414**	**96.6%**	**$137,758,480**

Source: NCEM Risk Management Tool

Table 4.51 – Buildings at Risk from 50-Year Hurricane 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
Currituck													
Unincorporated Currituck County	17,069	15,016	88%	$81,791,342	1,407	8.2%	$12,793,425	198	1.2%	$3,197,187	16,621	97.4%	$97,781,954
Subtotal Currituck	**17,069**	**15,016**	**88%**	**$81,791,342**	**1,407**	**8.2%**	**$12,793,425**	**198**	**1.2%**	**$3,197,187**	**16,621**	**97.4%**	**$97,781,954**
Dare													
Unincorporated Dare County	13,634	12,452	91.3%	$126,973,307	644	4.7%	$6,326,385	152	1.1%	$2,988,980	13,248	97.2%	$136,288,672
Town of Duck	2,400	2,105	87.7%	$28,665,690	53	2.2%	$408,190	4	0.2%	$246,813	2,162	90.1%	$29,320,693
Town of Kill Devil Hills	5,972	5,380	90.1%	$38,142,291	309	5.2%	$12,808,030	18	0.3%	$1,249,002	5,707	95.6%	$52,199,323
Town of Kitty Hawk	2,803	2,501	89.2%	$12,602,005	179	6.4%	$2,322,590	11	0.4%	$89,258	2,691	96%	$15,013,853
Town of Manteo	918	764	83.2%	$26,080,846	124	13.5%	$2,373,358	29	3.2%	$890,598	917	99.9%	$29,344,801
Town of Nags Head	4,827	4,268	88.4%	$100,729,126	293	6.1%	$9,752,559	30	0.6%	$1,673,623	4,591	95.1%	$112,155,307
Town of Southern Shores	2,496	2,436	97.6%	$15,720,752	33	1.3%	$191,748	8	0.3%	$69,027	2,477	99.2%	$15,981,527
Subtotal Dare	**33,050**	**29,906**	**90.5%**	**$348,914,017**	**1,635**	**5.0%**	**$34,182,860**	**252**	**0.8%**	**$7,207,301**	**31,793**	**96.2%**	**$390,304,176**
Region Total	**50,119**	**44,922**	**89.6%**	**$430,705,359**	**3,042**	**6.1%**	**$46,976,285**	**450**	**0.9%**	**$10,404,488**	**48,414**	**96.6%**	**$488,086,130**

Source: NCEM Risk Management Tool

Table 4.52 – Buildings at Risk from 100-Year Hurricane Winds

Jurisdiction	All Buildings	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
Currituck															
Unincorporated Currituck County	17,069	5,241	30.70%	15,016	88%	$240,667,857	1,407	8.20%	$27,645,681	198	1.20%	$7,819,259	16,621	97.40%	$276,132,796
Subtotal Currituck	**17,069**	**5,241**	**30.70%**	**15,016**	**88%**	**$240,667,857**	**1,407**	**8.20%**	**$27,645,681**	**198**	**1.20%**	**$7,819,259**	**16,621**	**97.40%**	**$276,132,796**
Dare															
Unincorporated Dare County	13,634	3,783	27.70%	12,452	91.30%	$324,260,872	644	4.70%	$15,512,965	152	1.10%	$8,346,279	13,248	97.20%	$348,120,116
Town of Duck	2,400	79	3.30%	2,105	87.70%	$84,678,939	53	2.20%	$1,095,113	4	0.20%	$577,554	2,162	90.10%	$86,351,606
Town of Kill Devil Hills	5,972	1,141	19.10%	5,380	90.10%	$115,328,828	309	5.20%	$27,436,454	18	0.30%	$3,753,387	5,707	95.60%	$146,518,669
Town of Kitty Hawk	2,803	980	35%	2,501	89.20%	$36,496,835	179	6.40%	$6,325,484	11	0.40%	$356,819	2,691	96%	$43,179,138
Town of Manteo	918	369	40.20%	764	83.20%	$58,902,065	124	13.50%	$5,733,864	29	3.20%	$2,953,744	917	99.90%	$67,589,673
Town of Nags Head	4,827	618	12.80%	4,268	88.40%	$226,733,723	293	6.10%	$21,903,999	30	0.60%	$4,083,163	4,591	95.10%	$252,720,885
Town of Southern Shores	2,496	197	7.90%	2,436	97.60%	$48,811,042	33	1.30%	$538,045	8	0.30%	$230,449	2,477	99.20%	$49,579,536
Subtotal Dare	**33,050**	**7,167**	**21.7%**	**29,906**	**90.5%**	**$895,212,304**	**1,635**	**4.9%**	**$78,545,924**	**252**	**0.8%**	**$20,301,395**	**31,793**	**96.2%**	**$994,059,623**
Region Total	**50,119**	**12,408**	**24.76%**	**44,922**	**89.63%**	**$1,135,880,161**	**3,042**	**6.07%**	**$106,191,605**	**450**	**0.90%**	**$28,120,654**	**48,414**	**96.60%**	**$1,270,192,419**

Source: NCEM Risk Management Tool

Table 4.53 – Buildings at Risk from 300-Year Hurricane 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
Currituck													
Unincorporated Currituck County	17,069	15,016	88%	$782,081,363	1,407	8.20%	$83,764,011	198	1.20%	$24,331,515	16,621	97.40%	$890,176,888
Subtotal Currituck	**17,069**	**15,016**	**88%**	**$782,081,363**	**1,407**	**8.20%**	**$83,764,011**	**198**	**1.20%**	**$24,331,515**	**16,621**	**97.40%**	**$890,176,888**
Dare													
Unincorporated Dare County	13,634	12,452	91.30%	$1,001,828,056	644	4.70%	$51,780,725	152	1.10%	$25,673,814	13,248	97.20%	$1,079,282,595
Town of Duck	2,400	2,105	87.70%	$343,595,786	53	2.20%	$5,289,417	4	0.20%	$2,827,816	2,162	90.10%	$351,713,019
Town of Kill Devil Hills	5,972	5,380	90.10%	$266,254,175	309	5.20%	$53,016,434	18	0.30%	$9,160,033	5,707	95.60%	$328,430,642
Town of Kitty Hawk	2,803	2,501	89.20%	$168,995,934	179	6.40%	$30,552,660	11	0.40%	$2,152,067	2,691	96%	$201,700,661
Town of Manteo	918	764	83.20%	$103,944,053	124	13.50%	$12,263,497	29	3.20%	$7,546,875	917	99.90%	$123,754,426
Town of Nags Head	4,827	4,268	88.40%	$415,761,393	293	6.10%	$41,947,287	30	0.60%	$8,415,759	4,591	95.10%	$466,124,439
Town of Southern Shores	2,496	2,436	97.60%	$246,181,529	33	1.30%	$3,374,636	8	0.30%	$1,793,515	2,477	99.20%	$251,349,680
Subtotal Dare	**33,050**	**29,906**	**90.5%**	**$2,546,560,926**	**1,635**	**4.9%**	**$198,224,656**	**252**	**0.8%**	**$57,569,879**	**31,793**	**96.2%**	**$2,802,355,462**
Region Total	**50,119**	**44,922**	**89.63%**	**$3,328,642,289**	**3,042**	**6.07%**	**$281,988,667**	**450**	**0.90%**	**$81,901,394**	**48,414**	**96.60%**	**$3,692,532,350**

Source: NCEM Risk Management Tool

Table 4.54 – Buildings at Risk from 700-Year Hurricane 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
Currituck													
Unincorporated Currituck County	17,069	15,016	88%	$1,208,312,578	1,407	8.20%	$138,913,269	198	1.20%	$44,823,778	16,621	97.40%	$1,392,049,626
Subtotal Currituck	**17,069**	**15,016**	**88%**	**$1,208,312,578**	**1,407**	**8.20%**	**$138,913,269**	**198**	**1.20%**	**$44,823,778**	**16,621**	**97.40%**	**$1,392,049,626**
Dare													
Unincorporated Dare County	13,634	12,452	91.30%	$1,328,473,902	644	4.70%	$75,657,812	152	1.10%	$39,750,650	13,248	97.20%	$1,443,882,364
Town of Duck	2,400	2,105	87.70%	$484,691,776	53	2.20%	$8,674,606	4	0.20%	$4,433,713	2,162	90.10%	$497,800,096
Town of Kill Devil Hills	5,972	5,380	90.10%	$414,250,034	309	5.20%	$82,053,054	18	0.30%	$16,232,324	5,707	95.60%	$512,535,411
Town of Kitty Hawk	2,803	2,501	89.20%	$261,402,873	179	6.40%	$50,096,193	11	0.40%	$3,572,443	2,691	96%	$315,071,509
Town of Manteo	918	764	83.20%	$143,774,461	124	13.50%	$20,915,288	29	3.20%	$13,656,593	917	99.90%	$178,346,343
Town of Nags Head	4,827	4,268	88.40%	$605,997,629	293	6.10%	$64,700,017	30	0.60%	$13,691,971	4,591	95.10%	$684,389,616
Town of Southern Shores	2,496	2,436	97.60%	$383,344,077	33	1.30%	$6,178,715	8	0.30%	$3,578,409	2,477	99.20%	$393,101,201
Subtotal Dare	**33,050**	**29,906**	**90.5%**	**$3,621,934,752**	**1,635**	**4.9%**	**$308,275,685**	**252**	**0.8%**	**$94,916,103**	**31,793**	**96.2%**	**$4,025,126,540**
Region Total	**50,119**	**44,922**	**89.63%**	**$4,830,247,330**	**3,042**	**6.07%**	**$447,188,954**	**450**	**0.90%**	**$139,739,881**	**48,414**	**96.60%**	**$5,417,176,166**

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, storm surge and intense rainfall. Endangered species can be dramatically impacted. Forests can be completely defoliated by strong winds.

Consequence Analysis

Table 4.55 summarizes the potential consequences of hurricane winds.

Table 4.55 – Consequence Analysis - Hurricane and Tropical Storm

Category	Consequences
Public	Impacts include injury or death, loss of property, outbreak of diseases, mental trauma and loss of livelihoods. Power outages and flooding are likely to displace people from their homes. Water can become polluted such that if consumed, diseases and infection can be easily spread. Residential, commercial, and public buildings, as well as critical infrastructure such as transportation, water, energy, and communication systems may be damaged or destroyed, resulting in cascading impacts on the public.
Responders	Localized impact expected to limit damage to personnel in the inundation area at the time of the incident.
Continuity of Operations (including Continued Delivery of Services)	Damage to facilities/personnel from flooding or wind may require temporary relocation of some operations. Operations may be interrupted by power outages. Disruption of roads and/or utilities may postpone delivery of some services. Regulatory waivers may be needed locally. Fulfillment of some contracts may be difficult. Impact may reduce deliveries.
Property, Facilities and Infrastructure	Structural damage to buildings may occur; loss of glass windows and doors by high winds and debris; loss of roof coverings, partial wall collapses, and other damages requiring significant repairs are possible in a major (category 3 to 5) hurricane.
Environment	Hurricanes can devastate wooded ecosystems and remove all the 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. Due to its coastal geography, the entire Region is uniformly susceptible to the impacts of hurricanes, tropical storms, and the associated storm surges and flooding. While hurricanes have the possibility of being catastrophic across all jurisdictions, certain areas may be even more vulnerable. 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. For example, unincorporated areas of both Dare and Currituck Counties have higher rates of mobile homes, making residents in such homes more susceptible to damages from

wind while Manteo, Southern Shores, and Kill Devil Hills all have higher population densities. Still, towns with higher property values could also suffer increased damages.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	Score	Priority
Currituck County	3	4	4	1	3	3.3	H
Dare County	3	4	4	1	3	3.3	H
Duck	3	4	4	1	3	3.3	H
Kill Devil Hills	3	4	4	1	3	3.3	H
Kitty Hawk	3	4	4	1	3	3.3	H
Manteo	3	4	4	1	3	3.3	H
Nags Head	3	4	4	1	3	3.3	H
Southern Shores	3	4	4	1	3	3.3	H

4.5.7 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 tornados 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, but even small pea sized hail can do damage.

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

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

Warning Time: 4 – Less than six hours

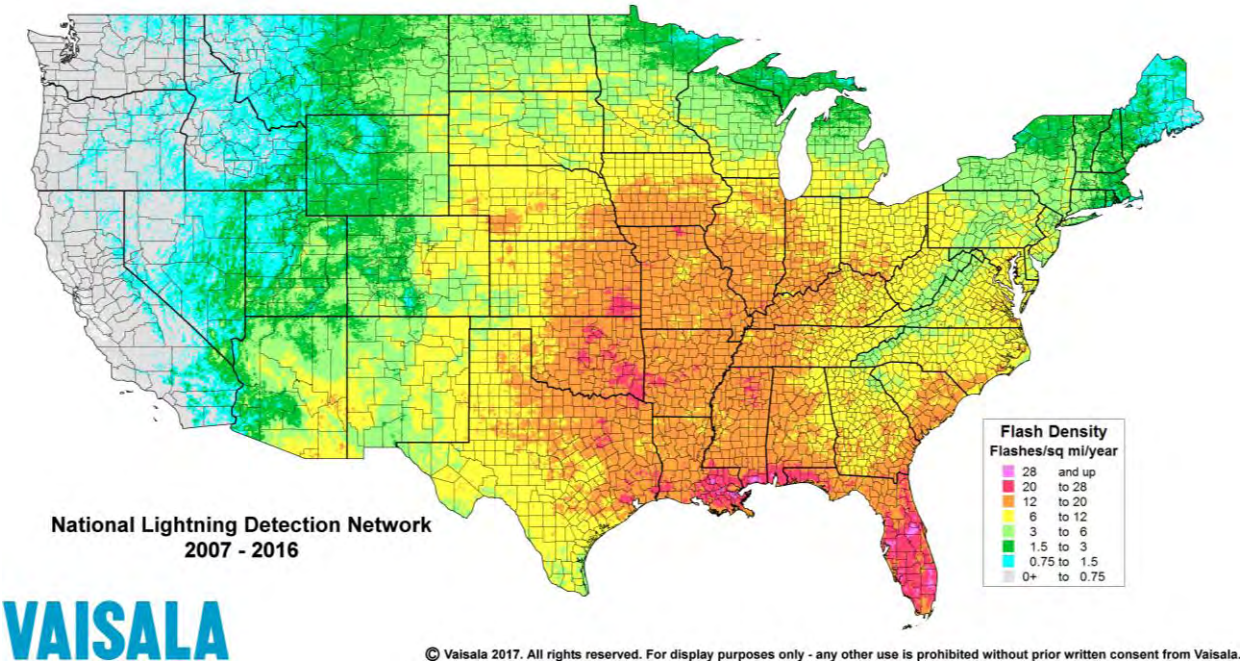
Duration: 1 – Less than six hours

Location

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

According to the Vaisala flash density map, shown in Figure 4.47, the majority of the Outer Banks Region is located in an area that experiences 6 to 12 lightning flashes per square kilometer per year, however southern Dare County could experience up to 20 lightning flashes per square kilometer per year. It should be noted that future lightning occurrences may exceed these figures.

Figure 4.47 – Lightning Flash Density (2007-2016)



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 Tornados 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 Region occurred on March 8, 2005 in Dare County with an estimated gust of 109 mph. The event caused $200,000 in recorded property damage, and no fatalities, injuries, or crop damage.

Impact: 2 – Limited

Spatial Extent: 4 – Large

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 the Outer Banks Region is uniformly exposed to the threat of lightning.

Spatial Extent: 1 – Negligible

Hail

The National Weather Service classifies hail by diameter size, and corresponding everyday objects to help relay scope and severity to the population. Table 4.57 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

Average Diameter	Corresponding Household Object
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 1999 and 2018 in the Outer Banks Region was a little under 1" in diameter; the largest hailstone recorded was 1.75", recorded on four separated occasions, none of which caused any damage, injuries, or fatalities.

Impact: 1 – Minor

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

Spatial Extent: 2 – Small

Historical Occurrences

Thunderstorm Winds

Between January 1, 1999 and December 31, 2018, the NCEI recorded 153 separate incidents of high winds, strong winds, and thunderstorm winds, occurring on 110 separate days. Of these events, 47 caused property damage. Wind gusts with property damage recorded averaged $26,063 in damage. These events caused $1,225,000 in recorded property damage, 8 injuries and no fatalities or crop damage. The recorded gusts averaged 61.14 mph, with the highest gusts recorded at 109 mph. Gusts of this speed were recorded only once in the Region, during a storm on March 8, 2005. Only one of these wind events caused injuries, which occurred during a storm in April 1999 when a circus tent was blown over, injuring eight circus workers.

Incidents with recorded damages are detailed below:

Table 4.59 – Recorded Thunderstorm Winds with Property Damages in the Outer Banks, 1998-2017

Location	Date	Time	Wind Speed (mph)	Fatalities	Injuries	Property Damage
Manteo Airport	4/11/1999	1415	104	0	8	$230,000
Currituck	7/24/1999	1620	-	0	0	$2,000
Rodanthe	5/27/2000	2330	-	0	0	$100,000
Eastern Currituck (Zone)	5/29/2000	900	69	0	0	$20,000
Eastern Dare (Zone)	3/13/2001	330	63	0	0	$10,000
Moyock	5/13/2002	2100	-	0	0	$2,000
Grandy	6/14/2002	1627	-	0	0	$2,000
Corolla	8/24/2002	1623	-	0	0	$2,000
Eastern Currituck (Zone)	4/10/2003	400	46	0	0	$5,000
Western Currituck (Zone)	4/10/2003	400	46	0	0	$5,000
Moyock	8/17/2003	1540	58	0	0	$2,000
Currituck	8/17/2003	1610	58	0	0	$1,000
Moyock	8/18/2003	1415	58	0	0	$2,000
Jarvisburg	6/25/2004	1543	58	0	0	$2,000
Poplar Branch	10/15/2004	1045	60	0	0	$5,000
Countywide	3/8/2005	1226	109	0	0	$200,000
Point Harbor	3/8/2005	1235	58	0	0	$2,000
Coinjock	7/28/2006	2007	58	0	0	$2,000
Moyock	8/4/2006	1740	58	0	0	$2,000
Aydlett	8/8/2006	1330	58	0	0	$2,000
Eastern Currituck (Zone)	11/3/2007	430	54	0	0	$1,000
Currituck Co Airport	5/11/2008	1853	58	0	0	$3,000
Grandy	5/11/2008	1905	58	0	0	$2,000
Snowden	1/7/2009	1105	58	0	0	$2,000
Snowden	9/28/2009	1955	58	0	0	$2,000
Knotts Is	9/28/2009	2010	58	0	0	$2,000
Aydlett	7/20/2010	1640	58	0	0	$2,000
Grandy	7/20/2010	1645	58	0	0	$2,000
Knotts Is	4/28/2011	1636	58	0	0	$2,000
Aydlett	6/25/2012	1800	58	0	0	$2,000
Currituck	6/29/2012	2340	58	0	0	$2,000

Location	Date	Time	Wind Speed (mph)	Fatalities	Injuries	Property Damage
Snowden	6/30/2012	2230	58	0	0	$2,000
Snowden	7/1/2012	10	58	0	0	$2,000
Snowden	8/15/2012	1600	58	0	0	$3,000
Waterlily	4/25/2014	1937	58	0	0	$2,000
Snowden	6/19/2014	1745	58	0	0	$10,000
Buffalo City	2/16/2016	1006	77	0	0	$10,000
Eastern Currituck (Zone)	10/8/2016	1800	70	0	0	$250,000
Western Currituck (Zone)	10/8/2016	1800	62	0	0	$250,000
Snowden	5/5/2017	715	58	0	0	$2,000
Jarvisburg	5/22/2017	1530	58	0	0	$2,000
Snowden	5/27/2017	2110	58	0	0	$5,000
Eastern Currituck (Zone)	3/2/2018	400	58	0	0	$25,000
Western Currituck (Zone)	3/2/2018	400	58	0	0	$25,000
Mayock	6/23/2018	1827	58	0	0	$2,000
Eastern Currituck (Zone)	10/11/2018	1830	63	0	0	$10,000
Western Currituck (Zone)	10/11/2018	1830	58	0	0	$5,000
Total				**0**	**8**	**$1,225,000**

Source: NCEI

Lightning

According to NCEI data, there were 12 lightning strikes reported between 1999 and 2018. Of these, 8 recorded property damage totaling over $80,000, three directly caused fatalities, and two caused injury. 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 the Outer Banks region. Table 4.60 details NCEI-recorded lightning strikes from 1999 through 2018.

Table 4.60 – Recorded Lightning Strikes in the Outer Banks Region, 1999-2018

Location	Date	Time	Fatalities	Injuries	Property Damage
Manteo	4/3/2002	2115	0	0	$10,000
Colington	8/24/2002	1800	0	0	$12,000
Hatteras	8/24/2002	2000	1	4	$0
Buxton	9/5/2002	1510	0	0	$20,000
Moyock	8/18/2003	1415	0	0	$2,000
Rodanthe	6/20/2008	1430	0	2	$0
Duck	7/27/2009	1600	1	0	$0
Currituck	8/6/2009	1230	0	0	$2,000
Kitty Hawk	7/21/2012	1910	0	0	$10,000
Corolla	7/10/2014	630	0	0	$25,000
Knotts Is	7/31/2016	1510	1	0	$0
Mayock	7/23/2017	1931	0	0	$3,000
		Total	**3**	**6**	**$84,000**

Source: NCEI

The following are a selection of narrative descriptions recorded in NCEI for lightning events that occurred in the Outer Banks Region:

August 24, 2002 – Lightning struck 5 people attempting to dig a vehicle out of the sand. One woman was killed, and 4 others were injured, one seriously. Another lightning strike on the same day caused $12,000 in property damages.
September 5, 2002 – Five homes here struck by lightning in and around Buxton as well as near Kitty Hawk. Property damage from fires occurred with several of the buildings.

June 20, 2008 – Scattered thunderstorms developed over eastern North Carolina during the afternoon hours north of a stalled frontal boundary. A few of the storms became severe producing large hail. Two people struck by lightning just south of Rodanthe. One person had to be revived by emergency medical technicians.

July 27, 2009 – Thunderstorms crossing the northern Outer Banks produced a lightning strike that killed a man in Southern Shores.

July 21, 2012 – Very unstable air developed over eastern North Carolina as a front was stalled to the north. Scattered to numerous showers and thunderstorms developed in the afternoon as an upper level disturbance approached from the northwest. A few of these storms became severe producing damaging winds into the early evening hours. Dare county 911 reported several homes struck by lightning in Duck and Kitty Hawk, actual damage estimates unknown.

July 31, 2016 – Scattered severe thunderstorms in advance of a frontal boundary produced damaging winds and a lightning death across portions of northeast North Carolina. A five-year-old boy was struck by lightning and killed near a vehicle at Carova Beach.

Eight of the 12 incidents recorded by the NCEI included property damage, which was mostly recorded as fire damage ignited by lightning. The highest rate of property damage recorded for a single incident was $25,000.

Hail

NCEI records 58 separate hail incidents across 58 days between January 1, 1999 and December 31, 2018 in the Outer Banks Region. None of these events were reported to have caused property damage, fatality, injury or crop damage. The largest diameter hail recorded in the Region was 1.75” and was recorded on four separate occasions; the average hail size in all storms was a little under one inch in diameter.

Table 4.61 – Summary of Hail Occurrences by County

Location	Number of Occurrences	Average Hail Diameter
Currituck	18	0.995”
Dare	40	0.8755”

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

March 25, 2004 – Dare County 911 Center reported half dollar size hail at the intersection of Routes 64 and 264 near Mann’s Harbor.

March 28, 2005 – Several severe thunderstorms produced large hail across northeastern portions of the area during the morning hours of March 28th.

April 22, 2009 – A cold front crossed eastern North Carolina during the morning of April 22nd 2009. A strong upper level disturbance was also crossing the region, and this combined with the front to produce isolated severe thunderstorms along the immediate coast.

Probability of Future Occurrence

Based on historical occurrences recorded by NCEI for the 20-year period from 1999 through 2018, the Outer Banks Region averages 7.65 thunderstorm wind events per year. Over this same period, 12 lightning events were reported as having caused death, injury, or property damage, which equates to an average of 0.6 damaging lightning strikes per year.

The average hail storm in the Outer Banks Region occurs in the afternoon and has a hail stone with a diameter of just under one inch. Over the 20-year period from 1998 through 2017, the Outer Banks Region experienced 58 reported hail incidents, or an average of 1.4 reported incidents per year somewhere in the planning area, or a 100% chance that the Region will experience a hail incident each year.

Based on these historical occurrences, there is a 100% chance that the Outer Banks 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

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. Individuals who work outdoors may face increased risk during severe weather events. Residents living in mobile homes are also more vulnerable to hail events due to the lack of shelter locations and the vulnerability of the housing unit to damages. Table 4.62 summarizes estimates of mobile home units in the Outer Banks Region by county as of 2017.

Table 4.62 – Mobile Home Units in the Northeastern NC Region, 2017

County	Occupied Mobile Home Units	Total Occupied Housing Units	Percent of Occupied Housing
Currituck County	1,810	9,766	18.5%
Dare County	1,203	15,264	7.9%

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

Individual who work outdoors may also face increased risk.

Since 1999, the NCEI records three fatalities and six injuries attributed to lightning in the Outer Banks. NCEI records 8 injures and no fatalities attributed to wind events in the Outer Banks. 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 the Outer Banks, the vast majority of recorded property damage was due to structure or vehicle fires. During the 20-year span between 1999 to 2018, NCEI reported $84,000 in property damage caused by lightning, averaging $7,000 in damages per incident.

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 the 20-year span between January 1, 1999 and December 31, 2018 in the Outer Banks Region, NCEI reported no property damage due to hail, however this does not mean damage is not possible in the future.

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

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

When strong enough, wind events can cause significant direct damage to buildings and infrastructure. NCEM's IRISK database estimates damages from increasing magnitudes of wind events, detailed in Table 4.63 through Table 4.66. Note that these tables sum the total estimated damage should every exposed property in each jurisdiction be impacted by an event of the given magnitude. Therefore, these tables are not an approximation of the total damages that would occur from an event of each magnitude because a thunderstorm wind event would not uniformly impact the entire Region. These tables should only be used to understand potential damages relative to storms of varying degrees of severity.

Table 4.63 – 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
Currituck													
Unincorporated Currituck County	17,069	15,016	88%	$91,761,900	1,407	8.20%	$14,466,176	198	1.20%	$3,993,985	16,621	97.40%	$110,222,060
Dare													
Unincorporated Dare County	13,634	12,452	91.30%	$45,084,257	644	4.70%	$2,139,366	152	1.10%	$897,345	13,248	97.20%	$48,120,968
Town of Duck	2,400	2,105	87.70%	$28,665,690	53	2.20%	$408,190	4	0.20%	$246,813	2,162	90.10%	$29,320,693
Town of Kill Devil Hills	5,972	5,380	90.10%	$17,848,780	309	5.20%	$6,239,803	18	0.30%	$331,816	5,707	95.60%	$24,420,400
Town of Kitty Hawk	2,803	2,501	89.20%	$12,602,005	179	6.40%	$2,322,590	11	0.40%	$89,258	2,691	96%	$15,013,853
Town of Manteo	918	764	83.20%	$8,937,422	124	13.50%	$858,031	29	3.20%	$204,241	917	99.90%	$9,999,694
Town of Nags Head	4,827	4,268	88.40%	$34,666,456	293	6.10%	$3,845,713	30	0.60%	$579,709	4,591	95.10%	$39,091,878
Town of Southern Shores	2,496	2,436	97.60%	$15,720,752	33	1.30%	$191,748	8	0.30%	$69,027	2,477	99.20%	$15,981,527
Subtotal Dare	**33,050**	**29,906**	**90.49%**	**$163,525,362**	**1,635**	**4.95%**	**$16,005,441**	**252**	**0.76%**	**$2,418,209**	**31,793**	**96.20%**	**$181,949,013**
Region Total	**50,119**	**44,922**	**89.63%**	**$255,287,262**	**3,042**	**6.07%**	**$30,471,617**	**450**	**0.90%**	**$6,412,194**	**48,414**	**96.60%**	**$292,171,073**

Source: NCEM Risk Management Tool

Table 4.64 – 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
Currituck													
Unincorporated Currituck County	17,069	15,016	88%	$161,808,463	1,407	8.20%	$22,164,041	198	1.20%	$6,456,559	16,621	97.40%	$190,429,062
Dare													
Unincorporated Dare County	13,634	12,452	91.30%	$87,841,017	644	4.70%	$4,082,396	152	1.10%	$1,757,250	13,248	97.20%	$93,680,662
Town of Duck	2,400	2,105	87.70%	$50,974,888	53	2.20%	$693,494	4	0.20%	$380,711	2,162	90.10%	$52,049,093
Town of Kill Devil Hills	5,972	5,380	90.10%	$31,894,645	309	5.20%	$9,359,791	18	0.30%	$699,873	5,707	95.60%	$41,954,309
Town of Kitty Hawk	2,803	2,501	89.20%	$22,042,279	179	6.40%	$3,957,036	11	0.40%	$195,491	2,691	96%	$26,194,806
Town of Manteo	918	764	83.20%	$15,822,249	124	13.50%	$1,478,199	29	3.20%	$461,130	917	99.90%	$17,761,578
Town of Nags Head	4,827	4,268	88.40%	$61,324,644	293	6.10%	$6,287,267	30	0.60%	$1,023,940	4,591	95.10%	$68,635,851
Town of Southern Shores	2,496	2,436	97.60%	$28,468,529	33	1.30%	$331,719	8	0.30%	$131,933	2,477	99.20%	$28,932,181
Subtotal Dare	**33,050**	**29,906**	**90.49%**	**$298,368,251**	**1,635**	**4.95%**	**$26,189,902**	**252**	**0.76%**	**$4,650,328**	**31,793**	**96.20%**	**$329,208,480**
Region Total	**50,119**	**44,922**	**89.63%**	**$460,176,714**	**3,042**	**6.07%**	**$48,353,943**	**450**	**0.90%**	**$11,106,887**	**48,414**	**96.60%**	**$519,637,542**

Source: NCEM Risk Management Tool

Table 4.65 – 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
Currituck													
Unincorporated Currituck County	17,069	15,016	88%	$434,239,527	1,407	8.20%	$49,005,339	198	1.20%	$15,388,540	16,621	97.40%	$498,633,407
Dare													
Unincorporated Dare County	13,634	12,452	91.30%	$254,863,601	644	4.70%	$10,900,046	152	1.10%	$5,619,385	13,248	97.20%	$271,383,031
Town of Duck	2,400	2,105	87.70%	$135,414,635	53	2.20%	$1,759,488	4	0.20%	$908,427	2,162	90.10%	$138,082,550
Town of Kill Devil Hills	5,972	5,380	90.10%	$90,538,050	309	5.20%	$20,215,931	18	0.30%	$2,444,415	5,707	95.60%	$113,198,396
Town of Kitty Hawk	2,803	2,501	89.20%	$59,387,565	179	6.40%	$10,249,480	11	0.40%	$665,500	2,691	96%	$70,302,545
Town of Manteo	918	764	83.20%	$41,515,662	124	13.50%	$3,897,650	29	3.20%	$1,847,770	917	99.90%	$47,261,082
Town of Nags Head	4,827	4,268	88.40%	$160,403,250	293	6.10%	$15,339,069	30	0.60%	$2,747,355	4,591	95.10%	$178,489,675
Town of Southern Shores	2,496	2,436	97.60%	$82,268,987	33	1.30%	$904,338	8	0.30%	$427,164	2,477	99.20%	$83,600,489
Subtotal Dare	**33,050**	**29,906**	**90.49%**	**$824,391,750**	**1,635**	**4.95%**	**$63,266,002**	**252**	**0.76%**	**$14,660,016**	**31,793**	**96.20%**	**$902,317,768**
Region Total	**50,119**	**44,922**	**89.63%**	**$1,258,631,277**	**3,042**	**6.07%**	**$112,271,341**	**450**	**0.90%**	**$30,048,556**	**48,414**	**96.60%**	**$1,400,951,175**

Source: NCEM Risk Management Tool

Table 4.66 – 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
Currituck													
Unincorporated Currituck County	17,069	15,016	88%	$623,514,962	1,407	8.20%	$66,946,120	198	1.20%	$21,638,742	16,621	97.40%	$712,099,825
Dare													
Unincorporated Dare County	13,634	12,452	91.30%	$377,572,581	644	4.70%	$16,145,127	152	1.10%	$8,487,159	13,248	97.20%	$402,204,867
Town of Duck	2,400	2,105	87.70%	$191,170,493	53	2.20%	$2,579,979	4	0.20%	$1,353,167	2,162	90.10%	$195,103,639
Town of Kill Devil Hills	5,972	5,380	90.10%	$133,103,913	309	5.20%	$28,007,393	18	0.30%	$3,753,387	5,707	95.60%	$164,864,693
Town of Kitty Hawk	2,803	2,501	89.20%	$86,439,461	179	6.40%	$14,923,375	11	0.40%	$983,713	2,691	96%	$102,346,550
Town of Manteo	918	764	83.20%	$58,902,065	124	13.50%	$5,733,864	29	3.20%	$2,953,744	917	99.90%	$67,589,673
Town of Nags Head	4,827	4,268	88.40%	$226,733,723	293	6.10%	$21,903,999	30	0.60%	$4,083,163	4,591	95.10%	$252,720,885
Town of Southern Shores	2,496	2,436	97.60%	$122,087,074	33	1.30%	$1,399,895	8	0.30%	$679,001	2,477	99.20%	$124,165,970
Subtotal Dare	**33,050**	**29,906**	**90.49%**	**$1,196,009,310**	**1,635**	**4.95%**	**$90,693,632**	**252**	**0.76%**	**$22,293,334**	**31,793**	**96.20%**	**$1,308,996,277**
Region Total	**50,119**	**44,922**	**89.63%**	**$1,819,524,272**	**3,042**	**6.07%**	**$157,639,752**	**450**	**0.90%**	**$43,932,076**	**48,414**	**96.60%**	**$2,021,096,102**

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 4.67 summarizes the potential negative consequences of severe weather.

Table 4.67 – 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, the unincorporated areas of Currituck and Dare Counties have 14.1 percent and 12 percent of mobile homes, respectively 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	Score	Priority
Currituck County	4	2	3	4	1	2.9	H
Dare County	4	2	3	4	1	2.9	H
Duck	4	2	3	4	1	2.9	H
Kill Devil Hills	4	3	3	4	1	3.2	H
Kitty Hawk	4	2	3	4	1	2.9	H
Manteo	4	3	3	4	1	3.2	H
Nags Head	4	2	3	4	1	2.9	H
Southern Shores	4	3	3	4	1	3.2	H

4.5.8 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, etcetera – have the potential to cause significant hazard to a community. Even small accumulations can down power lines and trees limbs and create hazardous driving conditions. Furthermore, communication and power may be disrupted for days.

Warning Time: 1 – More than 24 hours

Advancements in meteorology and forecasting usually allow for mostly accurate forecasting a few days in advance of an impending storm.

Duration: 3 – Less than one week

Most storms have a duration of a few hours; however, impacts can last a few days after the initial incident until cleanup is completed.

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 region.

Extent

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

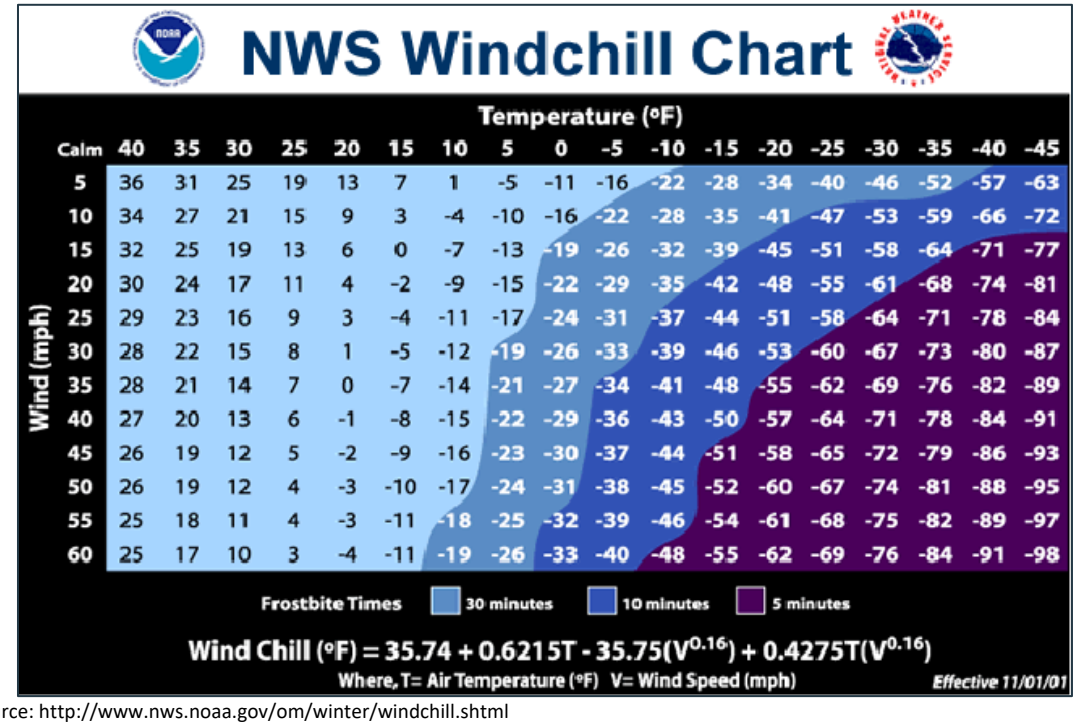
which receive very little snowfall on average may be more adversely affected than other regions, resulting in a higher severity.

Table 4.68 – Regional Snowfall Index (RSI) Values

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

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

Figure 4.48 – NWS Wind Chill Temperature Index



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

Per the North Carolina Climate office, the greatest snowfall amount recorded in Dare County was 11.0 inches, recorded on March 3, 1980 at the Hatteras weather station. There were no records for snowfall in Currituck County.

The most significant recorded snow depth over the last 20 years took place in December 2010, with recorded depths ranging from 2 to 11 inches across the two-county area.

Impact: 1 – Minor

Spatial Extent: 4 – Large

The entirety of North Carolina is susceptible to winter storm and freeze events. Some ice and winter storms may be large enough to affect several states, while others might affect limited, localized areas. The degree of exposure typically depends on the normal expected severity of local winter weather. The Outer Banks generally receives smaller scale severe winter weather conditions 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 1999 through 2018 are included in Table 4.69. Severe winter weather did not cause any reported damage, injuries, or fatalities, though these types of impacts are possible in future events. No cold/wind chill, extreme cold/wind chill, or sleet events were recorded.

Table 4.69 – Total Severe Winter Storm Impacts in the Outer Banks Region, 1999-2018

Event Type	Number of Recorded Incidents	Total Fatalities	Total Injuries	Total Property Damage	Total Crop Damage
Currituck					
Winter Storm	15	0	0	$0	$0
Winter Weather	11	0	0	$0	$0
Frost/Freeze	3	0	0	$0	$0
Blizzard	1	0	0	$0	$0
Dare					
Winter Storm	9	0	0	$0	$0
Winter Weather	4	0	0	$0	$0
Frost/Freeze	1	0	0	$0	$0
Heavy Snow	4	0	0	$0	$0
Region Total	**48**	**0**	**0**	**$0**	**$0**

Source: NCEI

Impacts in the Outer Banks by incident are recorded in Table 4.70.

Table 4.70 – Severe Winter Storm Incidents, Outer Banks, 1999-2018

Date	Event Type	Fatalities	Injuries	Property Damage	Crop Damage
12/3/2000	Winter Storm	0	0	$0	$0
1/2/2002	Winter Storm	0	0	$0	$0
1/3/2002	Winter Storm	0	0	$0	$0
1/23/2003	Winter Storm	0	0	$0	$0
1/23/2003	Winter Storm	0	0	$0	$0
11/30/2003	Frost/Freeze	0	0	$0	$0
1/9/2004	Winter Storm	0	0	$0	$0
1/9/2004	Winter Weather	0	0	$0	$0
1/25/2004	Winter Storm	0	0	$0	$0
1/25/2004	Winter Storm	0	0	$0	$0
2/15/2004	Winter Storm	0	0	$0	$0
2/16/2004	Winter Weather	0	0	$0	$0
3/23/2004	Frost/Freeze	0	0	$0	$0
4/6/2004	Frost/Freeze	0	0	$0	$0
12/19/2004	Winter Weather	0	0	$0	$0
12/20/2004	Winter Weather	0	0	$0	$0
12/26/2004	Winter Storm	0	0	$0	$0
1/19/2005	Winter Weather	0	0	$0	$0
2/20/2006	Winter Weather	0	0	$0	$0
1/28/2007	Winter Weather	0	0	$0	$0
11/21/2008	Winter Weather	0	0	$0	$0
1/20/2009	Winter Weather	0	0	$0	$0
1/20/2009	Heavy Snow	0	0	$0	$0
1/30/2010	Winter Storm	0	0	$0	$0
12/16/2010	Winter Weather	0	0	$0	$0
12/25/2010	Winter Storm	0	0	$0	$0
12/26/2010	Heavy Snow	0	0	$0	$0

Date	Event Type	Fatalities	Injuries	Property Damage	Crop Damage
1/22/2011	Heavy Snow	0	0	$0	$0
2/9/2011	Winter Storm	0	0	$0	$0
2/10/2011	Heavy Snow	0	0	$0	$0
1/25/2013	Winter Weather	0	0	$0	$0
1/21/2014	Winter Storm	0	0	$0	$0
1/28/2014	Winter Storm	0	0	$0	$0
1/28/2014	Winter Storm	0	0	$0	$0
2/11/2014	Winter Storm	0	0	$0	$0
3/3/2014	Winter Weather	0	0	$0	$0
2/16/2015	Winter Storm	0	0	$0	$0
2/24/2015	Winter Storm	0	0	$0	$0
2/25/2015	Winter Weather	0	0	$0	$0
1/22/2016	Winter Weather	0	0	$0	$0
2/12/2016	Winter Weather	0	0	$0	$0
2/12/2016	Winter Storm	0	0	$0	$0
4/5/2016	Frost/Freeze	0	0	$0	$0
1/7/2017	Winter Storm	0	0	$0	$0
1/3/2018	Blizzard	0	0	$0	$0
1/4/2018	Winter Storm	0	0	$0	$0
1/17/2018	Winter Storm	0	0	$0	$0
1/17/2018	Winter Storm	0	0	$0	$0
	Total	**0**	**0**	**$0**	**$0**

Source: NCEI

Several storm impacts from NCEI are summarized below:

January 23, 2003 - The storm dumped the highest amounts of snow east of highway 17 across the area known as the Outer Banks, where 8 to 12 inches of snow fell with isolated amounts up to 14 inches, including the counties of eastern Carteret, Dare and, and Hyde counties. This was the largest one-day snowfall on the Outer Banks in over a decade. Corolla received 4" of snow. Local law enforcement agencies reported numerous accidents and most, if not all, schools were closed due to slippery road conditions.

December 26, 2004 – A winter storm produced one to as much as five inches of snow across the coastal areas of northeast North Carolina. The snow caused hazardous driving conditions, which resulted in numerous accidents. 4.5” of snow were reported in Moyock.

January 20, 2009 – Low pressure developed over South Carolina during the early morning hours. The system tracked northeast and intensified offshore of the North Carolina coast during the rest of the day. Rain developed over eastern North Carolina after midnight on Jan 20th and changed to snow around 9 am over the northern part of the county and continue into the late evening hours. Over the southern half of the county the rain changed to snow during the late morning hours and continued into the late evening. Snow accumulated 2 to 5 inches across Dare County, and up to 2 inches in Currituck County.

December 25-26, 2010 – Strong low pressure moved northeast just offshore of the North Carolina coast. As the low approached the region areas of rain developed and as cold air spread the rain gradually turned to snow. Snowfall amounts were generally between five and eleven inches across Currituck County, where Moyock reported 10.0 inches of snow. In Dare County, widespread snow developed during the morning hours and continued into the early evening. Total snow accumulations across the county ranged from 2 to 4 inches north of Oregon Inlet to less than 1 inch south of Oregon Inlet.

January 28, 2014 – Sleet and freezing rain began during the early afternoon of January 28th over southern Dare County. As the precipitation spread north it became all snow north of Oregon Inlet toward evening. The precipitation ended during the late morning of January 29th. Total snow accumulations ranged from 5 to 8 inches north to around 1 inch of sleet and snow south. There was also up to 0.25 inches of freezing rain over the southern sections. Roads were icy during and several days after the event.

January 3-4, 2018 - Strong low pressure tracking northward just off the East Coast produced between three inches and twelve inches of snow across northeast North Carolina. In addition to the winter weather very strong winds occurred along the coast with minor coastal flooding along the Outer Banks. Snowfall totals ranged between three inches and eight inches across the county. Very strong north to northwest winds of 35 to 50 mph affected the area, producing blowing snow and poor visibilities. Knotts Island reported 7.5 inches of snow.

Dare County has received one emergency declaration since 1968 for an incident related to severe winter storms, and Currituck County received none. As a state, North Carolina received eight disaster declarations related to severe winter storms during this timeframe.

Table 4.71 – Emergency & Disaster Declarations in Dare County due to Severe Winter Storms

Disaster Number	Date	Disaster Type	Incident Start	Incident End
3110	1993	Severe Snow and Winter Storm	3/13/1993	3/17/1993

Source: FEMA, December 20, 2018

Probability of Future Occurrence

NCEI records 48 severe winter storm related events during the 20-year period from 1999 through 2018, which equates to an average of 2.4 events per year or more than 100 percent likelihood of an occurrence in any given year.

Probability: 4 – Highly Likely

Climate Change

According to the 2018 North Carolina Hazard Mitigation Plan, the uncertainty associated with potentially changing climate conditions creates uncertainty for predicting future severe winter storms. If it is determined that global temperatures are indeed rising, this 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.

Property

According to reported data of storm impacts recorded by the NCEI, between 1999 and 2018 the Outer Banks Region did not experience any reported property damage as a result of severe winter weather.

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 4.72 summarizes the potential negative consequences of severe winter storm.

Table 4.72 – Consequence Analysis - Severe Winter Storm

Category	Consequences
Public	Localized impact expected to be severe for affected areas and moderate to light for other less affected areas.
Responders	Adverse impact expected to be severe for unprotected personnel and moderate to light for trained, equipped, and protected personnel.
Continuity of Operations (including Continued Delivery of Services)	Localized disruption of roads and/or utilities caused by incident may postpone delivery of some services.
Property, Facilities and Infrastructure	Localized impact to facilities and infrastructure in the areas of the incident. Power lines and roads most adversely affected.
Environment	Environmental damage to trees, bushes, etc.
Economic Condition of the Jurisdiction	Local economy and finances may be adversely affected, depending on damage.
Public Confidence in the Jurisdiction's Governance	Ability to respond and recover may be questioned and challenged if planning, response, and recovery not timely and effective.

Hazard Summary by Jurisdiction

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

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	Score	Priority
Currituck County	4	1	4	1	3	2.7	H
Dare County	4	1	4	1	3	2.7	H
Duck	4	1	4	1	3	2.7	H
Kill Devil Hills	4	1	4	1	3	2.7	H
Kitty Hawk	4	1	4	1	3	2.7	H
Manteo	4	1	4	1	3	2.7	H
Nags Head	4	1	4	1	3	2.7	H
Southern Shores	4	1	4	1	3	2.7	H

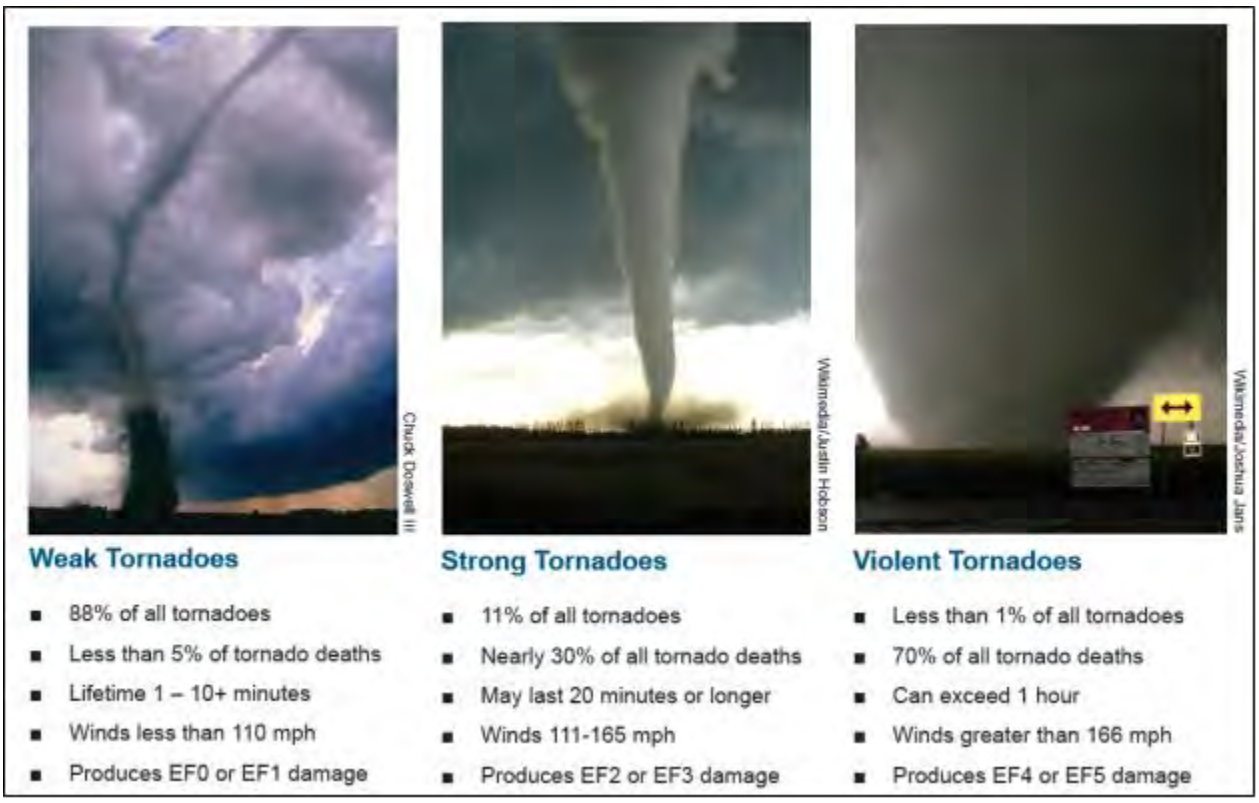
4.5.9 Tornado

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." Tornados can appear from any direction. Most move from southwest to northeast, or west to east. Some tornados have changed direction amid path, or even backtracked.

Tornados are commonly produced by land falling tropical cyclones. Those making landfall along the Gulf coast traditionally produce more tornados than those making landfall along the Atlantic coast. Tornados 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 tornados. Tornados are more likely to be spawned within 24 hours of landfall and are usually within 30 miles of the tropical cyclone's center.

Tornados 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. Tornados 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 tornados 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 tornados

(earning the designation of "tornado alley"), Florida experiences the greatest number of tornados per square mile of all U.S. states (SPC, 2002). Figure 4.49 shows tornado activity in the United States based on the number of recorded tornados per 1,000 square miles. North Carolina has averaged 1 to 5 tornados per 1,000 square miles.

Figure 4.49 – Tornado Activity in the U.S.

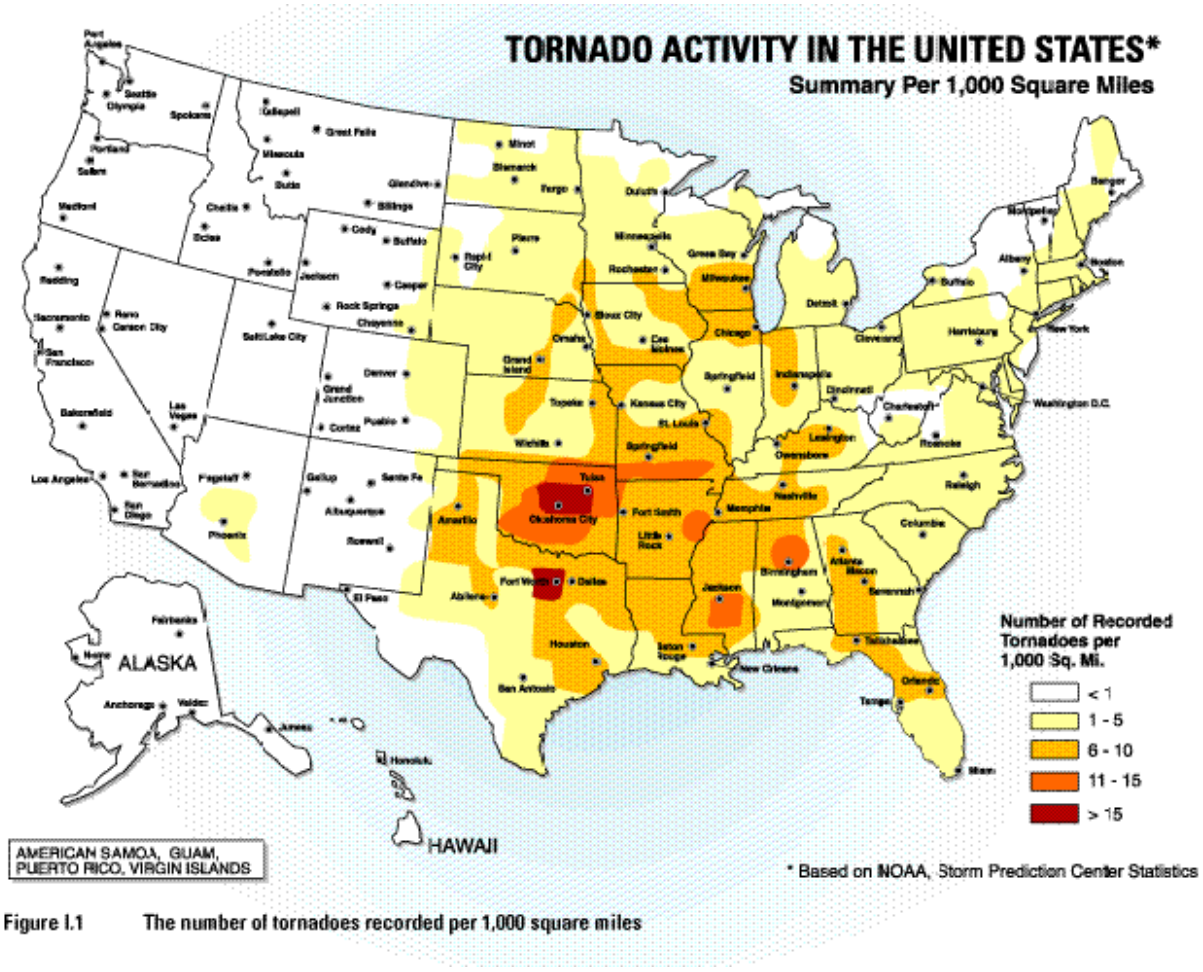


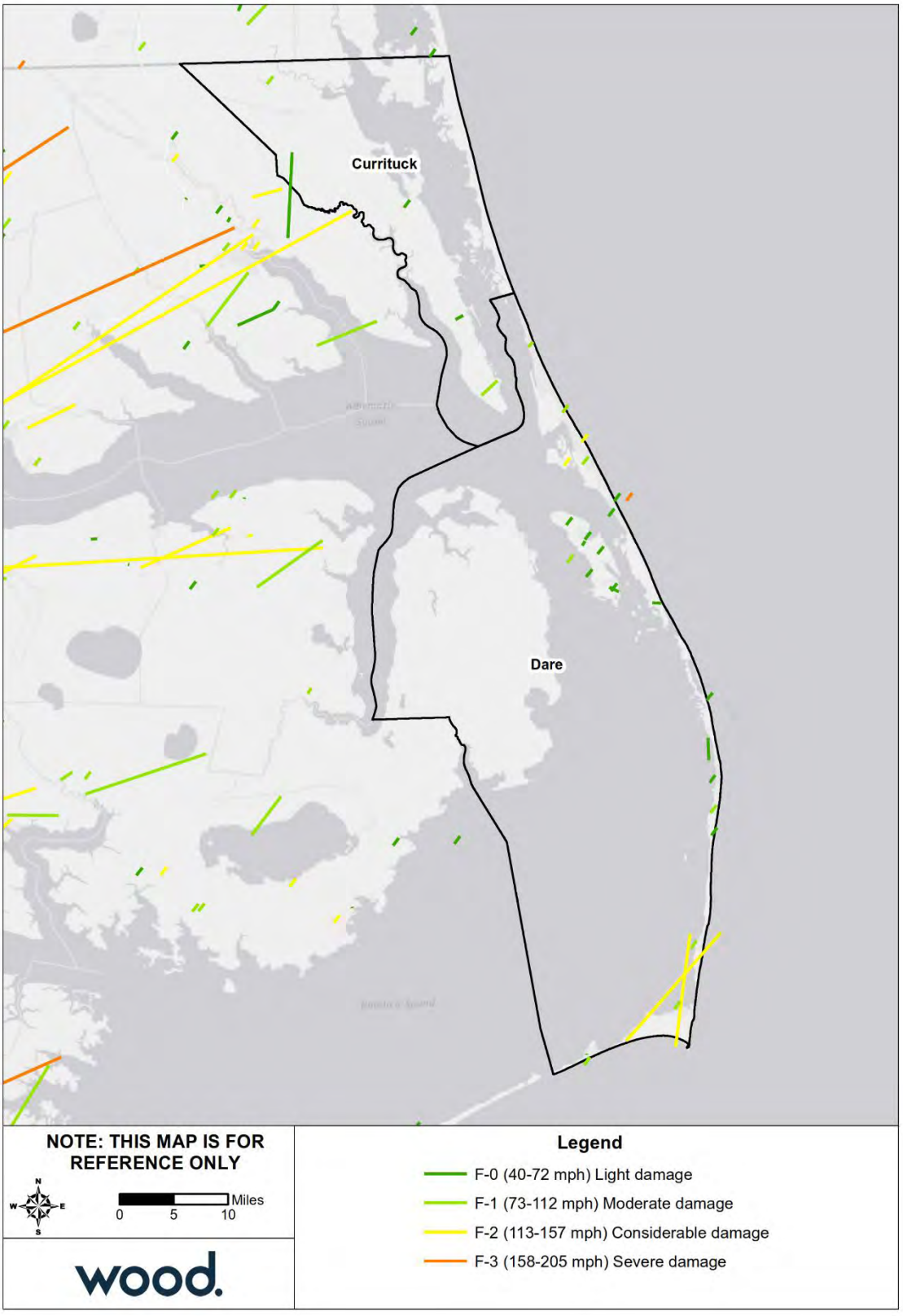
Figure I.1 The number of tornadoes recorded per 1,000 square miles

Source: American Society of Civil Engineers

Location

Figure 4.50 reflects the tracks of past tornados that passed through the Outer Banks Region from 1950 through 2017 according to data from the NOAA/National Weather Service Storm Prediction Center.

Figure 4.50 – Tornado Paths Through the Outer Banks Region, 1950-2017



Source: NOAA/NWS Storm Prediction Center

Tornados can occur anywhere in the Region. Tornados 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. Tornados can be spawned by tropical cyclones; however, these tornados typically occur up to 2 days before and as many as 3 days after landfall of the tropical cyclone. Therefore, the area of risk for these events encompasses the entire region. All of the Outer Banks Region is uniformly exposed to this hazard.

Extent

Prior to February 1, 2007, tornado intensity was measured by the Fujita (F) scale. This scale was revised and is now the Enhanced Fujita (EF) scale. Both scales are sets of wind estimates (not measurements) based on damage. The new scale provides more damage indicators (28) and associated degrees of damage, allowing for more detailed analysis, better correlation between damage and wind speed. It is also more precise because it takes into account the materials affected and the construction of structures damaged by a tornado. Table 4.5 shows the wind speeds associated with the enhanced Fujita scale ratings and the damage that could result at different levels of intensity.

Table 4.73 – 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.

The most intense tornado to pass through the Outer Banks Region was an F3 in 1952. During the 20-year span between 1999 through 2018, the strongest tornado to pass through was an EF1, causing $767,000 in damages.

Impact: 3 – Critical

Spatial Extent: 1 – Negligible

Historical Occurrences

NCEI storm reports were reviewed from 1999 through 2018 to assess whether recent trends varied from the longer historical record. According to NCEI, the Outer Banks Region experienced 16 tornado incidents between 1999 and 2018, causing 5 injuries, $1,347,000 in property damage and no fatalities or crop damage. Table 4.74 shows historical tornados in the Outer Banks Region during this time period.

Table 4.74 – Recorded Tornados in the Outer Banks Region, 1999-2018

Location	Date	Time	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Corolla	7/24/2000	1257	F0	0	0	$0	$0
Rodanthe	5/28/2001	1233	F0	0	0	$5,000	$0
Avon	8/26/2002	805	F0	0	0	$10,000	$0
Moyock	6/7/2003	1955	F0	0	2	$25,000	$0
Nags Head	8/14/2004	1715	F1	0	0	$225,000	$0
Frisco	6/14/2006	1340	F0	0	0	$0	$0
Rodanthe	7/15/2007	706	EF0	0	0	$0	$0
Harbinger	4/16/2011	2030	EF1	0	0	$40,000	$0
Duck	4/16/2011	2035	EF1	0	0	$767,000	$0
Wanchese	7/30/2012	940	EF0	0	0	$0	$0
Wanchese	7/30/2012	1001	EF0	0	0	$0	$0
Rodanthe	8/19/2012	1319	EF0	0	0	$0	$0
Jarvisburg	4/25/2014	1928	EF0	0	0	$15,000	$0
Manteo	5/11/2015	1610	EF0	0	0	$5,000	$0
Cape Hatteras	9/3/2016	2	EF0	0	3	$250,000	$0
Gregory	5/5/2017	708	EF0	0	0	$5,000	$0
Total				**0**	**5**	**$1,347,000**	**$0**

Source: NCEI

Specific incidents with some level of impact include:

June 7, 2003 – An F0 tornado downed numerous trees and stripped some siding off houses. Any structural damage was from falling trees and debris. Two injuries occurred when a large tree fell on a house and collapsed the roof of the one-story building.

August 14, 2004 – Tropical Storm Charley moved northeast across the Coastal Plains of Eastern North Carolina during the afternoon hours on August 14th. Five weak tornados were reported across the area associated with Charley with damage reported. The most significant damage related to a tornado occurred along the Outer Banks in Nags Head, where an F1 tornado damaged 20 structures and caused $225,000 in damages.

April 16, 2011 – One of the largest tornado outbreaks ever observed across eastern North Carolina occurred during the afternoon and evening. Several powerful super-cell thunderstorms developed ahead of an approaching cold front. Conditions ahead of the front were favorable for tornados with a moderately unstable atmosphere combined with strong winds that veered with height. In Duck, the tornado developed near the sound in the Four Seasons subdivision, then moved northeast across the community of Duck before exiting into the ocean. The tornado was estimated to be an EF1 with winds around 90 mph. About 75 structures were damaged mostly minor to roofs and siding. Several large pines were toppled and damaged homes.

September 3, 2016 – Hurricane Hermine weakened slightly to Tropical Storm strength and crossed through Eastern North Carolina during the late evening on September 2nd and exited off the North Carolina coast near Duck during the morning of September 3rd. Rain-bands associated with Hermine produced three tornados. In Cape Hatteras, a weak tornado briefly touched down at the Hatteras Sands

RV resort near Hatteras Village in Dare County, North Carolina, The EF0 tornado had winds estimated at 80 mph, a path width of 25 yards and path length of 100 yards. The tornado damaged or destroyed approximately 5 travel trailers and camping cabins, some which were not attached to the ground. Three injuries were reported from this tornado.

Probability of Future Occurrence

Probability of future occurrence was calculated based on past occurrences and was assumed to be uniform across the county.

In a twenty-year span between 1999 and 2018, the Outer Banks Region experienced 16 separate tornado incidents over 14 separate days. This correlates to an 80 percent annual probability that the county will experience a tornado somewhere in its boundaries. None of these past tornado events were a magnitude EF2 or greater.

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 tornados. Based on these studies meteorologists are unsure why some thunderstorms generate tornados and others don't, beyond knowing that they require a certain type of wind shear. Tornados 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 tornados, 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 tornados. The availability of sheltered locations such as basements, buildings constructed using tornado-resistant materials and methods, and public storm shelters, all reduce the exposure of the population. According to the 2017 American Community Survey (ACS), 3,013 occupied housing units (12%) in the Outer Banks Region are classified as "mobile homes or other types of housing." Based on an estimated average of 2.4 persons per household from the 2017 ACS, there are approximately 7,231 people in the Outer Banks Region living in mobile homes.

Table 4.75 – Mobile Home Units in Outer Banks Region, 2017

County	Occupied Mobile Home Units	Total Occupied Housing Units	Percent of Occupied Housing
Currituck County	1,810	9,766	18.5%
Dare County	1,203	15,264	7.9%

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

Since 1950, the NCEI five injuries attributed to tornados in the Outer Banks Region; these injuries were the result of tornados rated as low as EF0, illustrating the destructive power of tornados 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 tornados in the Region are directly responsible for $5.78 million worth of damage to property, and no reported damage to crops, according to NCEI data.

Table 4.76 through Table 4.80 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 4.76 – 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
Currituck													
Unincorporated Currituck County	17,069	15,414	90.30%	$178,065,227	1,424	8.30%	$34,519,793	205	1.20%	$9,896,177	17,043	99.80%	$222,481,197
Dare													
Unincorporated Dare County	13,634	12,796	93.90%	$139,889,753	667	4.90%	$11,067,229	153	1.10%	$4,046,015	13,616	99.90%	$155,002,997
Town of Duck	2,400	2,316	96.50%	$43,149,006	76	3.20%	$1,657,168	7	0.30%	$228,052	2,399	100%	$45,034,226
Town of Kill Devil Hills	5,972	5,634	94.30%	$50,505,590	312	5.20%	$10,353,998	18	0.30%	$2,554,498	5,964	99.90%	$63,414,086
Town of Kitty Hawk	2,803	2,597	92.70%	$29,105,180	188	6.70%	$7,001,890	11	0.40%	$304,849	2,796	99.80%	$36,411,919
Town of Manteo	918	764	83.20%	$11,900,936	125	13.60%	$3,480,108	29	3.20%	$2,514,397	918	100%	$17,895,440
Town of Nags Head	4,827	4,484	92.90%	$59,191,744	302	6.30%	$8,324,261	32	0.70%	$1,183,249	4,818	99.80%	$68,699,253
Town of Southern Shores	2,496	2,454	98.30%	$40,866,617	33	1.30%	$1,049,745	8	0.30%	$832,076	2,495	100%	$42,748,438
Subtotal Dare	**33,050**	**31,045**	**93.93%**	**$374,608,826**	**1,703**	**5.15%**	**$42,934,399**	**258**	**0.78%**	**$11,663,136**	**33,006**	**99.87%**	**$429,206,359**
Total	**50,119**	**46,459**	**92.70%**	**$552,674,053**	**3,127**	**6.24%**	**$77,454,192**	**463**	**0.92%**	**$21,559,313**	**50,049**	**99.86%**	**$651,687,556**

Source: NCEM Risk Management Tool

Table 4.77 – 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
Currituck													
Unincorporated Currituck County	17,069	15,414	90.30%	$1,294,061,085	1,424	8.30%	$229,163,011	205	1.20%	$53,512,793	17,043	99.80%	$1,576,736,889
Dare													
Unincorporated Dare County	13,634	12,796	93.90%	$1,027,086,735	667	4.90%	$78,375,396	153	1.10%	$24,026,165	13,616	99.90%	$1,129,488,296
Town of Duck	2,400	2,316	96.50%	$317,562,334	76	3.20%	$11,865,765	7	0.30%	$1,835,961	2,399	100%	$331,264,060
Town of Kill Devil Hills	5,972	5,634	94.30%	$370,626,461	312	5.20%	$69,834,686	18	0.30%	$11,200,656	5,964	99.90%	$451,661,802
Town of Kitty Hawk	2,803	2,597	92.70%	$212,152,299	188	6.70%	$41,305,118	11	0.40%	$2,138,419	2,796	99.80%	$255,595,835
Town of Manteo	918	764	83.20%	$86,142,861	125	13.60%	$21,985,706	29	3.20%	$11,392,412	918	100%	$119,520,979
Town of Nags Head	4,827	4,484	92.90%	$435,123,981	302	6.30%	$53,306,444	32	0.70%	$7,236,560	4,818	99.80%	$495,666,985
Town of Southern Shores	2,496	2,454	98.30%	$301,659,057	33	1.30%	$6,669,086	8	0.30%	$3,821,652	2,495	100%	$312,149,795
Subtotal Dare	**33,050**	**31,045**	**93.93%**	**$2,750,353,728**	**1,703**	**5.15%**	**$283,342,201**	**258**	**0.78%**	**$61,651,825**	**33,006**	**99.87%**	**$3,095,347,752**
Region Total	**50,119**	**46,459**	**92.70%**	**$4,044,414,813**	**3,127**	**6.24%**	**$512,505,212**	**463**	**0.92%**	**$115,164,618**	**50,049**	**99.86%**	**$4,672,084,641**

Source: NCEM Risk Management Tool

Table 4.78 – 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
Currituck													
Unincorporated Currituck County	17,069	15,414	90.30%	$2,387,791,292	1,424	8.30%	$524,768,770	205	1.20%	$166,566,759	17,043	99.80%	$3,079,126,820
Dare													
Unincorporated Dare County	13,634	12,796	93.90%	$1,933,865,758	667	4.90%	$173,664,046	153	1.10%	$78,094,463	13,616	99.90%	$2,185,624,268
Town of Duck	2,400	2,316	96.50%	$607,121,528	76	3.20%	$27,817,938	7	0.30%	$6,643,547	2,399	100%	$641,583,013
Town of Kill Devil Hills	5,972	5,634	94.30%	$710,188,520	312	5.20%	$156,638,264	18	0.30%	$30,837,989	5,964	99.90%	$897,664,772
Town of Kitty Hawk	2,803	2,597	92.70%	$407,496,528	188	6.70%	$96,647,759	11	0.40%	$7,411,157	2,796	99.80%	$511,555,444
Town of Manteo	918	764	83.20%	$167,975,354	125	13.60%	$50,300,235	29	3.20%	$32,064,479	918	100%	$250,340,068
Town of Nags Head	4,827	4,484	92.90%	$832,241,445	302	6.30%	$129,336,445	32	0.70%	$23,816,549	4,818	99.80%	$985,394,439
Town of Southern Shores	2,496	2,454	98.30%	$573,033,653	33	1.30%	$16,056,059	8	0.30%	$10,850,994	2,495	100%	$599,940,706
Subtotal Dare	**33,050**	**31,045**	**93.93%**	**$5,231,922,786**	**1,703**	**5.15%**	**$650,460,746**	**258**	**0.78%**	**$189,719,178**	**33,006**	**99.87%**	**$6,072,102,710**
Region Total	**50,119**	**46,459**	**92.70%**	**$7,619,714,078**	**3,127**	**6.24%**	**$1,175,229,516**	**463**	**0.92%**	**$356,285,937**	**50,049**	**99.86%**	**$9,151,229,530**

Source: NCEM Risk Management Tool

Table 4.79 – 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
Currituck													
Unincorporated Currituck County	17,069	15,414	90.30%	$2,803,861,364	1,424	8.30%	$668,416,507	205	1.20%	$258,884,800	17,043	99.80%	$3,731,162,671
Dare													
Unincorporated Dare County	13,634	12,796	93.90%	$2,270,106,638	667	4.90%	$218,082,364	153	1.10%	$122,238,478	13,616	99.90%	$2,610,427,480
Town of Duck	2,400	2,316	96.50%	$721,001,621	76	3.20%	$36,033,844	7	0.30%	$10,567,300	2,399	100%	$767,602,764
Town of Kill Devil Hills	5,972	5,634	94.30%	$850,694,604	312	5.20%	$215,082,091	18	0.30%	$46,882,379	5,964	99.90%	$1,112,659,074
Town of Kitty Hawk	2,803	2,597	92.70%	$496,294,655	188	6.70%	$129,497,373	11	0.40%	$11,715,128	2,796	99.80%	$637,507,157
Town of Manteo	918	764	83.20%	$210,696,505	125	13.60%	$68,806,093	29	3.20%	$48,952,430	918	100%	$328,455,027
Town of Nags Head	4,827	4,484	92.90%	$991,268,446	302	6.30%	$177,368,492	32	0.70%	$37,352,657	4,818	99.80%	$1,205,989,595
Town of Southern Shores	2,496	2,454	98.30%	$671,448,277	33	1.30%	$21,189,330	8	0.30%	$16,593,376	2,495	100%	$709,230,982
Subtotal Dare	**33,050**	**31,045**	**93.93%**	**$6,211,510,746**	**1,703**	**5.15%**	**$866,059,587**	**258**	**0.78%**	**$294,301,748**	**33,006**	**99.87%**	**$7,371,872,079**
Region Total	**50,119**	**46,459**	**92.70%**	**$9,015,372,110**	**3,127**	**6.24%**	**$1,534,476,094**	**463**	**0.92%**	**$553,186,548**	**50,049**	**99.86%**	**$11,103,034,750**

Source: NCEM Risk Management Tool

Table 4.80 – 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
Currituck													
Unincorporated Currituck County	17,069	15,414	90.30%	$2,812,831,275	1,424	8.30%	$695,713,949	205	1.20%	$279,218,271	17,043	99.80%	$3,787,763,495
Dare													
Unincorporated Dare County	13,634	12,796	93.90%	$2,273,954,207	667	4.90%	$225,551,949	153	1.10%	$130,233,359	13,616	99.90%	$2,629,739,514
Town of Duck	2,400	2,316	96.50%	$723,682,852	76	3.20%	$37,906,309	7	0.30%	$10,946,514	2,399	100%	$772,535,675
Town of Kill Devil Hills	5,972	5,634	94.30%	$855,650,080	312	5.20%	$224,255,508	18	0.30%	$52,518,361	5,964	99.90%	$1,132,423,948
Town of Kitty Hawk	2,803	2,597	92.70%	$501,245,386	188	6.70%	$135,931,988	11	0.40%	$12,268,859	2,796	99.80%	$649,446,233
Town of Manteo	918	764	83.20%	$214,170,995	125	13.60%	$71,901,024	29	3.20%	$54,445,442	918	100%	$340,517,461
Town of Nags Head	4,827	4,484	92.90%	$995,695,103	302	6.30%	$186,150,725	32	0.70%	$39,659,588	4,818	99.80%	$1,221,505,416
Town of Southern Shores	2,496	2,454	98.30%	$671,850,675	33	1.30%	$22,309,256	8	0.30%	$18,403,538	2,495	100%	$712,563,469
Subtotal Dare	**33,050**	**31,045**	**93.93%**	**$6,236,249,298**	**1,703**	**5.15%**	**$904,006,759**	**258**	**0.78%**	**$318,475,661**	**$33,006**	**99.87%**	**7,458,731,716**
Region Total	**50,119**	**46,459**	**92.70%**	**$9,049,080,573**	**3,127**	**6.24%**	**$1,599,720,708**	**463**	**0.92%**	**$597,693,932**	**$50,049**	**99.86%**	**$11,246,495,211**

Source: NCEM Risk Management Tool

Environment

Tornados 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 4.81 summarizes the potential negative consequences of tornado.

Table 4.81 – 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 tornados, EF0, can cause minor roof damage, while strong tornados can destroy frame buildings and even badly damage steel reinforced concrete structures. Buildings are vulnerable to direct impact from tornados and also from wind borne debris. Mobile homes are particularly susceptible to damage during tornados.
Environment	Potential devastating impacts in storm's path
Economic Condition of the Jurisdiction	Contingent on tornado's path; can severely impact/destroy critical infrastructure and other economic drivers
Public Confidence in the Jurisdiction's Governance	Public confidence in the jurisdiction's governance may be influenced by severe tornado events if response and recovery are not timely and effective.

Hazard Summary by Jurisdiction

The following table summarizes tornado hazard risk by jurisdiction. Tornado hazard risk does not vary substantially by jurisdiction.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	Score	Priority
Currituck County	3	3	1	4	1	2.5	H
Dare County	3	3	1	4	1	2.5	H
Duck	3	3	1	4	1	2.5	H
Kill Devil Hills	3	3	1	4	1	2.5	H
Kitty Hawk	3	3	1	4	1	2.5	H
Manteo	3	3	1	4	1	2.5	H
Nags Head	3	3	1	4	1	2.5	H
Southern Shores	3	3	1	4	1	2.5	H

4.5.10 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 4.51, the National Weather Service Newport/Morehead City Forecast Office provides year-round fire weather forecasts for Dare County. The Wakefield, VA Office provides forecasts for Currituck County.

Figure 4.51 – Fire Weather Forecast, Dare 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.

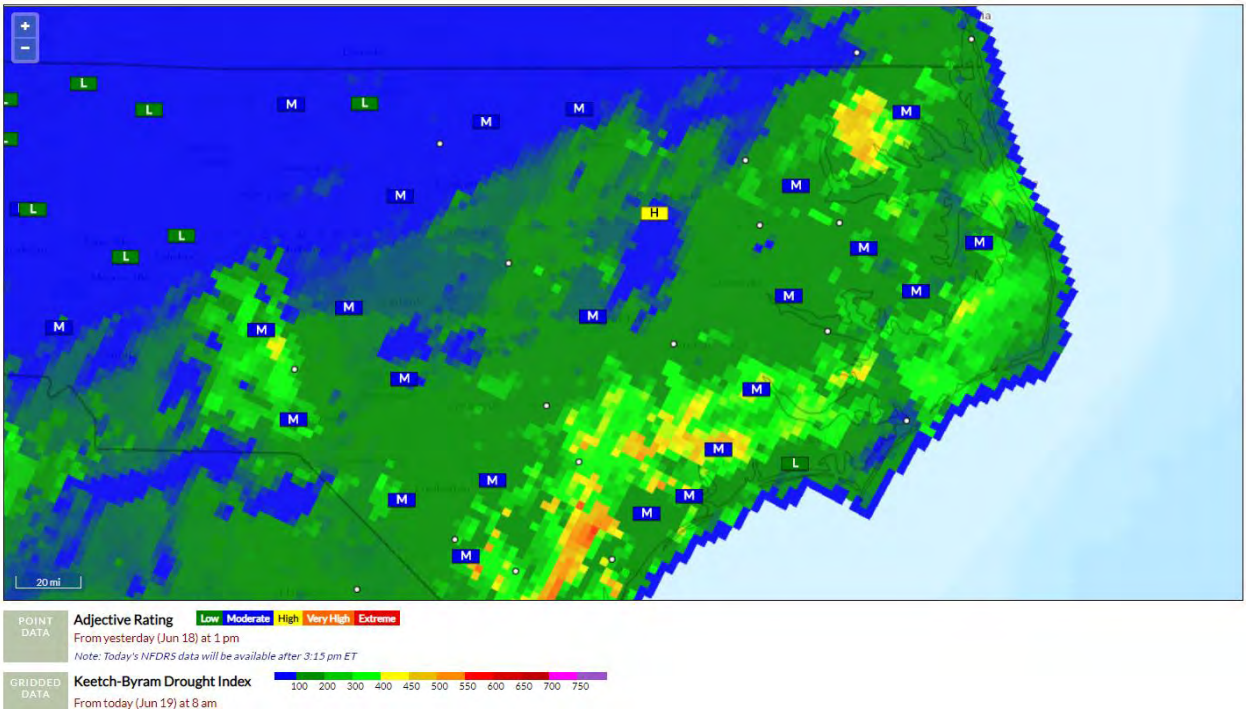
The Outer Banks Region experiences a variety of wildfire conditions found in the Keetch-Byram Drought Index, which is described in Table 4.82. The Keetch-Byram Drought Index (KBDI) for December 19, 2018 is shown in Figure 4.52 along with a Daily Fire Danger Estimate Adjective Rating for certain points across the state. The KBDI for the Region at this time was between 100 and 400, and the Fire Danger Estimate for the nearby area was "Moderate."

Table 4.82 – 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.

KBDI	Description
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 4.52 – Keetch-Byram Drought Index, June 2019



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 region that is not heavily urbanized. The Southern Wildfire Risk Assessment (SWRA) estimates that 88.9 percent of the Region's population lives within the WUI. The expansion of residential development from urban centers out into rural landscapes increases the potential for wildland fire threat to public safety and the potential for damage to forest resources and dependent industries. Population growth within the WUI substantially increases the risk of wildfire. Table 4.83 details the extent of the WUI in the Outer Banks Region, and Figure 4.53 and Figure 4.54 map the WUI. Note, maps for each local jurisdiction are provided in the jurisdictional annexes.

Table 4.83 – Wildland Urban Interface, Population and Acres

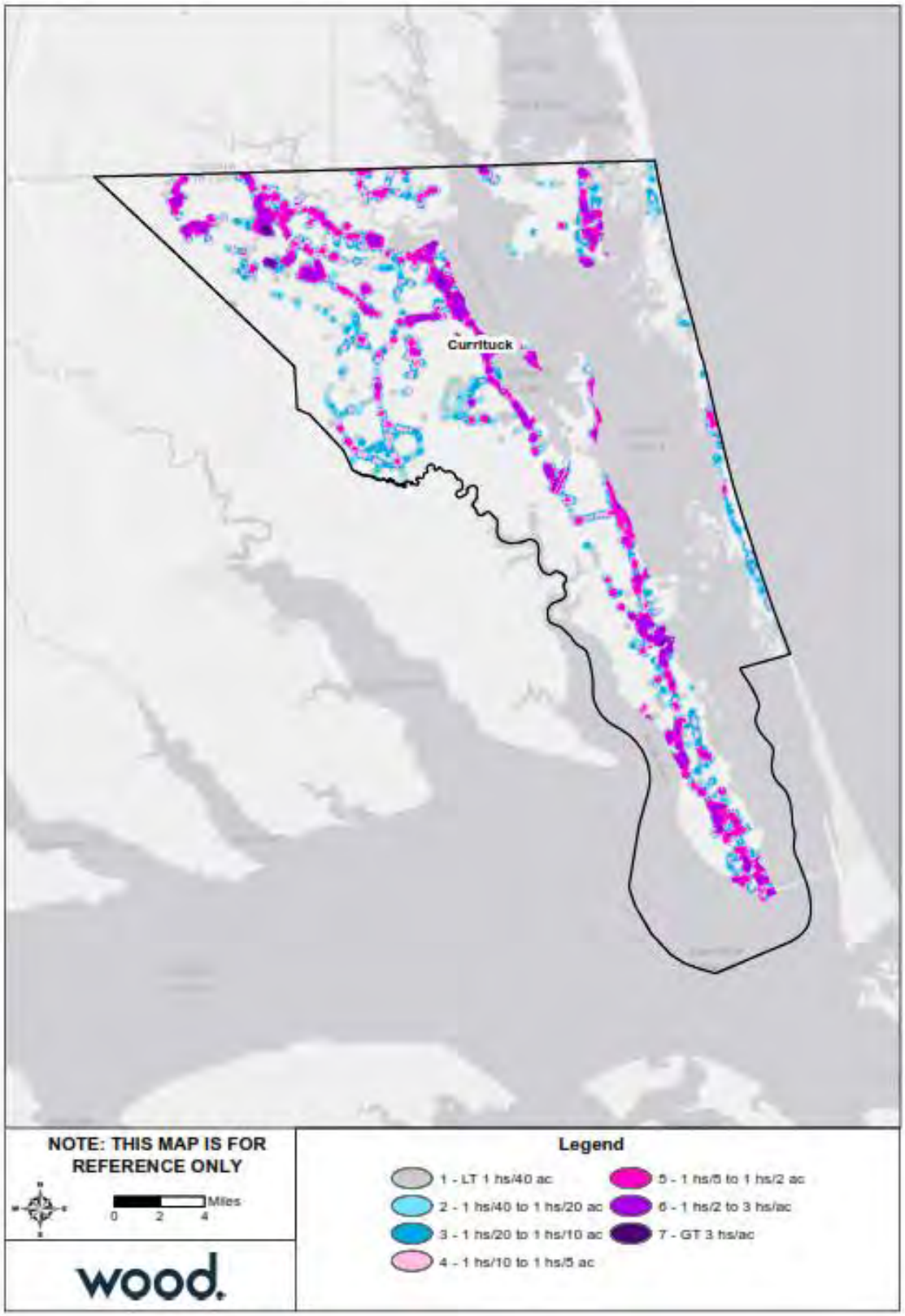
	Housing Density	WUI Population	Percent of WUI Population	WUI Acres	Percent of WUI Acres
	LT 1hs/40ac	208	0.4 %	14,150	16.1 %
	1hs/40ac to 1hs/20ac	310	0.6 %	8,519	9.7 %
	1hs/20ac to 1hs/10ac	968	1.9 %	12,731	14.5 %
	1hs/10ac to 1hs/5ac	2,016	3.9 %	12,669	14.4 %
	1hs/5ac to 1hs/2ac	6,848	13.4 %	17,274	19.6 %
	1hs/2ac to 3hs/1ac	29,030	56.8 %	20,332	23.1 %
	GT 3hs/1ac	11,756	23.0 %	2,373	2.7 %
	Total	**51,136**	**100.0 %**	**88,048**	**100.0 %**

Source: Southern Wildfire Risk Assessment

It should be noted that SWRA uses 2012 data for population estimates. 2017 American Community Survey estimates for population in the Outer Banks is 78,759; therefore, actual population exposure within the WUI may be as high as 70,017.

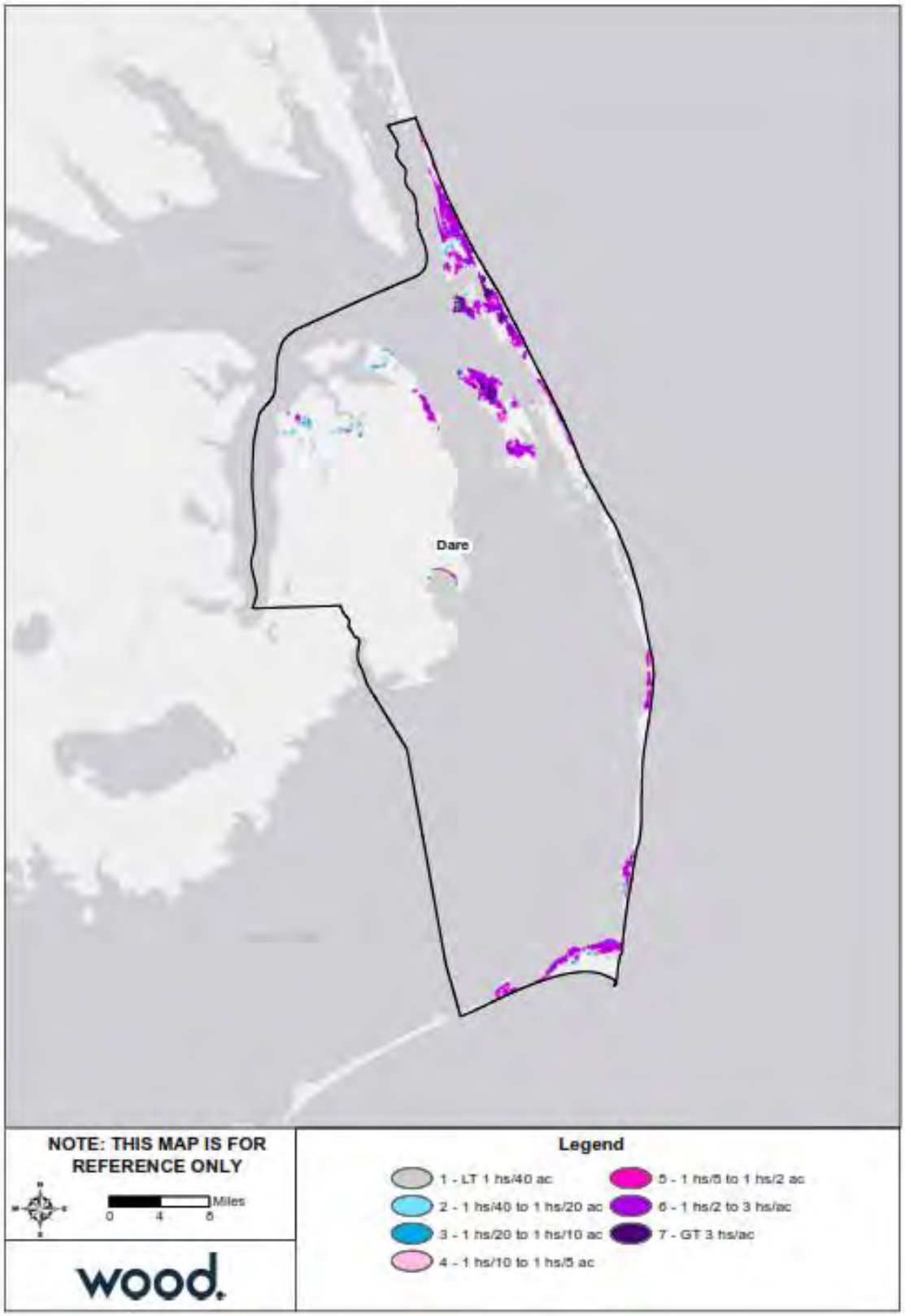
Based on the US Census Bureau's 2010 Decennial Census estimates, the Outer Banks contains a total land area of 413,613 acres. Therefore, approximately 21.3 percent of the Region falls within the WUI.

Figure 4.53 – Wildland Urban Interface, Currituck County



Source: Southern Wildfire Risk Assessment

Figure 4.54 – Wildland Urban Interface, Dare County



Source: Southern Wildfire Risk Assessment

Extent

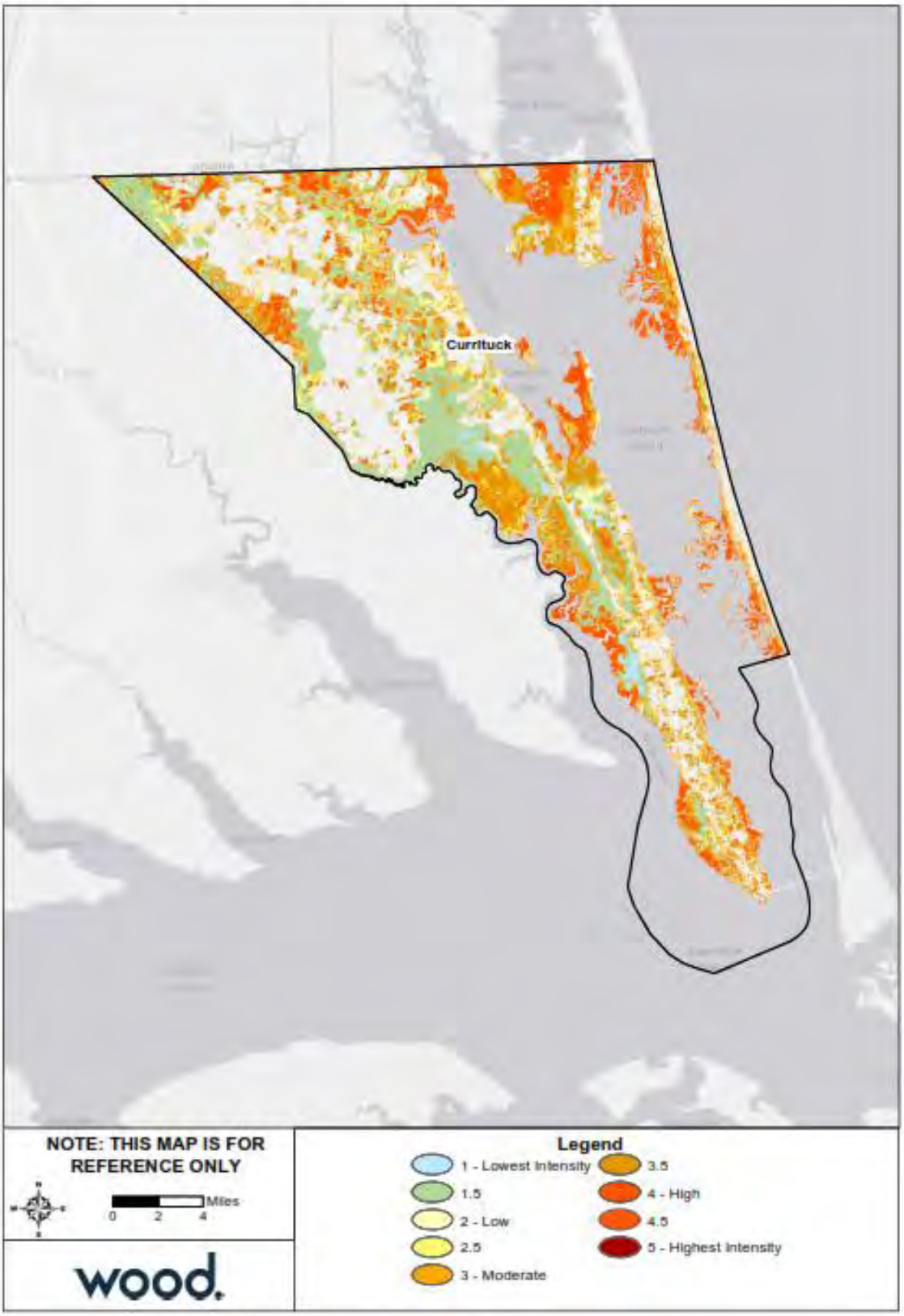
Wildfire extent can be defined by the fire's intensity and measured by the Characteristic Fire Intensity Scale, which identifies areas where significant fuel hazards which could produce dangerous fires exist. Fire Intensity ratings identify where significant fuel hazards and dangerous fire behavior potential 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 4.55 and Figure 4.59 show the potential fire intensity within the WUI across the Region. Note, maps for each local jurisdiction are provided in the jurisdictional annexes.

Table 4.84 – 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.

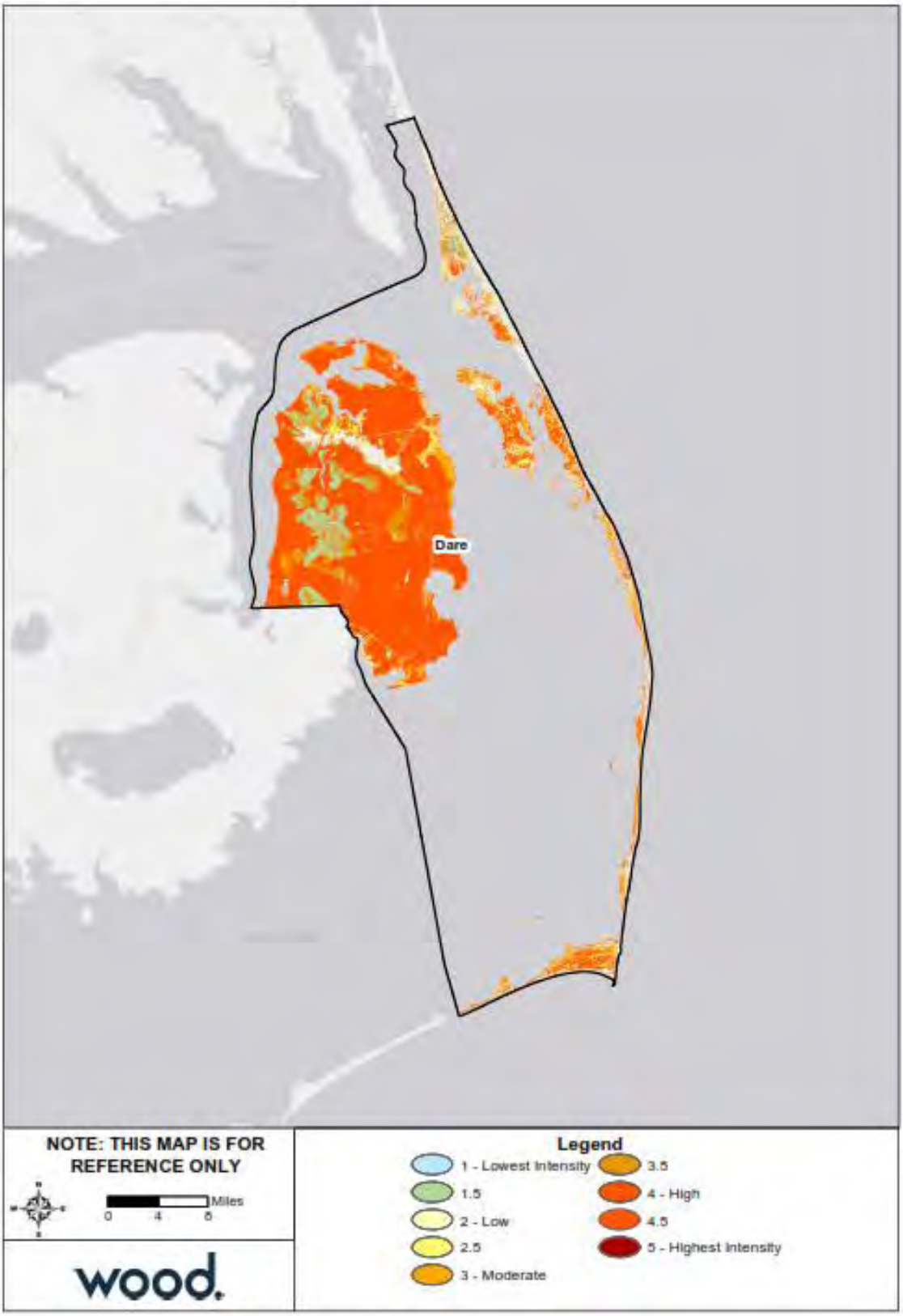
Source: Southern Wildfire Risk Assessment

Figure 4.55 – Characteristic Fire Intensity, Currituck County



Source: Southern Wildfire Risk Assessment

Figure 4.56 – Characteristic Fire Intensity, Dare County



Source: Southern Wildfire Risk Assessment

Table 4.85 shows the amount and percentage of land area susceptible to each level of the fire intensity scale by acre. Over 44% of the Region is susceptible to Class 4 and 4.5 high intensity fires, which pose significant harm or damage to life and property. Another 15.7 percent of the Region may experience Class 3 fire intensities, which have potential for harm to life and property but are easier to suppress with dozer and plows. The remainder of the Region is either non-burnable (21.1%) or would face a Class 1 or Class 2 Fire Intensity, which are easily suppressed.

Table 4.85 – Fire Intensity Scale

	Class	Acres	Percent
	Non-Burnable	87,336	21.12%
	1 Lowest Intensity	3,405	0.82%
	1.5	49,183	11.89%
	2 Low	8,192	1.98%
	2.5	18,265	4.42%
	3 Moderate	28,624	6.92%
	3.5	36,494	8.82%
	4 High	117,448	28.40%
	4.5	64,666	15.63%
	5 Highest Intensity	0	0.00%
	Total	**413,613**	**100.00%**

Source: Southern Wildfire Risk Assessment & GIS analysis
Note: This data was adjusted from SWRA estimates to exclude 922,098 acres of water area from the non-burnable area estimate.

Impact: 2 – Limited

Spatial Extent: 3 – Moderate

Historical Occurrences

The North Carolina Forest Service (NCFS) began keeping records of fire occurrence on private and state-owned lands in 1928. Since this time, there has been an average of approximately 4,000 fires burning more than 115,000 acres annually. Recently, within the last 10 years, the State has averaged closer to 3,200 fires per year and 15,000 acres burned annually.

Table 4.86 lists past occurrences of wildfire in the Outer Banks Region since 2009 as provided by the North Carolina Forest Service (NCFS) in May 2019. This data only accounts for occurrences within unincorporated areas of Currituck and Dare Counties, 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 4.86 – Records for Wildfire in Outer Banks, 2009-2018

Year	Number of Fires			Acreage Burned		
	Dare	Currituck	Region Total	Dare	Currituck	Region Total
2009	52	46	98	72.80	196.60	269.40
2010	43	36	79	15.10	18.20	33.30

Year	Number of Fires			Acreage Burned		
	Dare	Currituck	Region Total	Dare	Currituck	Region Total
2011	45	60	105	11.40	42.30	53.70
2012	22	24	46	315.10	6.80	321.90
2013	25	31	56	22.60	27.90	50.50
2014	9	18	27	1.90	6.40	8.30
2015	14	39	53	1.78	10.59	12.37
2016	9	31	40	255.62	15.08	270.70
2017	4	24	28	34.74	34.42	69.16
2018	3	24	27	0.05	5.38	5.43
Total	**226**	**333**	**559**	**731.09**	**363.67**	**1,094.76**

Source: NC Forest Service

The Outer Banks experienced prolonged periods of severe to extreme drought in 2011, as well as severe drought in 2008. These periods of drought may explain some of the annual variation in fires and acreage burned.

On average, the Outer Banks Region experiences 55.9 fires and 109.5 acres burned annually from fires that require the North Carolina Forest Service to respond. Actual number of fires and acreage burned is likely higher because smaller fires within jurisdictional boundaries are managed by local fire departments.

Probability of Future Occurrence

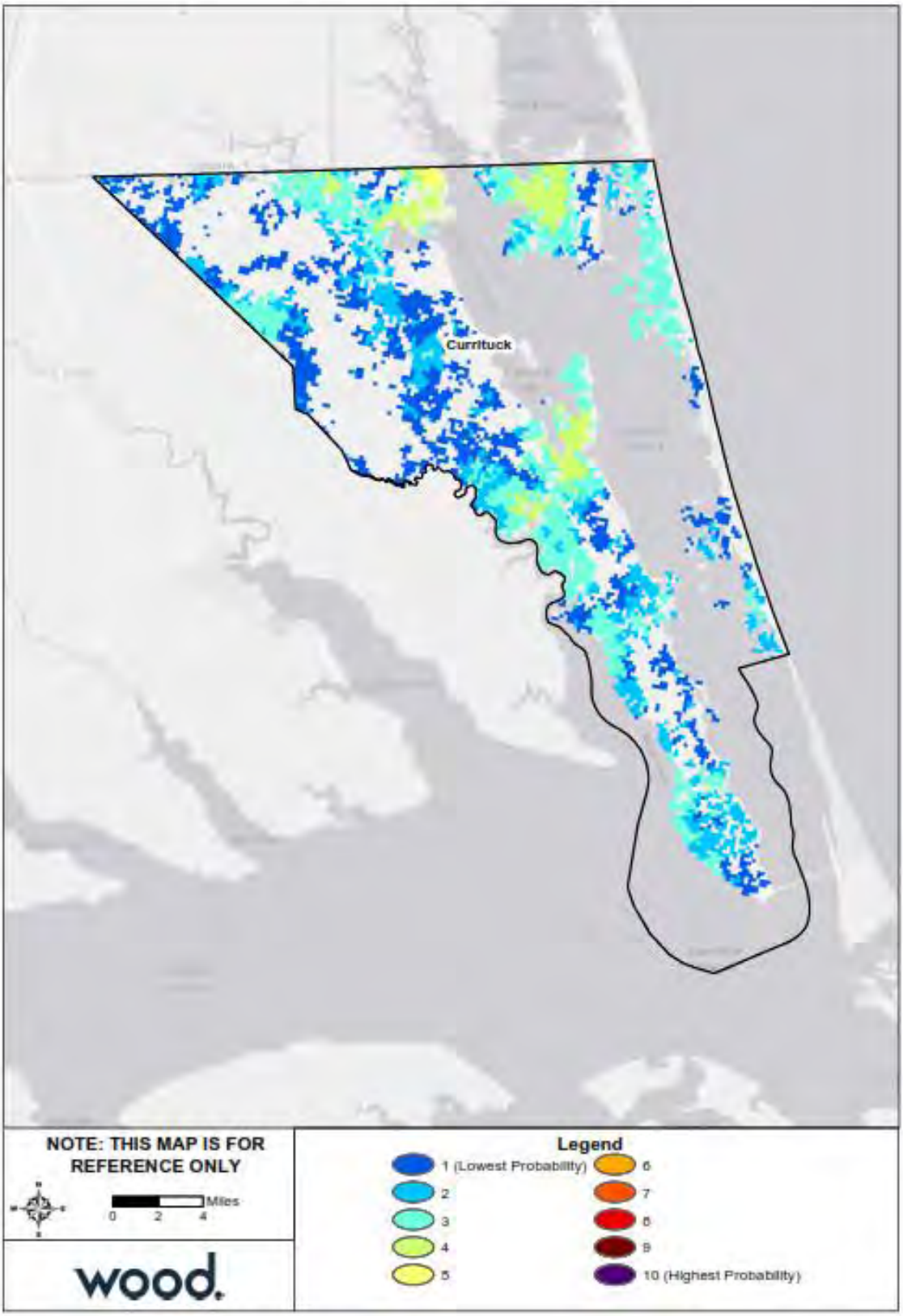
The Southern Wildfire Risk Assessment provides a Burn Probability analysis which predicts the probability of an area burning based on landscape conditions, weather, historical ignition patterns, and historical fire prevention and suppression efforts. Burn Probability data is generated by simulating fires under different weather, fire intensity, and other conditions. Values in the Burn Probability (BP) data layer indicate, for each pixel, the number of times that cell was burned by a modeled fire, divided by the total number of annual weather scenarios simulated. The simulations are calibrated to historical fire size distributions. The Burn Probability for the Outer Banks Region is presented in Table 4.87 and illustrated in Figure 4.57 and Figure 4.58. Note, maps for each local jurisdiction are provided in the jurisdictional annexes.

Table 4.87 – Burn Probability, Outer Banks Region

Class	Acres	Percent
1	39,595	13.2 %
2	34,425	11.4 %
3	36,875	12.3 %
4	16,663	5.5 %
5	44,062	14.7 %
6	116,712	38.8 %
7	12,340	4.1 %
8	0	0.0 %
9	0	0.0 %
10	0	0.0 %
Total	**300,672**	**100.0 %**

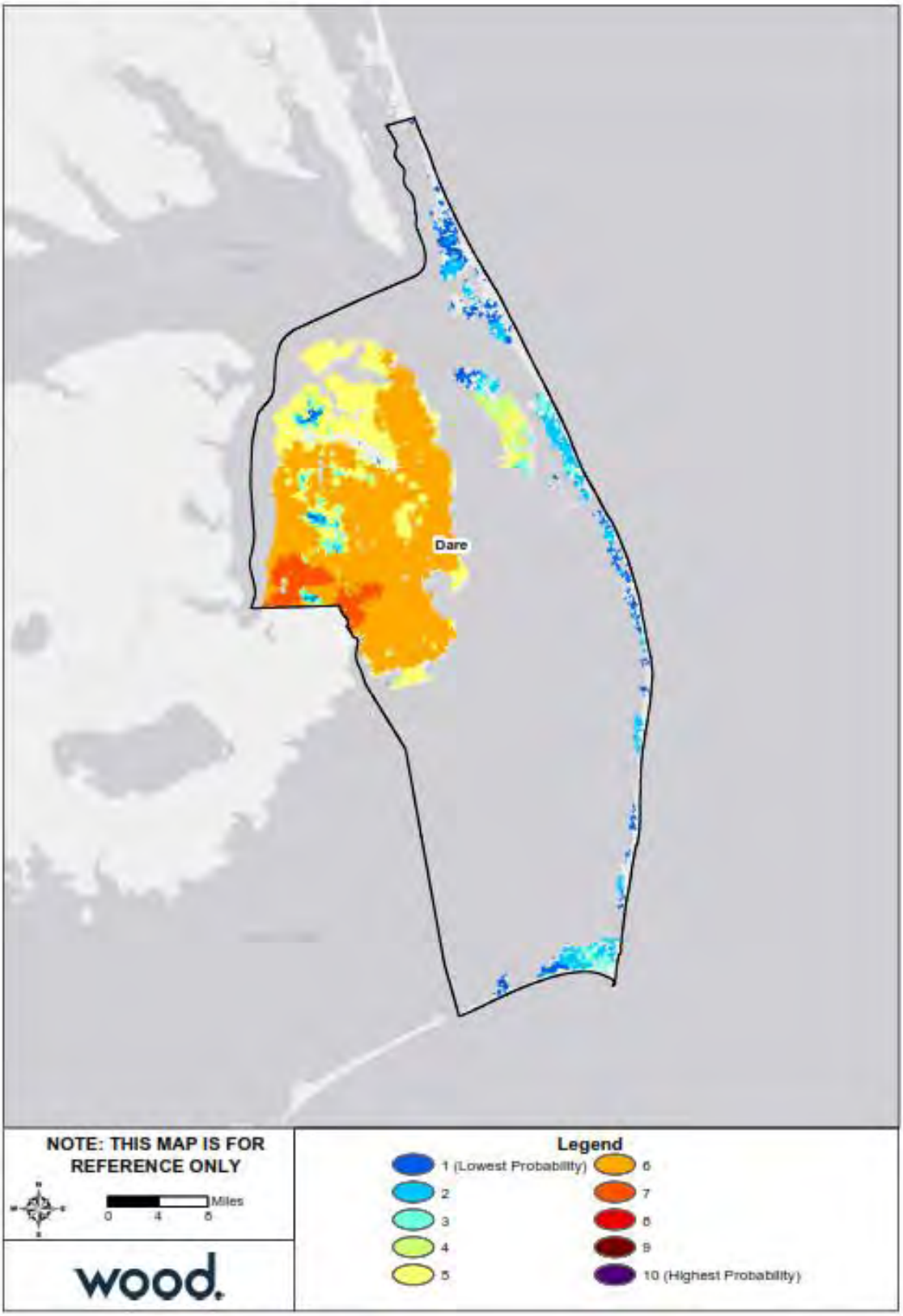
Source: Southern Wildfire Risk Assessment

Figure 4.57 – Burn Probability, Currituck County



Source: Southern Wildfire Risk Assessment

Figure 4.58 – Burn Probability, Dare County



Source: Southern Wildfire Risk Assessment

Most of the Outer Banks region has a relatively low burn probability of 5 or less, however approximately 43 percent of the Region has a burn probability of 6 or 7. These areas of moderate to high moderate burn probability are located primarily in mainland Dare County. The probability of wildfire across the Region county is considered possible, defined as between a 1% and 10% annual chance of occurrence. While the whole area falls 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 were 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 4.88 details the population estimated to be at risk to wildfire according to the NCEM IRISK database.

Table 4.88 – 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
Currituck									
Unincorporated Currituck County	23,540	12,818	54.5%	3,041	1,656	54.5%	1,329	724	54.5%
Dare									
Unincorporated Dare County	16,893	8,942	52.9%	2,574	1,363	53%	916	485	52.9%
Town of Duck	369	95	25.7%	56	14	25%	20	5	25%

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
Town of Kill Devil Hills	6,635	1,250	18.8%	1,011	190	18.8%	360	68	18.9%
Town of Kitty Hawk	3,270	1,084	33.1%	498	165	33.1%	177	59	33.3%
Town of Manteo	1,258	761	60.5%	192	116	60.4%	68	41	60.3%
Town of Nags Head	2,786	686	24.6%	425	105	24.7%	151	37	24.5%
Town of Southern Shores	2,695	1,081	40.1%	411	165	40.1%	146	59	40.4%
Subtotal Dare	**33,906**	**13,899**	**41%**	**5167**	**2118**	**41%**	**1838**	**754**	**41%**
Region Total	**57,446**	**26,717**	**46.5%**	**8208**	**3774**	**46%**	**3167**	**1478**	**46.7%**

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.

Table 4.89 details the buildings at risk to wildfire in the Outer Banks Region.

Table 4.89 – 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
Currituck													
Unincorporated Currituck County	17,069	8,402	49.20%	$1,182,194,384	889	5.20%	$438,834,481	131	0.80%	$173,800,464	9,422	55.20%	$1,794,829,329
Dare													
Unincorporated Dare County	13,634	6,792	49.80%	$1,065,575,892	325	2.40%	$98,327,901	89	0.70%	$91,146,105	7,206	52.90%	$1,255,049,898
Town of Duck	2,400	594	24.80%	$208,013,816	27	1.10%	$14,783,889	2	0.10%	$2,375,605	623	26%	$225,173,310
Town of Kill Devil Hills	5,972	1,071	17.90%	$172,524,391	71	1.20%	$48,033,306	10	0.20%	$39,129,320	1,152	19.30%	$259,687,017
Town of Kitty Hawk	2,803	863	30.80%	$169,526,300	47	1.70%	$32,352,996	5	0.20%	$4,654,834	915	32.60%	$206,534,131
Town of Manteo	918	458	49.90%	$114,321,743	83	9%	$49,400,268	17	1.90%	$49,456,777	558	60.80%	$213,178,787
Town of Nags Head	4,827	1,113	23.10%	$252,736,458	93	1.90%	$56,982,137	15	0.30%	$24,345,413	1,221	25.30%	$334,064,008
Town of Southern Shores	2,496	984	39.40%	$269,746,750	20	0.80%	$14,218,359	4	0.20%	$16,964,160	1,008	40.40%	$300,929,270
Subtotal Dare	**33,050**	**11,875**	**35.93%**	**$2,252,445,350**	**666**	**2.02%**	**$314,098,856**	**142**	**0.43%**	**$228,072,214**	**12,683**	**38.38%**	**$2,794,616,421**
Region Total	**50,119**	**20,277**	**40.46%**	**$3,434,639,734**	**1,555**	**3.10%**	**$752,933,337**	**273**	**0.54%**	**$401,872,678**	**22,105**	**44.11%**	**$4,589,445,750**

Source: NCEM Risk Management Tool

The sectors facing the greatest risk to wildfire in the Outer Banks Region are commercial facilities, critical manufacturing, food and agriculture, government facilities, and transportation systems.

Table 4.90 – Critical Facilities at Risk to Wildfire

Sector	Buildings at Risk	Estimated Damages
Banking and Finance	21	$10,130,189
Chemical	1	$78,007
Commercial Facilities	1,006	$610,530,600
Communications	9	$5,937,274
Critical Manufacturing	247	$107,353,576
Defense Industrial Base	1	$149,040
Emergency Services	19	$21,683,195
Energy	7	$27,676,032
Food and Agriculture	240	$17,054,606
Government Facilities	155	$275,168,331
Healthcare and Public Health	45	$35,213,477
Nuclear Reactors, Materials and Waste	1	$327,280
Postal and Shipping	1	$58,746
Transportation Systems	170	$91,779,460
Water	31	$5,691,681
Total	**1,954**	**$1,208,831,494**

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 4.91 summarizes the potential detrimental consequences of wildfire.

Table 4.91 – Consequence Analysis - Wildfire

Category	Consequences
Public	In addition to the potential for fatalities, wildfire and the resulting diminished air quality pose health risks, 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 priority in all wildland fire management activities. Wildfires are a 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.

Category	Consequences
Property, Facilities and Infrastructure	Wildfires can damage community infrastructure, including roadways, communication networks and facilities, power lines, and water distribution systems. Restoring basic services is critical. 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.
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. Local property values can decline. Extensive fire damage to trees can significantly alter the timber supply through a short-term surplus from timber salvage and a longer-term decline while trees regrow. Water supplies can be degraded by post-fire erosion and stream sedimentation.
Public Confidence in the Jurisdiction's Governance	Wildfire events may cause issues with public confidence because they have very visible impacts on the community. Public confidence in the jurisdiction's governance may be influenced by actions taken pre-disaster to mitigate and prepare for impacts, including the amount of public education provided; efforts to provide warning to residents; actions taken to respond to the event; and actions taken to recover from the impacts.

Hazard Summary by Jurisdiction

The following table summarizes flood hazard risk by jurisdiction. Wildfire warning time and duration do not vary by jurisdiction. Spatial extent ratings were based on the proportion of area within the WUI; all jurisdictions have at least 50% of their area in the WUI and were assigned a rating of 3. Impact ratings were based on fire intensity data from SWRA. Jurisdictions with significant clusters of moderate to high fire intensity were assigned a rating of 3; all other jurisdictions were assigned a rating of 2. Probability ratings were determined based on burn probability data from SWRA. Jurisdictions with clusters of moderate burn probability were assigned a rating of 3; all other jurisdictions were assigned a probability of 2.

Jurisdiction	Probability	Impact	Spatial Extent	Warning Time	Duration	Score	Priority
Currituck County	2	2	3	4	3	2.5	H
Dare County	3	3	3	4	3	3.1	H
Duck	2	2	3	4	3	2.5	H
Kill Devil Hills	2	2	3	4	3	2.5	H
Kitty Hawk	2	2	3	4	3	2.5	H
Manteo	2	3	3	4	3	2.8	H
Nags Head	2	2	3	4	3	2.5	H
Southern Shores	2	2	4	4	3	2.7	H

4.5.11 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 four sites with hazardous materials in the planning area, two in Currituck County and two in Dare County. These sites are shown in Figure 4.59 and detailed in Table 4.92 below.

Table 4.92 – Toxic Release Inventory Sites

Facility Name	County	Chemicals Reported	Most Recent Release
Tidewater Agricorp Central Fertilizer	Currituck	Ammonium Sulfate, Ammonia, Phosphoric Acid	1988
W S Clark & Sons Inc	Currituck	Ammonia, Phosphoric Acid	1990
Us Air Force Dare County Bomb Range	Dare	Lead Compounds, Lead, Aluminum	2018
Us Natl Park Service Cape Hattteras Natl Seashore (Caha)	Dare	Lead	2018

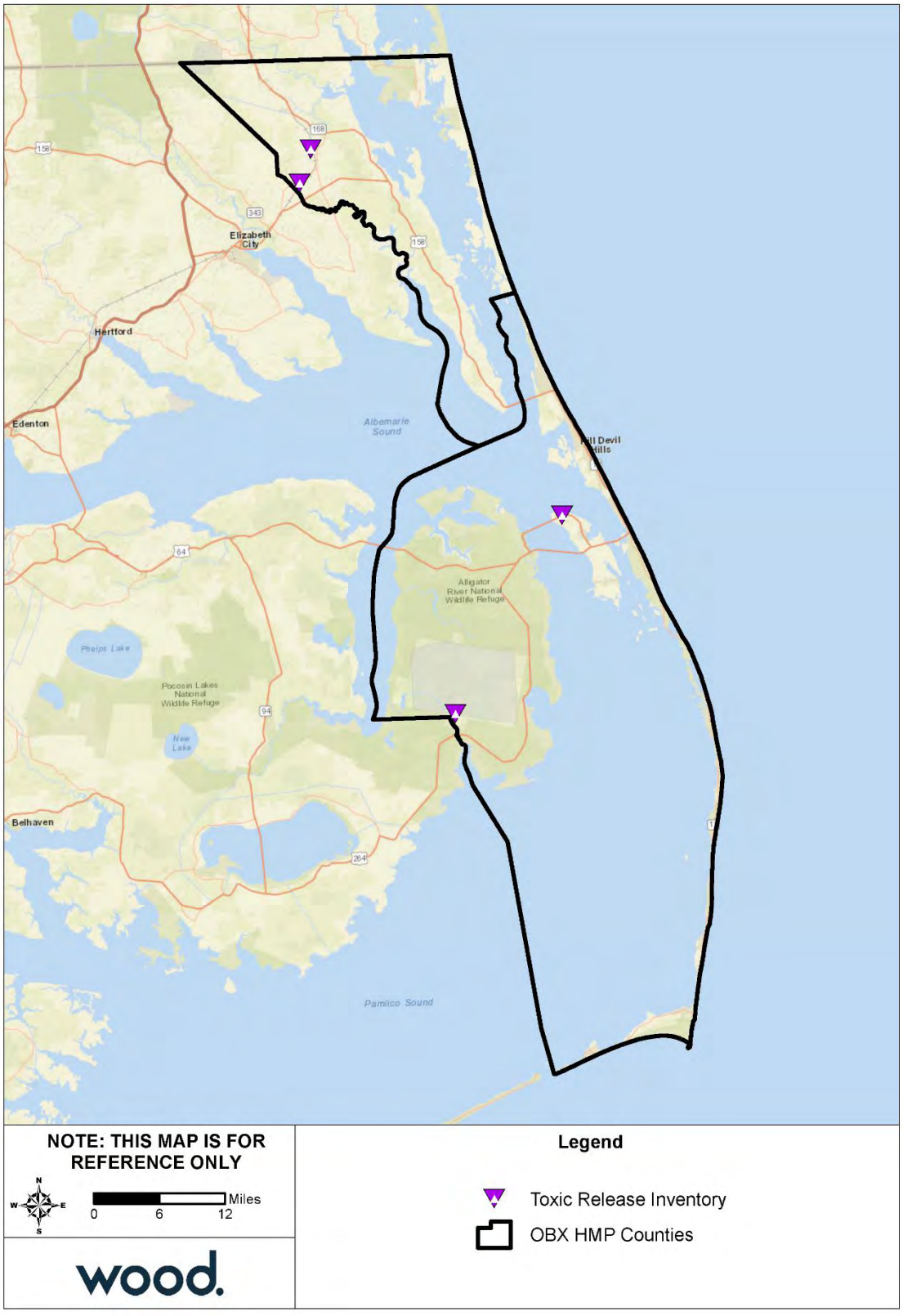
Source: US EPA

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 April 2019 there are no current RMP facilities located in the planning area; the database lists three former RMP facilities which have been deregistered due to no longer storing sufficient quantities of regulated materials.

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. Railroad lines may also transport hazardous materials, although rail lines are limited in the planning area, with only one freight line that passes through northwestern Currituck County from Virginia to Camden County. Lastly, many hazardous materials are transported through airports. Figure 4.60 shows the major transportation routes through the planning area.

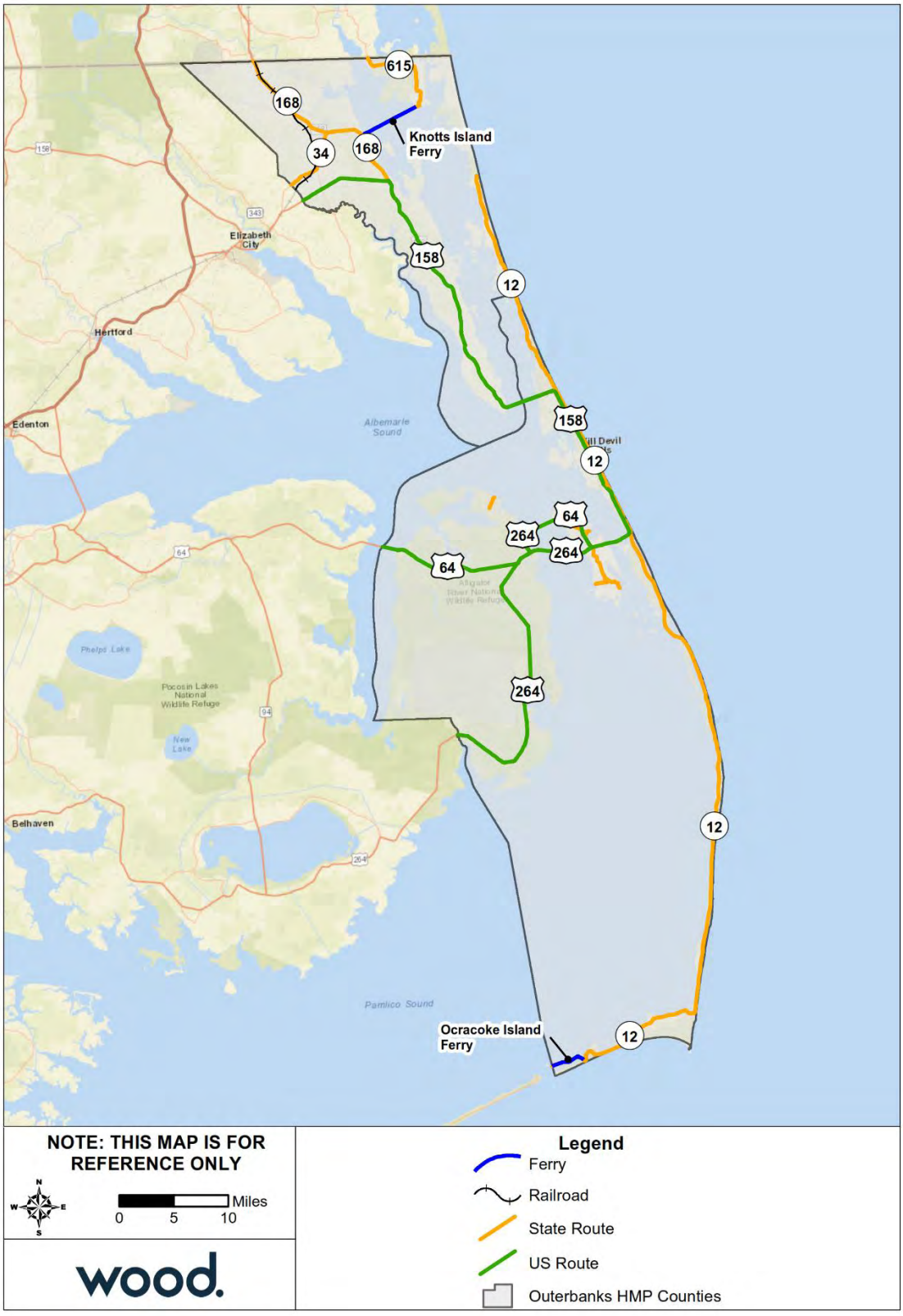
The U.S. Department of Transportation (USDOT) Pipeline and Hazardous Materials Safety Administration (PHMSA) maintains an inventory of the location of all gas transmission and hazardous liquid pipelines as well as liquid natural gas plants and hazardous liquid breakout tanks. The location of pipelines, pipeline infrastructure, and past pipeline incidents in the planning area are shown by county in Figure 4.61 and Figure 4.62, as reported in the public viewer of the National Pipeline Mapping System.

Figure 4.59 – Toxic Release Inventory Sites in the Planning Area



Source: EPA Toxic Release Inventory

Figure 4.60 – Key Transportation Routes in the Planning Area



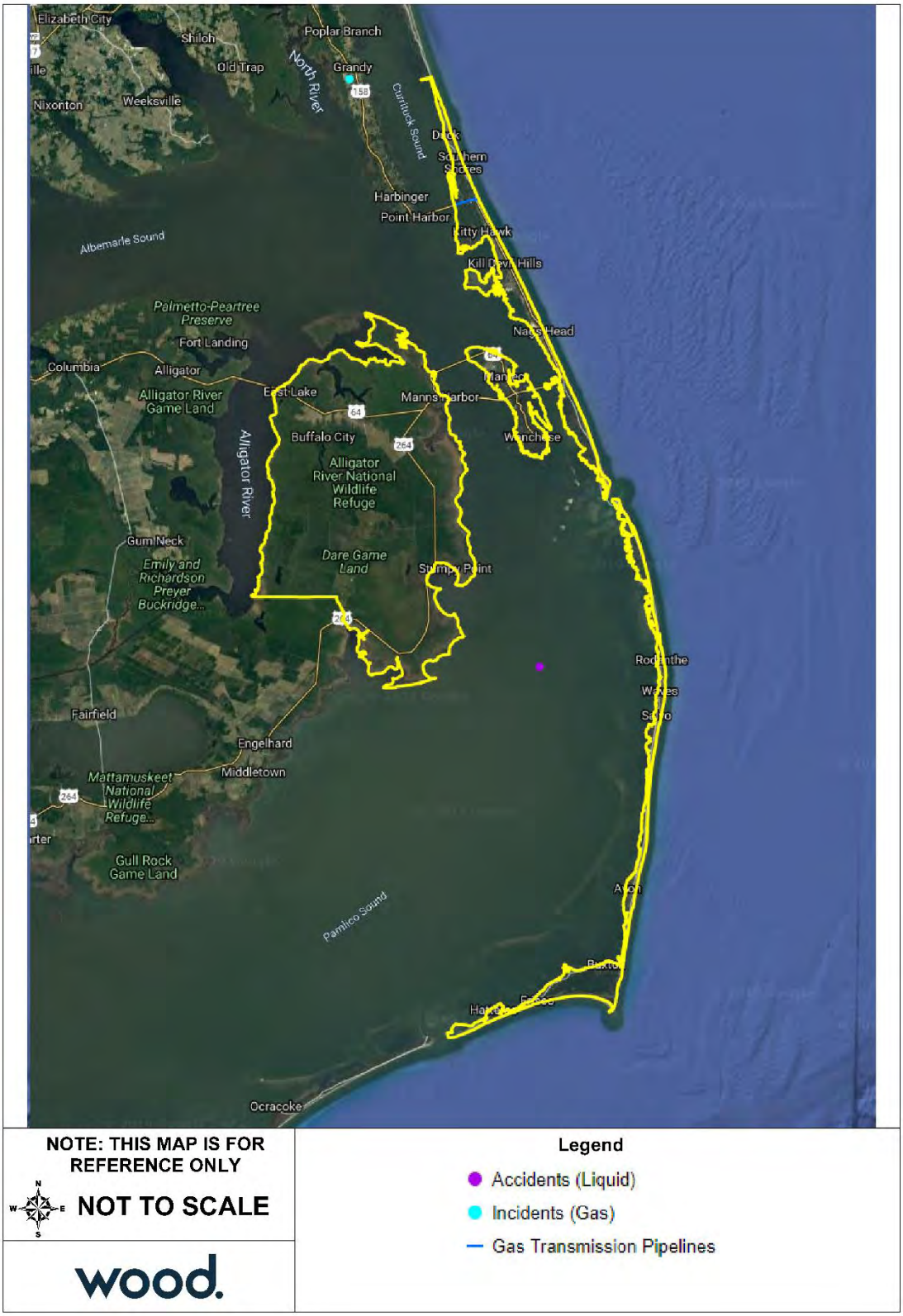
Source: NAVTEQ

Figure 4.61 – Pipelines, Pipeline Infrastructure, and Past Incident Locations in Currituck County



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

Figure 4.62 – Pipelines, Pipeline Infrastructure, and Past Incident Locations in Dare County



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

The incidents and accidents mapped above by PHMSA include a spill of 0.95 bbls of diesel fuel in 2004 in Dare County and a natural gas release in 2010 in Currituck County. Neither event caused any injuries or fatalities.

The locations of other past incidents recorded by the EPA can be found below in Table 4.94.

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.

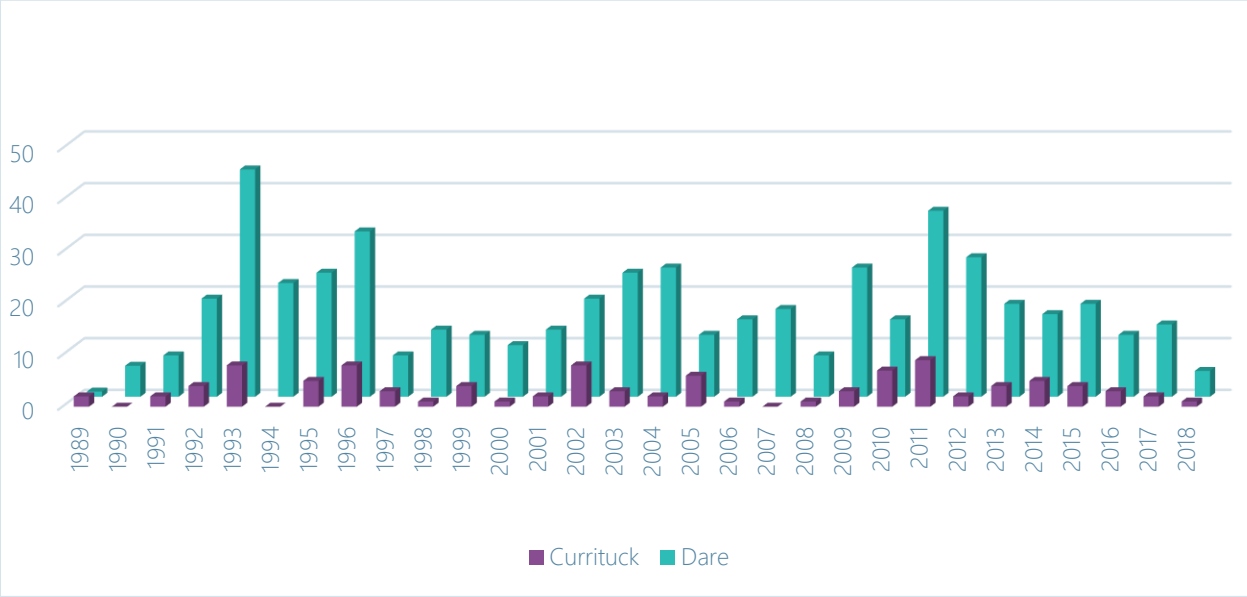
Impact: 1 – Minor

Spatial Extent: 1 – Negligible

Historical Occurrences

Multiple hazardous materials incidents take place in the planning area every month. The EPA's Right-To-Know network lists 619 hazardous materials incidents in the planning area since 1989 through 2018: 518 in Dare County and 101 in Currituck County. This represents less than 4% of the 16,333 incidents reported statewide during the same time period. These numbers break down to an average of 3.4 per year in Currituck and 17.3 a year in Dare, although the number of incidents varies greatly from year to year, as can be seen in Figure 4.63. Despite this variation, over the last 30 years the overall number of incidents has remained constant.

Figure 4.63 – Hazardous Materials by Year, 1989-2018



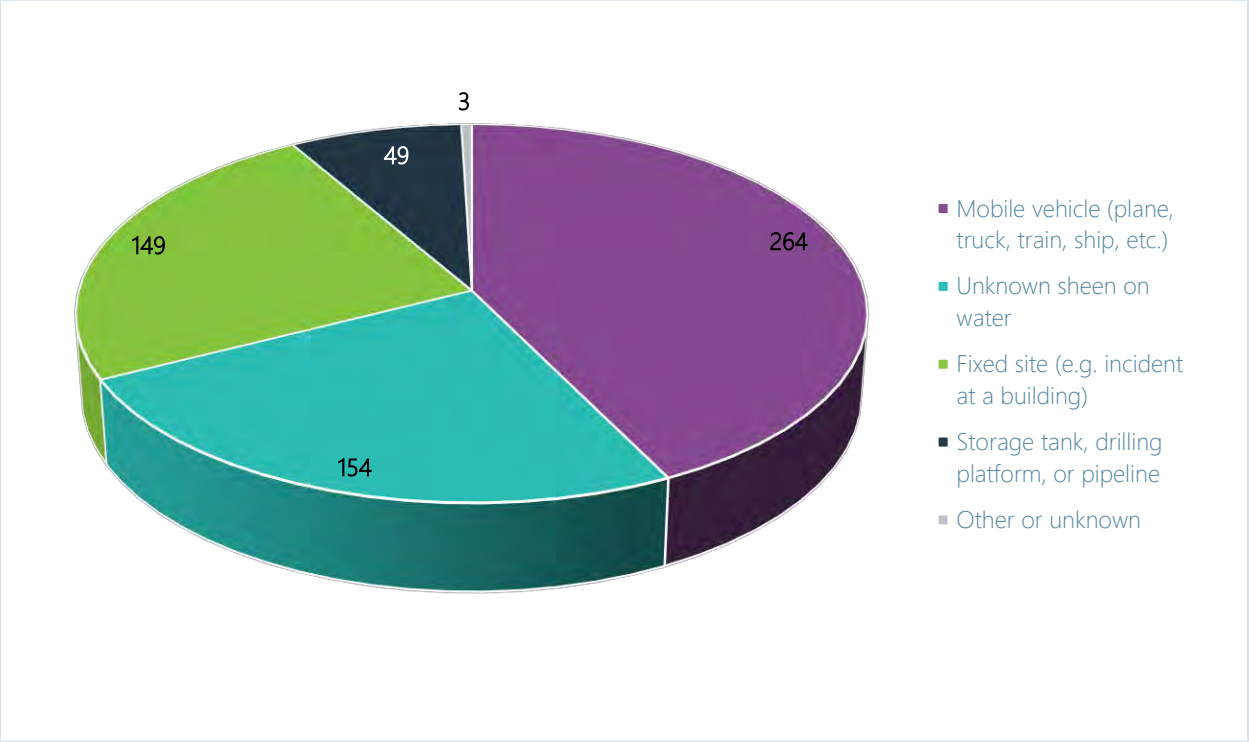
Source: U.S. EPA Right-to-Know Network (http://www.rtk.net), analysis by Wood

Fortunately, the vast majority of these incidents are minor with very localized impacts and do not result in injuries or significant damage:

- Incidents resulting in Fatalities: 0
- Incidents resulting in Injuries: 8
- Persons Injured: 14
- Persons Hospitalized: 14
- Incidents Leading to Evacuations: 2
- Persons Evacuated: 5
- Incidents Resulting in Property Damage: 3
- Damages: Unknown
- Total Incidents resulting in Injuries, Evacuations, or Damages: 11

As shown in Figure 4.64, of the 619 incidents recorded by the EPA, 43% (264) were transportation related. Another 25% (154) were an unknown sheen on water, 24% (149) were at fixed sites, and 8% were from storage tanks or pipelines.

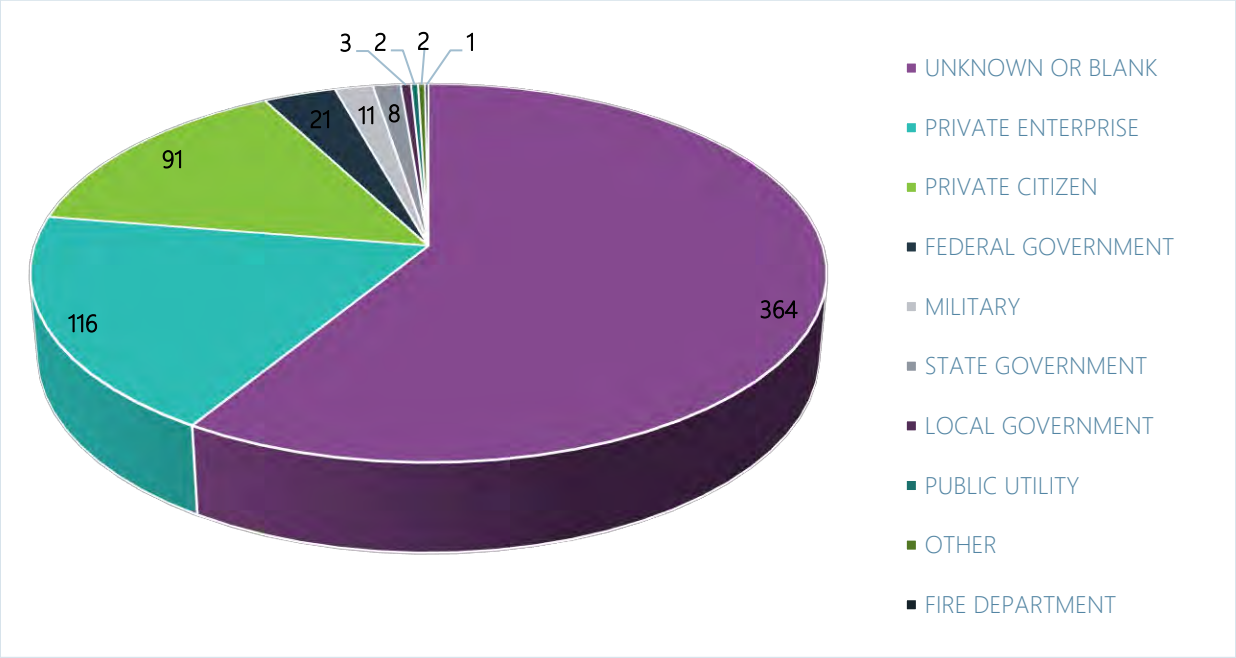
Figure 4.64 – Hazardous Materials by Type, 1989-2018



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

The party responsible for discharging the hazardous material is not known (or not listed) for the majority of incidents (59%) in the database. Of those that are known, the largest categories of dischargers were from private businesses (19%), and private individuals (15%); most of the remaining spills (7%) were from federal, state, or local governments or the military.

Figure 4.65 – Hazardous Materials by Discharger, 1989-2018



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

The most commonly-released substances are listed in Table 4.93.

Table 4.93 – Ten Most Commonly Released Hazardous Materials, 1989 – 2018

Material	Release Count
OUN: Unknown oil	159
ODS: Oils: diesel	101
MAR: Marine waste	78
NCC: Unknown / no CHRIS code	56
GAS: Gasoline: automotive (unleaded)	43
UNK: Unknown material	31
OTD: Oils, fuel: 2-D	28
OHY: Hydraulic oil	22
OMT: Oils, miscellaneous: motor	17
OTH: Other oil	9

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

Table 4.94 – Hazardous Materials Releases by Location, 1989 – 2018

Location	Release Count
Unincorporated Dare County	295
Currituck County	101
Unknown (Dare County)	64
Manteo	51
Nags Head	50
Kill Devil Hills	37

Location	Release Count
Kitty Hawk	11
Duck	8
Southern Shores	3

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

Probability of Future Occurrence

Based on historical occurrences, there have been 619 hazardous materials release in the 30-year period from 1989 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 21 hazardous materials incident a year, or roughly 1.7 per month. The majority of these (84%) will be in Dare County.

However, the number of hazardous materials incidents that result in fatalities, injuries, evacuations, or property damage is significantly lower: only 11 in 30 years. This means that based on historical data the planning area can expect a damaging hazardous materials incident approximately once every three years.

Probability: 3 – Likely

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 fatalities 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 impact 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 4.95 summarizes the potential detrimental consequences of hazardous materials incident.

Table 4.95 – 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.

4.5.12 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 an incident resulting in a release of radioactive material during transportation. Transportation of radioactive materials through North Carolina over the interstate highway system is considered a radiological hazard. The transportation of radioactive material by any means of transport is licensed and regulated by the federal government. As a rule, there are two categories of radioactive materials that are shipped over the interstate highways:

- Low level waste consists of primarily of materials that have been contaminated by low level radioactive substances but pose no serious threat except through long-term exposure. These materials are shipped in sealed drums within placarded trailers. The danger to the public is no more than a wide array of other hazardous materials.
- High level waste, usually in the form of spent fuel from nuclear power plants, is transported in specially constructed casks that are built to withstand a direct hit from a locomotive.

Radiological emergencies at nuclear power plants are divided into classifications. Table 4.96 shows these classifications, as well as descriptions of each.

Table 4.96 – 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 products may occur when radionuclides are deposited on surfaces.

The Surry Power Station is located in Surry, Virginia, about 17 miles away from Newport News. Its license of operation was issued in 1972 and is currently operating under a renewed license until 2032. The plant generates enough power for 420,000 homes. Northern Currituck county is located within the IPZ for this plant and could see impacts if there was a failure at the plant. Figure 4.66 shows nuclear power plants located in or impacting portions of the state, as well as their ingestion pathways. Figure 4.67 shows the location of Surry Power Station and the area that falls within the EPZ and IPZ of the plant.

Figure 4.66 – Nuclear Power Plants in North Carolina

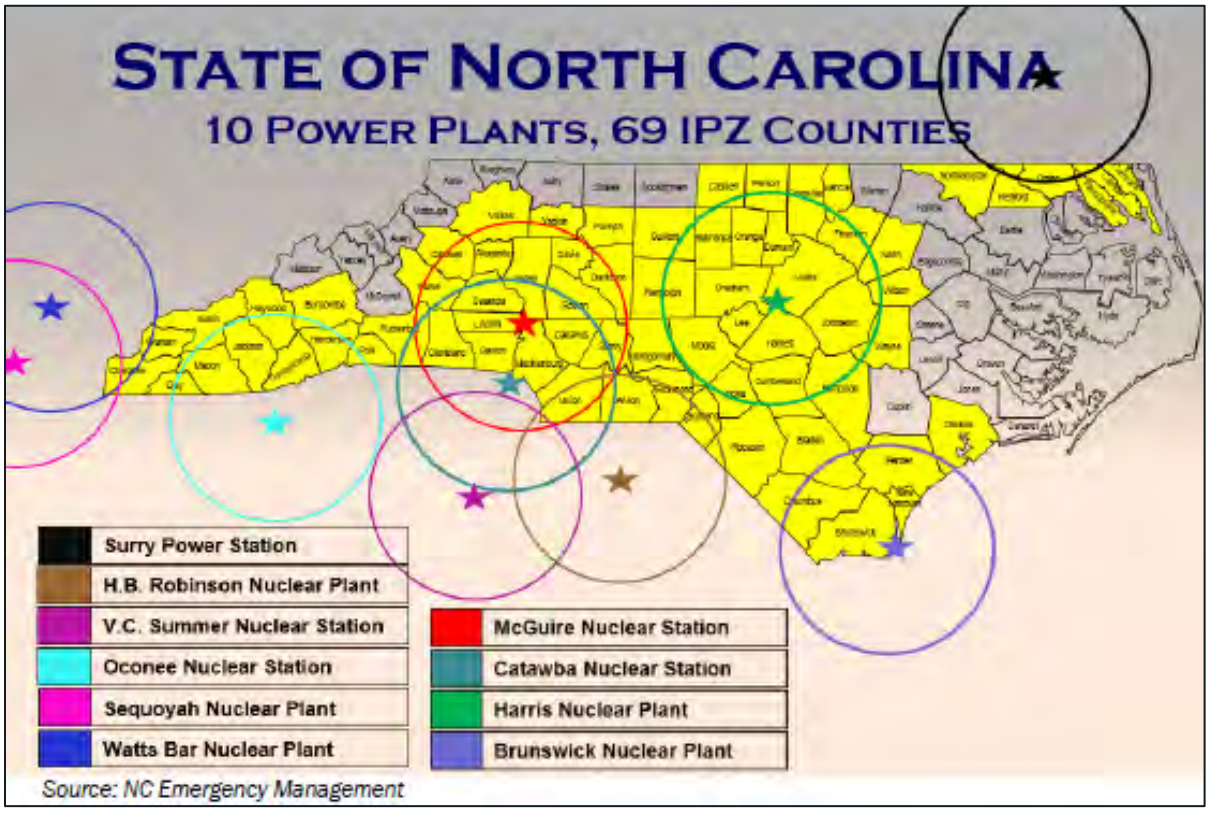
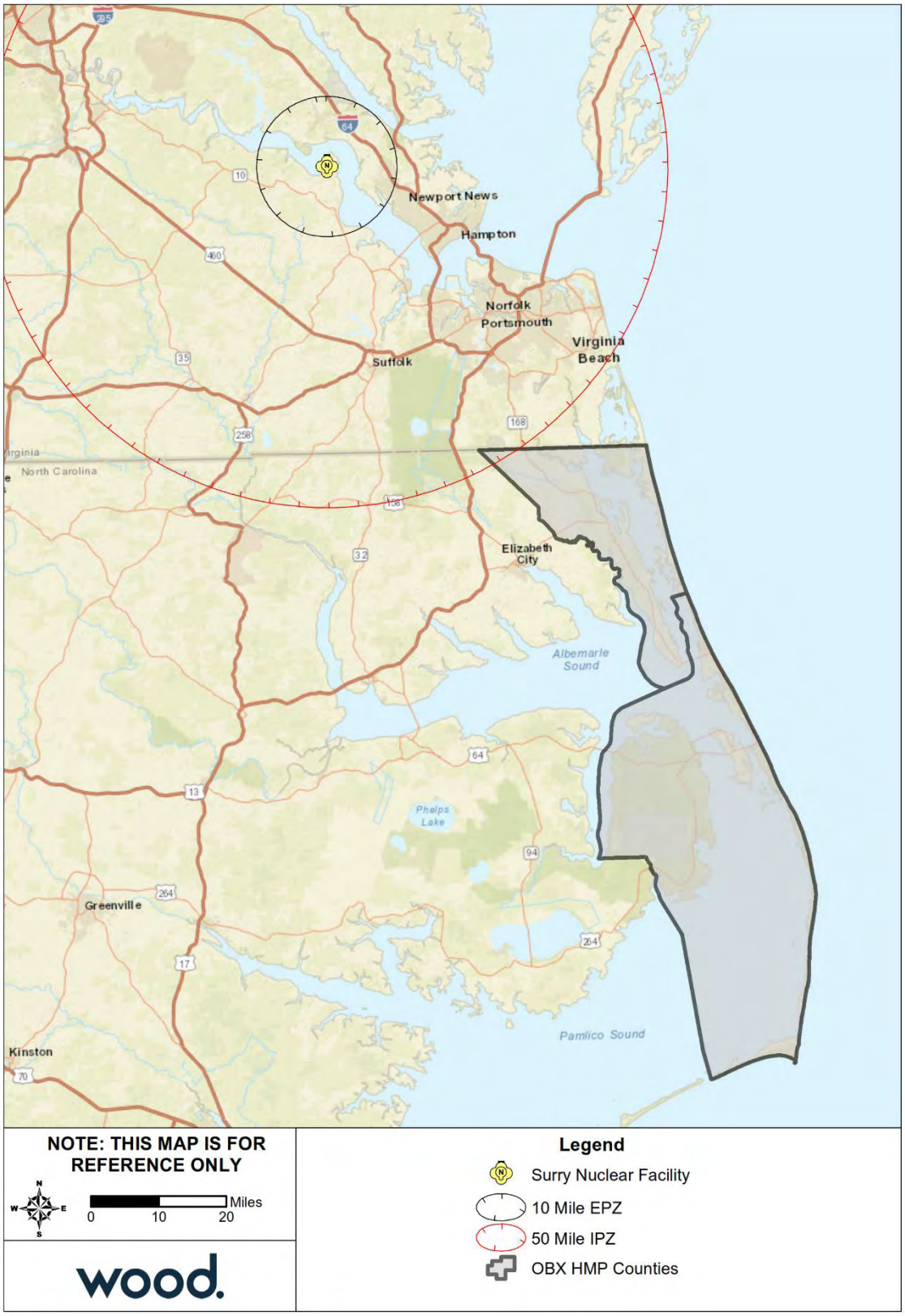


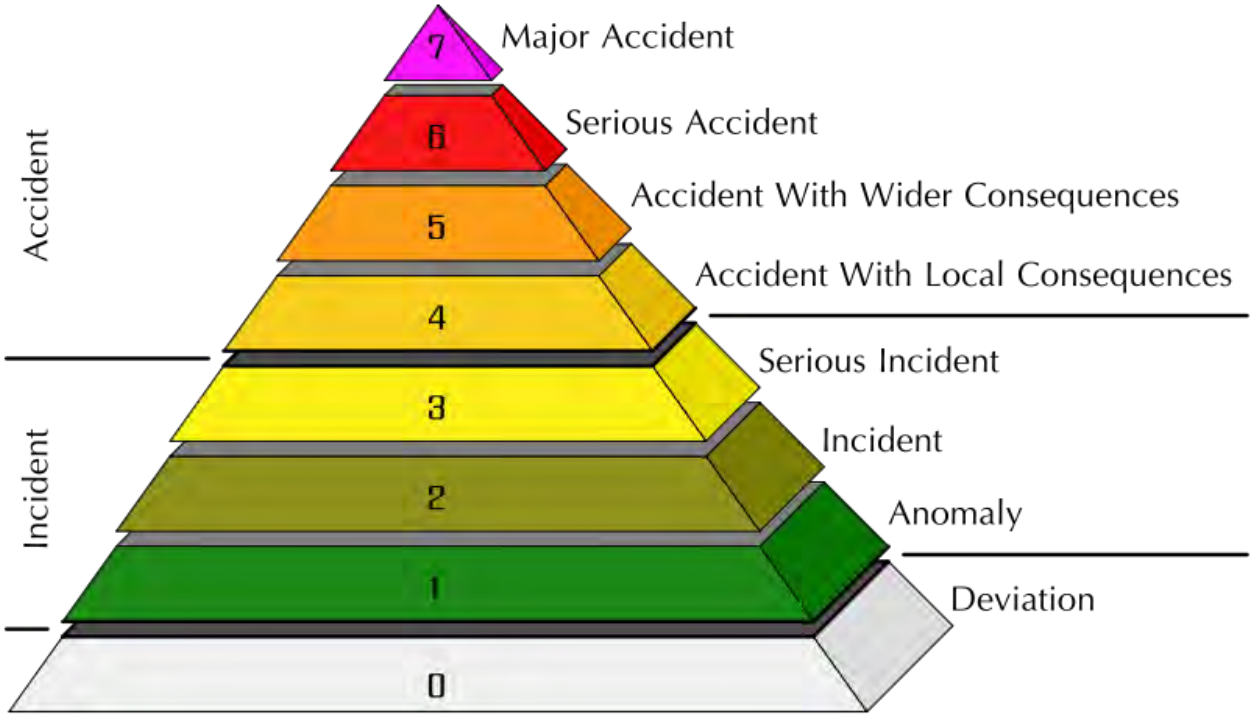
Figure 4.67– Surry Power Station Location



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: 2 – Limited

Spatial Extent: 2 – Small

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.

On August 23rd, 2011, an Earthquake occurred in central Virginia. Dominion Energy's North Anna reactors automatically shut down. The earthquake was felt at the Surry Power Station, but not as strongly. Dominion Energy declared a Notification of Unusual Event but exited it later the same day. The station was built to seismic standards appropriate for the region.

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 within the 50-mile IPZ are at risk of exposure through ingestion of contaminated food and water. Parts of northeastern Currituck County are located within a 50-mile radius, or within the Ingestion Pathway Zone (IPZ) of Surry Power Station.

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 4.97 summarizes the potential detrimental consequences of radiological incident.

Table 4.97 – Consequence Analysis - Radiological Incident

Category	Consequences
Public	High levels of radiation could cause serious illness or death. Those living and working closest to the nuclear 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. Public confidence can also be affected by false alarms.

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.

Cyber spying or espionage is the act of illicitly obtaining intellectual property, government secrets, or other confidential digital information, and often is associated with attacks carried out by professional agents working on behalf of a foreign government or corporation. According to cybersecurity firm Symantec, in 2016 "…the world of cyber espionage experienced a notable shift towards more overt activity, designed to destabilize and disrupt targeted organizations and countries."

Major data breaches - when hackers gain access to large amounts of personal, sensitive, or confidential information - have become increasingly common. The Symantec report says more than seven billion identities have been exposed in data breaches over the last eight years. In addition to networked systems, data breaches can occur due to the mishandling of external drives, as has been the case with losses of some state employee data.

Cyber-crime can refer to any of the above incidents when motivated primarily by financial gain or other criminal intent.

The most severe type of attack is cyber terrorism, which aims to disrupt or damage systems in order to cause fear, injury, and loss to advance a political agenda.

The North Carolina State Bureau of investigation' Computer Crime Unit helps law enforcement across North Carolina solve sophisticated crimes involving digital evidence.

Warning Time: 4 – Less than six hours

Duration: 4 – More than one week

Location

Cyber disruption events can occur and/or impact virtually any location in the state where computing devices are used. Incidents may involve a single location or multiple geographic areas. A disruption can have far-reaching effects beyond the location of the targeted system; disruptions that occur far outside the region can still impact people, businesses, and institutions within the region.

Extent

The extent or magnitude/severity of a cyber disruption event is variable depending on the nature of the event. A disruption affecting a small, isolated system could impact only a few functions/processes. Disruptions of large, integrated systems could impact many functions/processes, as well as many individuals that rely on those systems.

There is no universally accepted scale to quantify the severity of cyber-attacks. The strength of a DDoS attack is sometimes explained in terms of a data transmission rate. One of the largest DDoS disruptions ever, which brought down some of the internet's most popular sites on October 21, 2016, peaked at 1.2 terabytes per second.

Data breaches are often described in terms of the number of records or identities exposed.

Impact: 1 – Minor

Spatial Extent: 2 – Small

Historical Occurrences

Symantec reports there were a total of 1,209 data breaches worldwide in 2016, 15 of which involved the theft of more than 10 million identities. While the number of breaches has remained relatively steady, the average number of identities stolen has increased to almost one million per incident. The report also found that one in every 131 emails contains malware, and the company's software blocked an average of 229,000 web attacks every day.

The Privacy Rights Clearinghouse, a nonprofit organization based in San Diego, maintains a timeline of 2,631 data breaches resulting from computer hacking incidents in the United States from 2005-2018. The database lists 6 data breaches in North Carolina, totaling 294,415 records. While none of those breaches were specifically targeted at the Outer Banks Region, some of them almost certainly included information on individuals who live in the region. Similarly, some Outer Banks residents were almost certainly affected by national and international data breaches.

Probability of Future Occurrence

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

Probability: 2 – Possible

Vulnerability Assessment

As discussed above, the impacts from a cyber-attack vary greatly depending on the nature, severity, and success of the attack.

Methodologies and Assumptions

Vulnerability to cyber-attacks was assessed based on past occurrences nationally and internationally as well as publicly available information on these vulnerabilities.

People

Cyber-attacks can have a significant cumulative economic impact. Symantec reports that in the last three years, businesses have lost $3 billion due to spear-phishing email scams alone. A major cyber-attack has the potential to undermine public confidence and build doubt in their government's ability to protect them from harm.

Injuries or fatalities from cyber-attacks would generally only be possible from a major cyber terrorist attack against critical infrastructure.

Property

Short of a major cyber terrorist attacks against critical infrastructure, property damage from cyber-attacks is typically limited to computer systems.

Environment

Short of a major cyber terrorist attacks against critical infrastructure, property damage from cyber-attacks is typically limited to computer systems. A major cyber terrorism attack could potentially impact the environment by triggering a release of a hazardous materials, or by causing an accident involving hazardous materials by disrupting traffic-control devices.

Consequence Analysis

Table 4.98 summarizes the potential consequences of a cyber threat.

Table 4.98 – Consequence Analysis - Cyber Threat

Category	Consequences
Public	Cyber-attacks can impact personal data and accounts. Injuries or fatalities could potentially result from a major cyber terrorist attacks against critical infrastructure.
Responders	Cyber-attacks can impact personal data and accounts. Injuries or fatalities could potentially result from a major cyber terrorist attacks against critical infrastructure.
Continuity of Operations (including Continued Delivery of Services)	Agencies that rely on electronic backup of critical files are vulnerable. The delivery of services can be impacted since governments rely, to a great extent, upon electronic delivery of services.
Property, Facilities and Infrastructure	Rare. Most attacks affect only data and computer systems. Sabotage of utilities and infrastructure from a major cyber terrorist attacks could potentially result in system failures that damage property on a scale equal with natural disasters. Facilities and infrastructure may become unusable as a result of a cyber-attack.
Environment	Rare. A major attack could theoretically result in a hazardous materials release.
Economic Condition of the Jurisdiction	Could greatly affect the economy. In an electronic-based commerce society, any disruption to daily activities can have disastrous impacts to the economy. It is difficult to measure the true extent of the impact.
Public Confidence in the Jurisdiction's Governance	The government's inability to protect critical systems or confidential personal data could impact public confidence. An attack could raise questions regarding the security of using electronic systems for government services.

4.5.14 Terrorism

Hazard Background

There is no universal globally agreed-upon definition of terrorism. In a broad sense, terrorism is the use of violence and threats to intimidate or coerce, especially against civilians, in the pursuit of political aims.

For this analysis, this hazard encompasses the following sub-hazards: enemy attack, biological terrorism, agro-terrorism, chemical terrorism, conventional terrorism, cyber terrorism, radiological terrorism and public disorder. These hazards can occur anywhere and demonstrate unlawful force, violence, and/or threat against persons or property causing intentional harm for purposes of intimidation, coercion or ransom in violation of the criminal laws of the United States. These actions may cause massive destruction and/or extensive casualties. The threat of terrorism, both international and domestic, is ever present, and an attack can occur when least expected.

Enemy attack is an incident that could cause massive destruction and extensive casualties throughout the world. Some areas could experience direct weapons' effects: blast and heat; others could experience indirect weapons' effect. International political and military activities of other nations are closely monitored by the federal government and the State of North Carolina would be notified of any escalating military threats.

Use of conventional weapons and explosives against persons or property in violation of the criminal laws of the United States for purposes of intimidations, coercion, or ransom is conventional terrorism. Hazard effects are instantaneous; additional secondary devices may be used, lengthening the time duration of the hazard until the attack site is determined to be clear. The extent of damage is determined by the type and quantity of explosive. Effects are generally static other than cascading consequences and incremental structural failures. Conventional terrorism can also include tactical assault or sniping from remote locations.

Biological terrorism is the use of biological agents against persons or property. Liquid or solid contaminants can be dispersed using sprayers/aerosol generators or by point of line sources such as munitions, covert deposits and moving sprayers. Biological agents vary in the amount of time they pose a threat. They can be a threat for hours to years depending upon the agent and the conditions in which it exists.

Chemical terrorism involves the use or threat of chemical agents against persons or property. Effects of chemical contaminants are similar to biological agents.

Radiological terrorism is the use of radiological materials against persons or property. Radioactive contaminants can be dispersed using sprayers/aerosol generators, or by point of line sources such as munitions, covert deposits and moving sprayers or by the detonation of a nuclear device underground, at the surface, in the air or at high altitude.

Electronic attack using one computer system against another in order to intimidate people or disrupt other systems is a cyber-attack. All governments, businesses and citizens that conduct business utilizing computers face these threats. Cyber-security and critical infrastructure protection are among the most important national security issues facing our country today. The North Carolina State Bureau of investigation' Computer Crime Unit helps law enforcement across North Carolina solve sophisticated crimes involving digital evidence.

Mass demonstrations, or direct conflict by large groups of citizens, as in marches, protect rallies, riots, and non-peaceful strikes are examples of public disorder. These are assembling of people together in a manner to substantially interfere with public peace to constitute a threat, and with use of unlawful force or

violence against another person, or causing property damage or attempting to interfere with, disrupting, or destroying the government, political subdivision, or group of people. Labor strikes and work stoppages are not considered in this hazard unless they escalate into a threat to the community. Vandalism is usually initiated by a small number of individuals and limited to a small target or institution. Most events are within the capacity of local law enforcement.

The Southern Poverty Law Center (SPLC) reports 32 active hate groups in North Carolina, listed in Table 4.99. The SPLC defines a hate group as any group with "beliefs or practices that attack or malign an entire class of people – particularly when the characteristics being maligned are immutable." It is important to note that inclusion on the SPLC list is not meant to imply that a group advocates or engages in violence or other criminal activity.

Table 4.99 – Hate Groups Active in North Carolina

Group	Type	Location
Nation of Islam	Black Nationalist, Nation of Islam	Greensboro
ACTBAC NC	Neo-confederate	Snow Camp
Israelite Church of God in Jesus Christ	Black Nationalist	Greensboro
American Guard	General Hate	Statewide
Traditionalist Worker Party	Neo-Nazi; Traditionalist Worker Party	Statewide
Vinlanders Social Club	Racist Skinhead; Vinlanders Social Club	Statewide
Vanguard America	Neo-Nazi	Statewide
Israelite School of Universal Practical Knowledge	Black Nationalist	Statewide
Crew 38	Racist Skinhead	Statewide
Soldiers of Odin	Anti-Muslim	Statewide
Blood and Honour Social Club	Racist Skinhead; Blood and Honour	Statewide
The Daily Stormer	Neo-Nazi	Statewide
Confederate Hammerskins	Racist Skinhead	Statewide
Blood and Honour U.S.A.	Racist Skinhead; Blood and Honour	Statewide
East Coast Nights of the True Invisible Empire	Ku Klux Klan	Statewide
Israel United in Christ	Black Nationalist	Concord
Nation of Islam	Black Nationalist; Nation of Islam	Durham
Nation of Islam	Black Nationalist; Nation of Islam	Charlotte
Great Millstone	Black Nationalist	Charlotte
Loyal White Knights of the Ku Klux Klan	Ku Klux Klan	Pelham
Americans for Legal Immigration (ALIPAC)	Anti-Immigrant	Raleigh
Identity Dixie	Neo-Confederate	Statewide
Loyal White Knights of the Ku Klux Klan	Ku Klux Klan	Pelham
ACT for America	Anti-Muslim; Act for America	Fayetteville
Nation of Islam	Black Nationalist; Nation of Islam	Raleigh
Cumberland Conservatives	Anti-Muslim	Statewide
North Carolinians for Immigration Reform and Enforcement	Anti-Immigrant	Wade
Confederate White Knights of the Ku Klux Klan	Ku Klux Klan	Vale
North Carolina Pastors Network	Anti-Muslim	Morgantown
Identity Evropa	White Nationalist; Identity Evropa	Boone
Revolutionary Black Panther Party	Black Nationalist	Wilmington
Nation of Islam	Black Nationalist; Nation of Islam	Wilmington

Source: SPLC, https://www.splcenter.org/hate-map

None of the hate groups identified in the SPLC have a specifically identified footprint in Currituck or Dare counties, though it can be inferred that any group with a statewide footprint may have a presence in the area.

Warning Time: 4 – Less than six hours

Duration: 4 – More than one week

Generally, no warning is given for specific acts of terrorism. Duration is dependent on the vehicle used during the terrorist attack. This score takes into account a prolonged scenario with continuous impacts.

Location

A terror threat could occur at any location in the Region, but are more likely to target highly populated areas, critical infrastructure, or symbolic locations.

Extent

The extent of a terrorist incident is tied to many factors, including the attack vector, location, time of day, and other circumstances; for this reason, it is difficult to put assess a single definition or conclusion of the extent of "terrorism." As a general rule, terrorism incidents are targeted to where they can do the most damage and have the maximum impact possible, though this impact is tempered by the weapon used in the attack itself.

Impact: 4 – Catastrophic

Spatial Extent: 2 – Small

Historical Occurrences

There has never been an act of terrorism in Dare or Currituck counties; however, given the number of visitors to the many national sites and monuments in the region, and the ability to strike at will in most any area, it is prudent for communities in the Outer Banks to recognize potential terrorist threat. The ability to respond to a terrorist incident is provided by county and community emergency operations plans.

Probability of Future Occurrence

While difficult to estimate when a deliberate act like terrorism may occur, it can be inferred that the probability of a terrorism attack in any one area in the Region is very low at any given time. When identified, credible threats may increase the probability of an incident; these threats are generally tracked by law enforcement.

Probability: 1 – Unlikely

Vulnerability Assessment

Methodologies and Assumptions

Terrorism impacts van vary widely by the type of terror attack suffered. Terror attacks can be chemical, biological, radiological, nuclear or explosive.

Vulnerability to terrorism was assessed through hypothetical scenarios. These scenarios were modeled using the Electronic Mass Casualty Assessment and Planning Scenarios (EMCAPS) tool developed by the Johns Hopkins Office of Critical Event Preparedness and Response, Johns Hopkins Applied Physics Laboratory, the U.S. Department of Homeland Security, and the National Center for the Study of Preparedness and Catastrophic Event Response.

People

People can suffer death or illness as a result of a terrorist attack. Symptoms of illness from a biological or chemical attack may go undetected for days or even weeks. Local healthcare workers may observe a pattern of unusual illness or early warning monitoring systems may detect airborne pathogens. People will face increased risk if a biological or chemical agent is released indoors, as this may result in exposure to a higher concentration of pathogens, whereas agents that are released outdoors would disperse in the direction of the wind. Physical harm from a weapons attack or explosive device is not dependent on location, but risk is greater in areas where higher numbers of people may gather. People could also be affected by an attack on food and water supply. In addition to impacts on physical health, any terrorist attack could cause significant stress and anxiety.

The following hypothetical scenarios illustrate the potential impacts of biological, chemical, and explosive attacks on sites in the Outer Banks Region. Three specific sites were chosen to illustrate potential worst-case scenarios. These scenarios were modeled using the Electronic Mass Casualty Assessment and Planning Scenarios (EMCAPS) tool developed by the Johns Hopkins Office of Critical Event Preparedness and Response, Johns Hopkins Applied Physics Laboratory, the U.S. Department of Homeland Security, and the National Center for the Study of Preparedness and Catastrophic Event Response.

Scenario #1 – Biological Attack: Aerosol Anthrax

Scenario Overview: A truck fitted with an improvised spraying device disseminates a liquid slurry containing anthrax spores. The hypothetical target for this attack is the Independence Day Fireworks Display at Historic Corolla Park in Currituck County, which typically draws approximately 7,000 attendees, with additional viewers likely watching from a distance. The size of the affected area and the percentage of people within the area that develop inhalational anthrax are determined based on the following input variables: quantity of release agent is 50 liters, line of release distance is 500 meters (the minimum allowable by the model, assuming the truck drives along Highway 12), population density is 8,000 persons per square mile (assuming the average crowd expands beyond the park boundaries), and dissemination efficiency is 1% (assuming low-tech dissemination). The following assumptions inherent to the model also apply:

- Infectious dose for 50% of people = 10,000 cfu
- Infectious dose for 1% of people = 530 cfu
- This scenario assumes treatment is provided to patients after the infectious agent is identified. For calculation purposes, the untreated case fatality rate = 99%
- Protection factor of buildings = 50%
- Percentage of population outdoors = 15%

Table 4.101 outlines the expected losses based on the above parameters.

Table 4.100 – Estimated Casualties from Aerosol Anthrax

Injury Description	Population affected
Exposures	14,128
Percentage Infected	3.95%
Total inhalation anthrax cases	556

Source: EMCAPS tool

Per the Department of Homeland Security's National Planning Scenarios guidance, "efforts to mitigate the impact of the attack include the provision of Prepositioned Equipment Pods (PEP), environmental testing and decontamination, and care of ill persons. Persons with primary aerosol exposure to anthrax need to

receive antibiotic therapy prior to the onset of symptoms in order to prevent inhalation anthrax - this is an illness with an exceptionally high mortality rate (approximately 40% to 50%) even when met with aggressive medical care. Person-to-person spread does not occur. Actions of incident-site personnel tested after the attack include hazard identification, site control, establishment and operation of ICS, treatment of exposed victims, mitigation efforts, obtainment of personal protective equipment (PPE) and prophylaxis for responders, site remediation and monitoring, notification of airlines and other transportation providers, provision of public information, and effective coordination with national and international public health and governmental agencies" (DHS, 2005).

Scenario #2 – Chemical Attack: Toxic Gas – Chlorine Release

Scenario Overview: A bomb is attached to a tractor trailer tanker carrying compressed chlorine. The entire contents of the tank escape to the atmosphere and the plume spreads to the surrounding area. The hypothetical target for this attack is the annual Dare Day celebration, which brings approximately 5,000 people to downtown Manteo. The plume spreading and the effect on the population are calculated according to the following input variables: outdoor temperature is 85°F, wind speed is 9 mph, the setting is urban (defined by presence of obstructions from buildings and forested areas), and the population density is 3,000 persons per square mile, to account for the increase over normal population density brought by the festival. The following assumptions apply:

- 4,850-gallon tank, all contents released through 3-ft hole
- Partly cloudy, no precipitation
- 50% of people in plume area are indoors
- Effects of chlorine on population determined through evaluation of chlorine gas concentration zones, which were determined using ALOHA plume modeling software (see References)
- First effects on humans at concentration = 10 ppm
- Minimum lethal dose = 430 ppm for 30 min
- Median lethal dose (short-term exposure) = 1,000 ppm

Table 4.101 outlines the expected losses based on the above parameters.

Table 4.101 – Estimated Casualties from Chlorine Attack

Injury Description	Population affected
Fatality	63 persons
Eye pain & swelling, headache, restricted airflow – difficulty breathing, coughing, chest pain, lung inflammation and edema, bloody sputum, vomiting, skin irritation, possible chemical burns	98 persons
Eye pain & swelling, headache, throat irritation, rapid breathing, coughing, chest pain, lung inflammation and edema, bloody sputum, vomiting, skin irritation	221 persons
Eye pain & swelling, headache, throat irritation, rapid breathing, coughing, chest pain, skin irritation	449 persons
Eye irritation, headache, throat irritation, coughing, skin irritation	550 persons
Eye irritation, headache, coughing, skin irritation	522 persons
Total impacted population	1,903 persons
"Worried Well" Cases (assumed to be 9x affected population)	17,127 persons

Injury Description	Population affected
Cost of Decontamination @ $12/person (assumes all persons with skin injuries will require decontamination and approximately 1/10 of the worried well will demand to be decontaminated). Total persons treated = 3,616	$43,392

Source: EMCAPS tool

Scenario #3 – IED: Truck Bomb

Scenario Overview: An Improvised Explosive Device (IED) utilizing an ammonium nitrate/fuel oil (ANFO) mixture is carried in a cargo truck to a populated area and detonated. The hypothetical target for this attack is the annual Seafood Festival at the Soundside Event Site in Nags Head, which brings between 10,000-12,500 people to downtown Manteo. The bomb size is assumed to be 1000 lbs ANFO and the population density is 1 person per 50 square feet, equivalent to a moderately crowded pedestrian area as might be found on the festival grounds. It is assumed that the explosion takes place in a relatively open area (e.g. stadium parking lot, park, etc). The following assumptions apply:

- ANFO - TNT equivalence = 0.82
- Blast pressure damage impact taken from National Fire Protection Association (NFPA) 921 Guide for Fire and Explosion Investigations - 2001 Edition, Table 18.13.3.1[b]
- Buildings and other physical structures are not considered in these calculations

Table 4.102 outlines the expected losses based on the above parameters.

Table 4.102 – Estimated Casualties from IED Attack

Injury Description	Population affected
Fatality	275 persons
Traumatic Injuries	483 persons
Urgent Care Injuries	2,367 persons
Injuries not Requiring Hospitalization	886 persons

Source: EMCAPS tool

Expected symptoms and injuries would include impact injuries (pulmonary blast), pulmonary contusion, barotrauma, fractures (internal, compound, spinal), smoke inhalation, GI blast injury (edema, hemorrhage, rupture), auditory blast injury (partial or total loss of hearing), lacerations, shrapnel, debris penetrations (glass, metal, etc.) and burns. Transportation would be limited or inaccessible near the blast, and services and utilities could be unavailable.

Property

The potential for damage to property is highly dependent on the type of attack. Buildings and infrastructure may be damaged by an explosive device or by contamination from a biological or chemical attack. Impacts are generally highly localized to the target of the attack.

Environment

Environmental impacts are also dependent on the type of attack. Impacts could be negligible or could require major clean-up and remediation.

Consequence Analysis

Table 4.103 summarizes the potential consequences of a terror attack.

Table 4.103 – Consequence Analysis – Terrorism

Category	Consequences
Public	Illness, injury, or fatality are possible; these impacts would be highly localized to the attack. Widespread stress and psychological suffering may occur. Human impacts may be long-term based on attack vector.
Responders	Injuries; fatalities are possible. Responders face increased risks during an effort to stop an attack or rescue others while an attack is underway. Potential impacts to response capabilities may result from an attack.
Continuity of Operations (including Continued Delivery of Services)	Potential impacts to continuity of operations due to attack impacts; delays in providing services; impacts tied to attack vector
Property, Facilities and Infrastructure	Impacted roads; downed power lines and power loss; utility disruption. Several key critical sites could be targeted in an attack, causing cascading impacts to daily life in the region
Environment	Water and food supply could be contaminated by a biological or chemical attack. Remediation could be required.
Economic Condition of the Jurisdiction	The local economy could be disrupted, depending on the location and scale of an attack.
Public Confidence in the Jurisdiction's Governance	Loss of public confidence likely should an attack be carried out; additional loss of confidence and trust may result if response and recovery are not swift and effective

4.5.15 Transportation Infrastructure Failure

Hazard Background

The Outer Banks region depends on several key bridges, roads, and ferry crossings for access and services. There is limited redundancy in the transportation network, which means these key infrastructure are integral to the functioning of the communities in the planning area and would cause severe disruptions should they become inaccessible. Damage to any of this infrastructure could result from the majority of the natural and human-caused hazards described in this plan. In addition to a secondary or cascading impact from another primary hazard, infrastructure can fail as a result of faulty equipment, lack of maintenance, degradation over time, or accidental damage such as a barge colliding with a bridge support.

Building and construction standards along with regular inspection and maintenance can provide a degree of certainty as to the capacity of infrastructure to withstand some damages. However, accidental damage is unpredictable. Moreover, any damages that take a road or bridge out of service will likely require significant repairs that could take weeks or months to complete.

Warning Time: 4 – Less than six hours

Duration: 4 – More than one week

Location

The primary transportation systems in the region are shown in Figure 4.68.

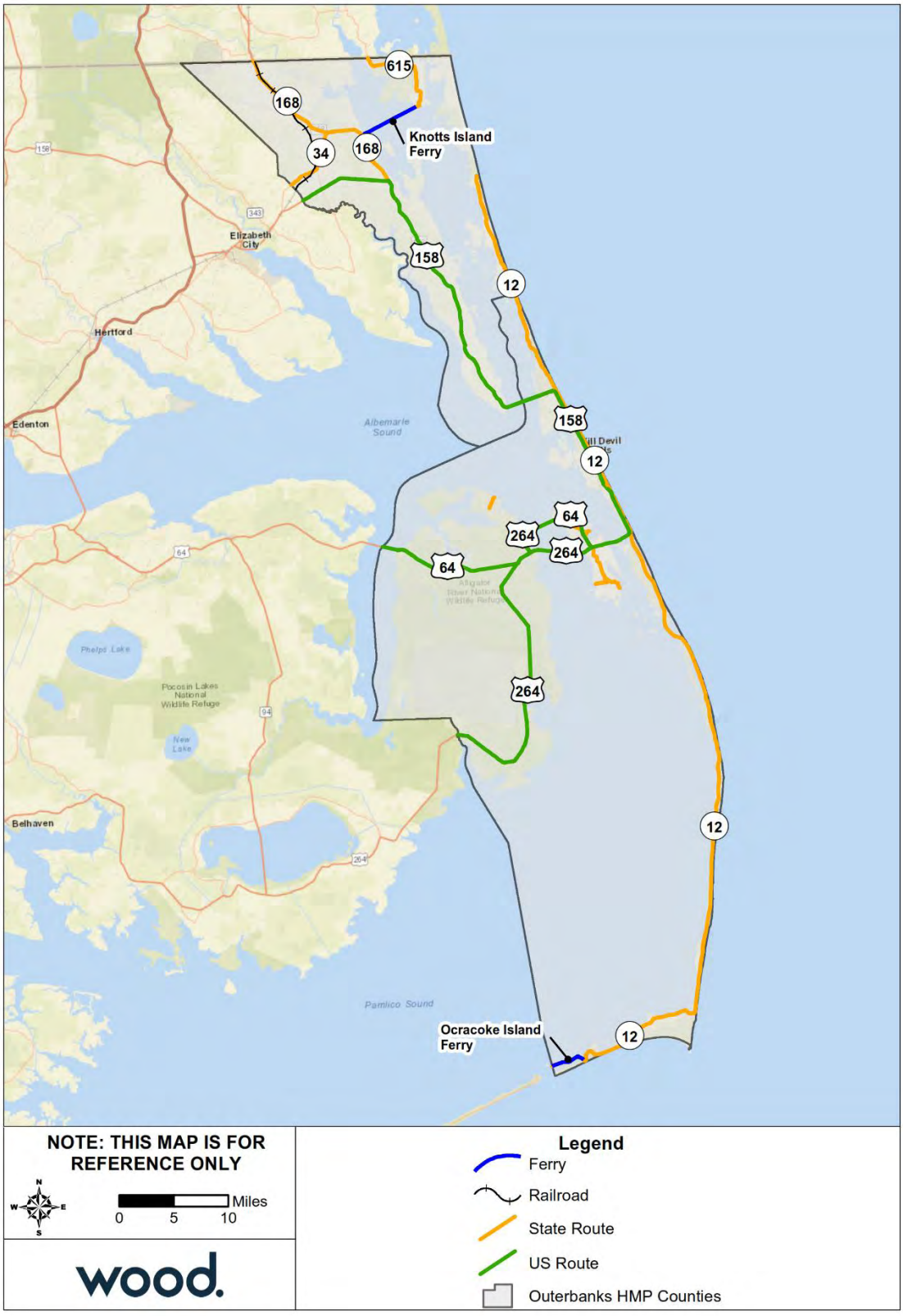
The North Carolina Department of Transportation maintains a list of bridges in North Carolina. Bridges built in 1989 or prior are listed below in Table 4.104.

Table 4.104 – Bridges Built in 1989 or Prior

County	Bridge Number	Route	Crossing	Year Built	Age (years)
Currituck	260006	SR1228	Shingle Landing Creek	1962	57
Currituck	260012	SR1142	C. Off Intercoastal W	1979	40
Currituck	260015	US158	Intracoastal Waterway	1986	33
Currituck	260016	US158 E	Currituck Sound	1966	53
Dare	270004	US158	Jean Guite Creek	1966	53
Dare	270008	NC12	The Slash	1956	63
Dare	270009	US64	Croatan Sound	1955	64
Dare	270011	NC12	Oregon Inlet	1962	57
Dare	270040	SR1208	Jean Guite Creek	1959	60
Dare	270043	NC400	Dough's Creek	1983	36

Source: North Carolina Department of Transportation, updated February 2019

Figure 4.68 – Key Transportation Routes in the Planning Area



Source: NAVTEQ

Extent

The significance of any transportation infrastructure failure will vary depending on the location and nature of the infrastructure itself. The loss of a local road may have only minor impacts limited to the immediate area. However, the loss of a major highway or key bridge could cause significant disruption across the Region. Depending on time of day and the onset of the failure, significant casualties are also possible: the 1967 Silver Bridge collapse between Point Pleasant, West Virginia and Gallipolis, Ohio and the 1980 Sunshine Skyway Bridge collapse outside St. Petersburg, Florida killed 46 and 35 people respectively. If a bridge were closed or failed during a hurricane evacuation, it could put thousands of residents and visitors at risk.

Impact: 3 – Critical

Spatial Extent: 2 – Small

Historical Occurrences

A 2014 analysis of bridge failure rates by Dr. Wesley Cook of Utah State University found that an average of 128 bridges collapse every year in the U.S.; 53% of bridges that collapsed had been rated as structurally deficient prior to their collapse. Only 4% of bridge collapses resulted in loss of life.

In 1990, a portion of the Herbert Bonner Bridge collapsed after being hit by a dredge vessel that was carried by hurricane winds and waves. The incident left approximately 5,000 Hattaras residents as well as tourists and fishermen stranded on the island and without power or phone service, as the bridge also carried electrical and phone lines. The economic losses from the incident were estimated at $20 million.

The HMPC also noted issues with frequent, unpredictable closure of the Alligator River Bridge due to mechanical failures. The bridge is 60 years old and is a key access point between the barrier island, Roanoke Island, and the mainland.

Probability of Future Occurrence

The likelihood of a major transportation infrastructure failure occurring in the Outer Banks Region is difficult to quantify. The continuing age and deterioration of America's transportation infrastructure, coupled with increasing traffic and declining public investment in maintaining our infrastructure, indicate that road and bridge failures are likely to be more common in future decades than they have in the past. The American Society of Civil Engineers (ASCE) has estimated that $2.2 trillion would be needed to bring the nation's infrastructure up to a condition that meets the needs of the current population. (Note that this total includes non-transportation infrastructure.) The potential for accidents and failures from infrastructure operating beyond its intended lifespan or with insufficient maintenance thus continues to increase.

According to the Federal Highway Administration (FHA), North Carolina ranks 27th among the 50 states in having the most roads in poor condition (6.6 percent) and 18th in terms of number of bridges rated as structurally deficient (9.9 percent). According to the U.S. Census Bureau's 2017 Annual Survey of State Government Finances, 8.8 percent of North Carolina's public spending is devoted to highways, ranking 11th among all states, and well above the national average of 5.6 percent.

Probability: 2 – Possible

Vulnerability Assessment

The impacts of transportation failures vary widely by the type of system, as well as the time of day and season of the failure.

Methodologies and Assumptions

Vulnerability to transportation infrastructure failures was assessed based on past occurrences nationally and internationally as well as publicly available information on infrastructure vulnerability.

People

People can be injured or killed during transportation infrastructure failures. As noted above, the U.S. averages five fatality-causing bridge collapses per year, although data on the number of fatalities involved was not available. Numbers of non-fatal injuries was also not available.

Aside from direct injuries and fatalities, transportation failures can result in significant losses of time and money as individuals and commercial shipments are detoured or blocked. Disruption of transportation systems can limit the ability of emergency services and utility work crews to reach affected areas, and can put some members of the public at severe risk if they are unable to reach needed medical services, such as dialysis patients.

In extreme cases, a transportation failure could leave residents stranded without power, food, or other emergency supplies. Residents at a public meeting in Buxton expressed concern that a road or bridge washout following a major storm will leave them stranded for an extended period of time without emergency supplies or an alternative route off the island.

Property

The primary property damage from transportation infrastructure failures is to the infrastructure itself, as well as to privately-owned automobiles.

Environment

Transportation infrastructure failures can result in oil spills or other hazardous materials releases that can severely impact the environment in the surrounding area.

Consequence Analysis

Table 4.105 summarizes the potential consequences of a transportation infrastructure failure.

Table 4.105 – Consequence Analysis - Transportation Infrastructure Failure

Category	Consequences
Public	Potential injuries and fatalities.
Responders	Potential injuries and fatalities, as well as potentially significant delays to response times.
Continuity of Operations (including Continued Delivery of Services)	Loss of key roads or bridges can affect delivery of services.
Property, Facilities and Infrastructure	In addition to the loss of transportation infrastructure itself, sustained road closure can impact supply chain deliveries to other critical facilities.
Environment	Potential for oil spills or other hazardous materials releases.
Economic Condition of the Jurisdiction	Delays in movement of commuters, as well as good and services
Public Confidence in the Jurisdiction's Governance	Can cause loss of confidence in government's ability to maintain other critical infrastructure

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

Table 4.106 – Summary of PRI Results

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Coastal Hazards: Erosion[1]	Likely	Limited	Moderate	More than 24 hrs	More than 1 week	2.6
Coastal Hazards: Rip Current[1]	Highly Likely	Critical	Small	Less than 6 hrs	Less than 24 hrs	3.1
Coastal Hazards: Sea Level Rise[1]	Likely	Critical	Moderate	More than 24 hrs	More than 1 week	2.9
Drought	Possible	Minor	Large	More than 24 hrs	More than 1 week	2.2
Earthquake	Unlikely	Minor	Large	Less than 6 hrs	Less than 6 hrs	1.9
Extreme Heat	Highly Likely	Limited	Large	More than 24 hrs	Less than 1 week	3.0
Flood	Likely	Critical	Moderate	6 to 12 hours	Less than 1 week	3.0
Hurricane & Tropical Storm	Likely	Catastrophic	Large	More than 24 hrs	Less than 1 week	3.3
Severe Weather: Hail[2]	Highly Likely	Minor	Small	Less than 6 hrs	Less than 6 hrs	2.4
Severe Weather: Lightning[2]	Highly Likely	Minor	Negligible	Less than 6 hrs	Less than 6 hrs	2.2
Severe Weather: Thunderstorm Winds[2]	Highly Likely	Limited	Large	Less than 6 hrs	Less than 6 hrs	3.1
Severe Winter Storm	Highly Likely	Minor	Large	More than 24 hrs	Less than 1 week	2.7
Tornado	Likely	Critical	Negligible	Less than 6 hrs	Less than 6 hrs	2.5
Wildfire	Possible	Limited	Moderate	Less than 6 hrs	Less than 1 week	2.5
Hazardous Materials Incident	Likely	Minor	Negligible	Less than 6 hrs	Less than 24 hrs	2.0
Radiological Emergency	Unlikely	Limited	Small	Less than 6 hrs	More than 1 week	2.1
Cyber Attack	Possible	Minor	Small	Less than 6 hrs	More than 1 week	2.1
Terrorism	Unlikely	Catastrophic	Small	Less than 6 hrs	More than 1 week	2.7
Transportation Infrastructure Failure	Possible	Critical	Small	Less than 6 hrs	More than 1 week	2.7

[1]Note: Coastal Hazards average to a score of 2.9 and are therefore considered together as a high-risk hazard.
[2]Note: Severe Weather hazards average to a score of 2.6 and are therefore considered together as a high-risk hazard.

The results from the PRI have been classified into three categories based on the assigned risk value which are summarized in Table 4.107:

- **High Risk** – Widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread.
- **Medium Risk** – Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster.
- **Low Risk** – Minimal potential impact. The occurrence and potential cost of damage to life and property is negligible or nonexistent. This is not a priority hazard for mitigation projects.

Table 4.107 – Summary of Hazard Risk Classification

High Risk (> 2.4)	Hurricane & Tropical Storm Extreme Heat Flood Coastal Hazards Severe Winter Storm Terrorism Transportation Infrastructure Failure Severe Weather Tornado Wildfire
Moderate Risk (2.0 – 2.4)	Drought Radiological Emergency Cyber Attack Hazardous Materials Incident
Low Risk (< 2.0)	Earthquake

Note: Low risk hazards are not prioritized for mitigation.

5 Capability Assessment

This section discusses the capability of the Outer Banks region to implement hazard mitigation activities. It consists of the following four subsections:

5.1 Overview
5.2 Conducting the Capability Assessment
5.3 Capability Assessment Findings
5.4 Conclusions on Local Capability

5.1 OVERVIEW

The purpose of conducting a capability assessment is to determine the ability of a local jurisdiction to implement a comprehensive mitigation strategy, and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs, or projects. As in any planning process, it is important to try to establish which goals, objectives, and actions are feasible, based on an understanding of the organizational capacity of those agencies or departments tasked with their implementation. A capability assessment helps to determine which mitigation actions are practical and likely to be implemented over time given a local government's planning and regulatory framework, level of administrative and technical support, amount of fiscal resources, and current political climate.

A capability assessment has two primary components: 1) an inventory of a local jurisdiction's relevant plans, ordinances, and programs already in place; and 2) an analysis of its capacity to carry them out. Careful examination of local capabilities will detect any existing gaps, shortfalls, or weaknesses with ongoing government activities that could hinder proposed mitigation activities and possibly exacerbate community hazard vulnerability. The capability assessment also highlights the positive mitigation measures already in place or being implemented at the local government level, which should continue to be supported and enhanced through future mitigation efforts.

The capability assessment completed for the Outer Banks region serves as a critical planning step toward developing an effective mitigation strategy. Coupled with the risk assessment, the capability assessment helps identify and target effective goals, objectives, and mitigation actions that are realistically achievable under given local conditions.

5.2 CONDUCTING THE CAPABILITY ASSESSMENT

To facilitate the inventory and analysis of local government capabilities within the planning area, a detailed Local Capability Self-Assessment worksheet was distributed to members of the HMPC after the first planning committee meeting. The survey questionnaire requested information on a variety of "capability indicators" such as existing local plans, policies, programs, or ordinances that contribute to and/or hinder the region's ability to implement hazard mitigation actions. Other indicators included information related to the region's fiscal, administrative, and technical capabilities, such as access to local budgetary and personnel resources for mitigation purposes, and existing education and outreach programs that can be used to promote mitigation. Communities were also asked to comment on the current political climate with respect to hazard mitigation, an important consideration for any local planning or decision-making process.

At a minimum, the survey results provide an extensive and consolidated inventory of existing local plans, ordinances, programs, and resources in place or under development. With this information, inferences can be made about the overall effect on hazard loss reduction in each community. In completing the

survey, local officials were also asked to rate their jurisdiction's specific capabilities. The survey instrument thereby not only helps accurately assess the degree of local capability, but it also serves as a good source of introspection for counties and local jurisdictions that want to improve their capabilities. Identified gaps, weaknesses, or conflicts can be recast as opportunities for specific actions to be proposed as part of the mitigation strategy.

The information provided in response to the survey questionnaire was incorporated into a database for further analysis. A general scoring methodology was then applied to quantify each jurisdiction's overall capability. According to the scoring system, each capability indicator was assigned a point value based on its relevance to hazard mitigation. Additional points were added based on the jurisdiction's self-assessment of their own planning and regulatory capability, administrative and technical capability, fiscal capability, education and outreach capability, and political capability.

Using this scoring methodology, a total score and an overall capability rating of "High," "Moderate," or "Limited" could be determined according to the total number of points received. These classifications are designed to provide nothing more than a general assessment of local government capability. In combination with the narrative responses provided by local officials, the results of this capability assessment provide critical information for developing an effective and meaningful mitigation strategy.

5.3 CAPABILITY ASSESSMENT FINDINGS

The findings of the capability assessment are summarized in this plan to provide insight into the relevant capacity of the Outer Banks 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 Outer Banks region, along with their potential effect on loss reduction. This information will help identify opportunities to address gaps, weaknesses, or conflicts with other initiatives and integrate the implementation of this plan with existing planning mechanisms where appropriate.

Table 5.1 provides a summary of the relevant local plans, ordinances, and programs already in place or under development for the Outer Banks region. A checkmark (√) indicates that the given item is currently in place and being implemented. An asterisk (*) indicates that the given item is currently being developed for future implementation. 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
Currituck County	√	√			√	√	√			√	*	*			√	√	√	√	√	√		√	√		√	√
Dare County	√	√				√	*			√	*	√	√		√	√	√	√	√			√	√	*	√	√
Town of Duck	√	√				√				+		√			√	√	√	√	√			√	√	*	√	√
Town of Kill Devil Hills	√	√			√	+				+	+	√		√	+	√	√	√	√			√	√		√	√
Town of Kitty Hawk	√	√				√					√	√			+	√	√	√	√			√	√		√	√
Town of Manteo	√	√	√		√	√				+				√	+	√	√	√	√	√		√	√		√	√
Town of Nags Head	√	√			*	√	+		√	+		√		√	√	√	√	√	√	*	√	√	√		√	√
Town of Southern Shores	√	√				√				+		√			+	√	√	√	√		√	√	√		√	√

A more detailed discussion on the region's planning and regulatory capability follows, along with the incorporation of additional information based on the narrative comments provided by local officials in response to the survey questionnaire.

5.3.1.1 Emergency Management

Hazard mitigation is widely recognized as one of the four primary phases of emergency management, as is shown in Figure 5.1. In reality, mitigation is interconnected with all other phases and is an essential component of effective preparedness, response, and recovery. Opportunities to reduce potential losses through mitigation practices are most often implemented before a disaster event, such as through the elevation of flood-prone structures or by regular enforcement of policies that regulate development. However, mitigation opportunities can also be identified during immediate preparedness or response activities, such as installing storm shutters in advance of a hurricane. Furthermore, incorporating mitigation during the long-term recovery and redevelopment process following a disaster event is what enables a community to become more resilient.

Figure 5.1 – The Four Phases of Emergency Management



Planning for each phase is a critical part of a comprehensive emergency management program and a key to the successful implementation of hazard mitigation actions. As such, the Local Capability Self-Assessment asked several questions across a range of emergency management plans to assess the region's willingness to plan and their level of technical planning proficiency.

Hazard Mitigation Plan

A hazard mitigation plan is a community's blueprint for how it intends to reduce the impact of natural, and in some cases human-caused, hazards on people and the built environment. The essential elements of a hazard mitigation plan include a risk assessment, capability assessment, and mitigation strategy.

- All participating jurisdictions in this regional planning effort have previously been covered by the Albemarle Regional 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.

- 4 of the 8 participating jurisdictions have a disaster recovery plan either in place or under development. (1 jurisdiction has one in place; 2 have one under development; 1 covered under a county plan)

Emergency Operations Plan

An emergency operations plan outlines responsibilities and how resources will be deployed during and following an emergency or disaster.

- All participating jurisdictions have an emergency operations plan either in place or are covered under a county plan.

Continuity of Operations Plan

A continuity of operations plan establishes a chain of command, line of succession, and plans for backup or alternate emergency facilities in case of an extreme emergency or disaster event.

- One participating jurisdiction has 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 region.

Comprehensive/General Plan

A comprehensive land use plan, or general plan, establishes the overall vision for what a community wants to be and serves as a guide for future governmental decision making. Typically, a comprehensive plan contains sections on demographic conditions, land use, transportation elements, and community facilities. Given the broad nature of the plan and its regulatory standing in many communities, the integration of hazard mitigation measures into the comprehensive plan can enhance the likelihood of achieving risk reduction goals, objectives, and actions.

- All participating jurisdictions have a comprehensive land use plan in place.

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.

- 3 of the 8 participating jurisdictions have a 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.

Subdivision Ordinance

A subdivision ordinance is intended to regulate the development of residential, commercial, industrial, or other uses, including associated public infrastructure, as land is subdivided into buildable lots for sale or future development. Subdivision design that accounts for natural hazards can dramatically reduce the exposure of future development.

- All participating jurisdictions have a subdivision ordinance in place.

Building Codes, Permitting, and Inspections

Building codes regulate construction standards. In many communities, permits and inspections are required for new construction. Decisions regarding the adoption of building codes (that account for hazard risk), the type of permitting process required both before and after a disaster, and the enforcement of inspection protocols all affect the level of hazard risk faced by a community.

- All participating jurisdictions have building codes in place.

The adoption and enforcement of building codes by local jurisdictions is routinely assessed through the Building Code Effectiveness Grading Schedule (BCEGS) program, developed by the Insurance Services Office, Inc. (ISO). In North Carolina, the North Carolina Department of Insurance assesses the building codes in effect in a particular community and how the community enforces its building codes, with special emphasis on mitigation of losses from natural hazards. The results of BCEGS assessments are routinely provided to ISO's member private insurance companies, which in turn may offer ratings credits for new buildings constructed in communities with strong BCEGS classifications. The expectation is that communities with well-enforced, up-to-date codes should experience fewer disaster-related losses, and as a result should have lower insurance rates.

In conducting the assessment, ISO collects information related to personnel qualification and continuing education, as well as number of inspections performed per day. This type of information combined with local building codes is used to determine a grade for that jurisdiction. The grades range from 1 to 10, with a BCEGS grade of 1 representing exemplary commitment to building code enforcement, and a grade of 10 indicating less than minimum recognized protection.

5.3.1.3 Floodplain Management

Flooding represents the greatest natural hazard facing the nation, yet the tools available to reduce the impacts associated with flooding are among the most developed when compared to other hazard-specific mitigation techniques. In addition to approaches that cut across hazards such as education, outreach, and the training of local officials, the National Flood Insurance Program (NFIP) contains specific regulatory measures that enable government officials to determine where and how growth occurs relative to flood hazards. Participation in the NFIP is voluntary for local governments; however, program participation is strongly encouraged by FEMA as a first step for implementing and sustaining an effective hazard mitigation program. It is therefore used as part of this capability assessment as a key indicator for measuring local capability.

In order for a county or municipality to participate in the NFIP, they must adopt a local flood damage prevention ordinance that requires jurisdictions to follow established minimum building standards in the floodplain. These standards require that all new buildings and substantial improvements to existing buildings be protected from damage by a 100-year flood event, and that new development in the floodplain not exacerbate existing flood problems or increase damage to other properties.

A key service provided by the NFIP is the mapping of identified flood hazard areas. Once completed, the Flood Insurance Rate Maps (FIRMs) are used to assess flood hazard risk, regulate construction practices, and set flood insurance rates. FIRMs are an important source of information to educate residents, government officials, and the private sector about the likelihood of flooding in their community.

Table 5.2 provides NFIP policy and claim information for each participating jurisdiction in the Outer Banks region.

All jurisdictions in the region participate in the NFIP and will continue to comply with all required provisions of the program. Floodplain management is managed through zoning ordinances, building code restrictions, and the county 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.

- All communities in the Outer Banks Region participate in the Community Rating System. Each community's CRS Class is shown in the table below.

Table 5.2 – NFIP Policy and Claim Information

Jurisdiction	Date Joined NFIP	CRS Class	Current Effective Map Date	NFIP Policies in Force	Insurance in Force	Written Premium in Force	Closed Losses	Total Payments
Currituck County	01/31/75	8	12/16/05	5,087	$1,438,126,100	$4,745,019	1,247	$18,513,294
Dare County	04/08/71	7	09/20/06	8,924	$2,205,995,900	$6,025,937	7,043	$124,725,001
Town of Duck	04/08/71	7	09/20/06	910	$286,265,900	$854,646	45	$619,399
Town of Kill Devil Hills	05/04/73	6	09/20/06	4,300	$1,008,255,500	$2,787,649	1,273	$17,735,077
Town of Kitty Hawk	10/01/83	6	09/20/06	1,549	$404,040,300	$1,480,702	1,440	$18,212,825
Town of Manteo	01/05/73	7	09/20/06	845	$198,504,200	$537,295	171	$3,592,714
Town of Nags Head	11/10/72	6	09/20/06	3,515	$967,531,200	$3,226,837	2,106	$32,976,459
Town of Southern Shores	05/13/72	6	09/20/06	1,177	$349,409,400	$1,042,781	180	$1,645,559
TOTAL PLAN	-	-	-	**26,307**	**$6,858,128,500**	**$20,700,866**	**13,505**	**$218,020,328**

Source: FEMA NFIP Policy Statistics

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.

- Only one participating jurisdiction has 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.

- None of the 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.

- Half the 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 GIS to analyze and assess community hazard vulnerability. The Local Capability Self-Assessment was used to capture information on administrative and technical capability through the identification of available staff and personnel resources.

Table 5.3 provides a summary of the Local Capability Self-Assessment results for the region with regard to relevant staff and personnel resources. A checkmark indicates the presence of a staff member(s) in that jurisdiction with the specified knowledge or skill.

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
Currituck County	√	√	√	√	√	√			√	√		√	√	√
Dare County	√		√	√	√	√			√	√	√		√	√
Town of Duck	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Town of Kill Devil Hills	√	√	√	√		√			√	√	√		√	√
Town of Kitty Hawk	√	√	√	√		√							√	√
Town of Manteo	√	√	√	√	√	√			√		√		√	√
Town of Nags Head	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Town of Southern Shores	√	√	√	√	√	√					√		√	√

Source: Local Capability Assessment Survey

5.3.3 Fiscal Capability

The ability of a local government to implement mitigation actions is often dependent on the amount of money available. This may take the form of outside grant funding awards or locally based revenue and financing. The costs associated with mitigation policy and project implementation vary widely. In some cases, policies are tied primarily to staff time or administrative costs associated with the creation and monitoring of a given program. In other cases, direct expenses are linked to an actual project such as the acquisition of flood-prone houses, which can require a substantial commitment from local, state, and federal funding sources.

The Local Capability Self-Assessment was used to capture information on the region's fiscal capability through the identification of locally available financial resources.

Table 5.4 provides a summary of the results for the region with regard to relevant fiscal resources. A checkmark indicates that the given fiscal resource is locally available for hazard mitigation purposes (including match funds for state and federal mitigation grant funds).

Table 5.4 – Relevant Fiscal Resources

Jurisdiction	Capital Improvement Programming	Community Development Block Grants (CDBG)	Special Purpose Taxes	Gas/Electric Utility Fees	Water/Sewer Fees	Stormwater Utility Fees	Development Impact Fees	General Obligation Bonds	Revenue Bonds	Special Tax Bonds	Other
Currituck County	√		√		√		√		√		
Dare County	√	√	√		√	√		√	√	√	
Town of Duck	√	√	√	√	√		√	√	√	√	
Town of Kill Devil Hills	√				√		√				
Town of Kitty Hawk	√		√								
Town of Manteo	√				√		√				
Town of Nags Head	√		√		√	√	√	√	√	√	√
Town of Southern Shores	√							√	√		

Source: Local Capability Assessment Survey

5.3.4 Education and Outreach Capability

This type of local capability refers to education and outreach programs and methods already in place that could be used to implement mitigation activities and communicate hazard-related information. Examples include natural disaster or safety related school programs; participation in community programs such as Firewise or StormReady; and activities conducted as part of hazard awareness campaigns such as a Tornado Awareness Month.

Table 5.5 provides a summary of the results for the region with regard to relevant education and outreach resources. A checkmark indicates that the given resource is locally available for hazard mitigation purposes.

Table 5.5 – Education and Outreach Resources

Jurisdiction	Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Natural disaster or safety related school programs	StormReady certification	Firewise Communities certification	Public-private partnership initiatives addressing disaster-related issues	Other
Currituck County	√	√		√	√		
Dare County	√	√	√	√		√	
Town of Duck	√	√					
Town of Kill Devil Hills	√	√	√				
Town of Kitty Hawk		√		√			
Town of Manteo	√	√	√	√			
Town of Nags Head	√	√	√			√	√
Town of Southern Shores	√	√				√	

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?
Currituck County	√		√	
Dare County	√		√	
Town of Duck	√	√		
Town of Kill Devil Hills			√	
Town of Kitty Hawk				
Town of Manteo	√	√	√	
Town of Nags Head	√		√	√
Town of Southern Shores				

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 region. Survey respondents were asked to rate political support as they perceive it and identify general examples of local political capability, such as guiding development away from identified hazard areas, restricting public investments or capital improvements within hazard areas, or enforcing local development standards that go beyond minimum state or federal requirements (e.g., building codes, floodplain management, etc.). The comments provided by the participating jurisdictions are listed below:

HMPC representatives from all participating jurisdictions responded that political leaders are at least potentially willing to implement mitigation measures. Additionally, nearly all participating jurisdictions have some local standards that exceed state requirements. For example, Currituck County, Dare County,

Kill Devil Hills, Kitty Hawk, Manteo, and Nags Head have a one-foot freeboard requirement; Duck and Southern Shores require a two-foot freeboard.

5.3.7 Local Self-Assessment Rating

In addition to the inventory and analysis of specific local capabilities, the Local Capability Self-Assessment asked counties and local jurisdictions within the Outer Banks region to assign a rating of their perceived capability across each of the capability categories and overall as either "limited," "moderate," or "high."

Table 5.7 summarizes the results of the self-assessment ratings for each community in the Outer Banks Region.

Table 5.7 – Self-Assessment of Capability

Jurisdiction	Plans, Ordinances, Codes and Programs	Administrative and Technical Capability	Fiscal Capability	Education and Outreach Capability	Mitigation Capability	Political Capability	OVERALL CAPABILITY
Currituck County	High	High	High	Moderate	Moderate	Moderate	High
Dare County	High	High	High	High	High	High	High
Town of Duck	High	Moderate	Moderate	High	Limited	Moderate	Moderate
Town of Kill Devil Hills	High	High	Moderate	High	Limited	Moderate	Moderate
Town of Kitty Hawk	Moderate	Limited	Moderate	Limited	Moderate	Moderate	Moderate
Town of Manteo	Moderate	Moderate	Moderate	Limited	Limited	Moderate	Moderate
Town of Nags Head	High	High	High	High	High	High	High
Town of Southern Shores	High	High	High	High	High	High	High

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 Outer Banks region to implement hazard mitigation actions.

Table 5.8 shows the results of the capability assessment using the designed scoring methodology. The capability score is based solely on the information provided by local officials in response to the Local Capability Self-Assessment. According to the assessment, the average local capability score for all responding jurisdictions is 147, which falls into the High capability ranking; however, this is somewhat skewed by a few very high-performing jurisdictions. The median score is 92.

Table 5.8 – Capability Assessment Results

Jurisdiction	Overall Capability Score	Overall Capability Rating
Currituck County	90	Moderate
Dare County	94	Moderate
Town of Duck	84	Moderate
Town of Kill Devil Hills	80	Moderate
Town of Kitty Hawk	192	High
Town of Manteo	81	Moderate
Town of Nags Head	318	High
Town of Southern Shores	237	High

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 Outer Banks Regional Hazard Mitigation Plan. It describes how the Region met the requirements for Planning Step 6 (Set Goals), Planning Step 7 (Review Possible Activities), and Planning Step 8 (Draft an Action Plan). This section includes the following sub-sections:

- 6.1 Goals and Objectives
- 6.2 Identification & Analysis of Mitigation Activities

6.1 GOALS AND OBJECTIVES

Requirement §201.6(c)(3)(i): [The mitigation strategy section shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Goal setting builds upon the findings of Section 4, which documents the hazards and associated risks that threaten the Outer Banks planning area, and Section 5, which evaluates the capacity of the Region to reduce the impact of those hazards. The intent of Goal Setting is to identify areas where improvements to existing capabilities can be made so that community vulnerability is reduced. Goals are also necessary to guide the review of possible mitigation measures. This plan needs to make sure that recommended actions are consistent with what is appropriate for the Region. 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 counties' 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 meetings, held on June 4, 2019 and June 5, 2019, the HMPC reviewed and discussed the goals from the 2015 plan. The goals of the 2015 Albemarle Regional Hazard Mitigation Plan, which included Dare and Currituck counties, were as follows:

#1	Reduce the risk of loss of life and personal injury from natural hazards.
#2	Reduce the risk and impact of future natural disasters by regulating development in known high hazard areas.
#3	Maintain critical facilities in functional order.
#4	Protect infrastructure from damage.
#5	Ensure that hazard mitigation is considered when redevelopment occurs after a natural disaster.
#6	Provide education to citizens that empowers them to protect themselves and their families from natural hazards.
#7	Fulfill Federal and State requirements for receipt of future disaster recovery and hazard mitigation assistance.
#8	Improve interjurisdictional cooperation and coordination, especially regarding the reduction of natural hazard impacts.

The HMPC largely approved of the existing goals, but proposed changes to consolidate them into fewer, stronger goals. Goals 1 and 8 were largely maintained, and the sentiment of goals 3 and 4 was combined into one new goal. Goal 5 was maintained and expanded upon, while goals 6 and 7 were essentially removed.

During the second planning meeting, the HMPC also discussed objectives within each goal in order to better facilitate the development of clearly defined mitigation actions.

The revised goals and the new objectives of this plan update are detailed below in Section 6.1.3.

6.1.3 Resulting Goals and Objectives

The HMPC agreed upon seven general goals for this planning effort and included specific objectives in support of each goal. The refined goals and objectives are as follows:

Goal 1 – Reduce the risk of loss of life and personal injury from hazards.

Objective 1.1: Educate citizens to encourage individual responsibility to protect themselves and their families from hazards.

Objective 1.2: Reduce the risk and impact of future hazards by mitigating risk of development in both known hazard areas and areas expected to face future hazard risk.

Goal 2 – Maintain critical facilities and infrastructure and protect them from damage.

Objective 2.1: Retrofit or otherwise protect critical facilities and infrastructure.

Objective 2.2: Increase redundancy of critical systems and services

Goal 3 – Ensure that hazard mitigation practices, construction techniques, policies, and ordinances are integrated for both new development and post-disaster redevelopment to enhance resiliency and enable speedy recovery.

Objective 3.1: Adopt protective development standards and establish post-disaster redevelopment policies.

Objective 3.2: Preserve and protect natural and beneficial floodplain functions and key natural resources.

Objective 3.3: Explore, develop, and implement new pre-disaster opportunities that build community resilience.

Goal 4 – Improve interjurisdictional cooperation and coordination, especially regarding the reduction of hazard impacts.

Objective 4.1: Coordinate development standards across jurisdictions.

Objective 4.2: Encourage and enable inter-jurisdictional communication.

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:

- Coastal Hazards
- Drought
- Extreme Heat
- Flood
- Hurricane & Tropical Storm
- Severe Weather (Thunderstorm Wind, Lightning, & Hail)
- Severe Winter Storm
- Tornado
- Wildfire
- Cyber Attack
- Hazardous Materials Incident
- Radiological Emergency
- Terrorism
- Transportation Infrastructure Failure

Note: While this list contains technological/human-caused hazards, only natural hazards on this list were necessarily prioritized for mitigation. Mitigation action development for technological/human-caused hazards was left to the discretion of each jurisdiction.

Once it was determined which hazards warranted the development of specific mitigation actions, the HMPC analyzed viable mitigation options that supported the identified goals and objectives. The HMPC was provided with the following list of mitigation categories which are utilized as part of the CRS planning process but are also applicable to multi-hazard mitigation.

- Prevention
- Property Protection
- Natural Resource Protection
- Emergency Services
- Structural Projects
- Public Information and Outreach

The HMPC was also provided with examples of potential mitigation actions for each of the above categories. The HMPC was instructed to consider both future and existing buildings in evaluating possible mitigation actions. Facilitated discussions took place to examine and analyze the options. The HMPC also considered which actions from the previous plan that were not already completed should be continued in this action plan.

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 consider a set of prioritization criteria, which were grouped into three categories: Suitability, Risk Reduction, and Cost. The criteria for the prioritization process included the following:

- **Suitability**
  - Appropriateness of Action
  - Community Acceptance
  - Technical and Administrative Feasibility
  - Environmental Impact
  - Legal Conformance
  - Consistency with Existing Plans and Other Community Goals
- **Risk Reduction**
  - Scope of Benefits
  - Potential to Save Lives
  - Importance of Benefits
  - Level of Inconvenience or Unintended Consequence
  - Losses Avoided
  - Number of People to Benefit
- **Cost**
  - Estimate of Upfront Cost
  - Estimate of Ongoing Cost
  - Benefit to Cost Ratio
  - Financing Availability
  - Affordability
  - Elimination of Repetitive Damages

In accordance with the DMA requirements, an emphasis was placed on the importance of a benefit-cost analysis in determining action priority, as reflected in the prioritization criteria above. For each action, the HMPC considered the benefit-cost analysis in terms of:

- Ability of the action to address the problem
- Contribution of the action to save life or property
- Available technical and administrative resources for implementation
- Availability of funding and perceived cost-effectiveness

The consideration of these criteria helped to prioritize and refine mitigation actions but did not constitute a full benefit-cost analysis. The cost-effectiveness of any mitigation alternative will be considered in greater detail through performing benefit-cost project analyses when seeking FEMA mitigation grant funding for eligible actions associated with this plan.

Using these prioritization criteria, the HMPC assigned each action a ranking of High, Medium, 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:

- Currituck County (Unincorporated Area)
- Dare County (Unincorporated Area)
- Town of Duck
- Town of Kill Devil Hills
- Town of Kitty Hawk
- Town of Manteo
- Town of Nags Head
- Town of Southern Shores

Table 7.1 – Mitigation Action Plan, Currituck County

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
CUR1	Establish appropriate buffers/setbacks between critical facilities and other uses that may be incompatible	All Hazards	2.1	High	Planning	General Fund	On going	Carried Forward	Planning staff will coordinate with Emergency Management to evaluate current and planned critical facilities and determine where setbacks/buffers need to be maintained or increased. Need to re-evaluate this action in plan update.
CUR2	Maintain partnerships with adjacent counties and municipalities to leverage and share resources.	All Hazards	2.2	Moderate	Emergency Management	General Fund	On going	Carried Forward	Continuous - county-to-county mutual aid agreement
CUR3	Encourage clustering of residential lots outside of hazard areas in subdivision design/review and discourage development intensity and infrastructure improvements in known hazard areas	All Hazards	3.1	Moderate	Planning	General Fund	On going	Carried Forward	This is somewhat addressed by ordinance language but will be reinforced by policies in the new Land Use Plan.
CUR4	Direct development away from high-risk and vulnerable areas and establish redevelopment standards that decrease hazard risk	All Hazards	3.1	High	Planning	General Fund	On going	Carried Forward	We allow higher density development as an incentive for developers to place special flood hazard area portions of large tracts in perpetual conservation. Need to change to "Encourage" instead of "Direct." Conservation subdivision option in UDO. The new Coastal Resilience tool should also assist with this action.
Natural Resource Protection									
CUR5	Preserve natural environmental features to naturally absorb water run-off and serve as wind buffers	Coastal Hazards, Flood, Hurricane & Tropical Storm, Severe Weather	3.2	Moderate	Planning	General Fund	On going	Carried Forward	Our Unified Development Ordinance contains provisions for preserving existing vegetation for buffers as well as preservation of wetland areas. Our stormwater manual contains water quality standards as well.
CUR6	Retain vegetation and require buffers in areas adjacent to wetlands, water bodies and Maritime forests	Coastal Hazards, Flood, Hurricane & Tropical Storm, Severe Weather	3.2	Moderate	Planning	General Fund	On going	Carried Forward	This is ongoing through a combination of wetland buffers, implementation of CAMA regulations, and heritage tree protection standards.
CUR7	Evaluate allocating a portion of occupancy tax toward the dune protection program and shoreline restoration.	Coastal Hazards, Flood, Hurricane & Tropical Storm, Severe Weather	3.2	High	Planning	Occ Tax	On going	Carried Forward	We are currently offering $15,000 annually to the dune planting grant program.
CUR8	Work in conjunction with the Division of Coastal Management and the GIS Coordinator to track the extent of local beach erosion and annually produce a "State of the Beach" report	Coastal Hazards	3.3	Moderate	Planning	General Funds	On going	Carried Forward	There has been no progress towards completing this action.
CUR9	Create maps reflecting the historical migration of the marsh to track erosion	Coastal Hazards	3.3	Moderate	Planning, GIS	General Funds	On going	Carried Forward	There has been no progress towards completing this action.
Structural Projects									
CUR10	Seek funding for public hazard mitigation projects.	All Hazards	1.2	Moderate	Emergency Management	Grant	On going	Carried Forward	County will continue to seek mitigation funding. Submitted 7 properties for elevation under Flood Mitigation Assistance grant program (2018); application currently under review with FEMA. Submitted 8 properties for HMGP - elevation following Hurricane Matthew but projects were not considered cost beneficial. Grant writing and monitoring added to Soil & Water admin position. Also monitoring EPA flood reduction grants.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
CUR11	Continue to support efforts for planning, design, and construction of the Mid-County bridge project.	All Hazards	3.3	Moderate	Planning	NC Turnpike Authority	5 years	Carried Forward	Planning staff is working on terminus designs and studying impacts to properties on both sides of the bridge. Funding allocated in STIP for FY18; awaiting Record of Decision which should be issued spring/summer 2018.
CUR12	Identify bridges for retrofitting.	All Hazards	1.2	High	Planning	NCDOT	On going	Carried Forward	On going. Continuing to work with DOT to maintain roadways and the Wright Memorial Bridge.
CUR13	Secure funding, design, and construct an EOC/Public Safety Facility	All Hazards	3.3	High	Engineering/Emergency Management	General Fund/Grant	2 years	Carried Forward	Resolution for design-build project approved by BOC on March 5, 2018. Groundbreaking anticipated in late summer 2019.
Emergency Services									
CUR14	Maintain and work to improve radio communications and technology throughout public safety programs	All Hazards	4.2	High	Public Safety Agencies	General Funds and Grants	On going	Carried Forward	Continuous - Currently working on project to amplify the paging radio signal and broadcast it through a speaker system Inside fire departments. County is also pursuing county-wide broadband internet service.
CUR15	Provide continuous training and information for first responders in hazard response	All Hazards	4.1	High	Public Safety Agencies	General Funds and Grants	On going	Carried Forward	Ongoing
CUR16	Coordinate response to bridge incidents for the Wright Memorial Bridge	Transportation Infrastructure Failure	4.1	High	Public Safety Agencies	General Funds/Grants	On going	Carried Forward	Response agencies coordinate on a regular basis. OBX LEPC held exercise in Jan. 2019 in which agencies responded to multi-vehicle accident with hazardous materials on the Wright Memorial Bridge. The LEPC will use lessons learned to improve response.
Public Education & Awareness									
CUR17	Educate the public and inform them of the benefits of participation in the Fire Wise program.	Wildfire	1.1	High	Emergency Management	Grant	On going	Carried Forward	NCFS continues to promote FireWise. FireWise success story: Point Harbor Beach community only had one access into the subdivision. The subdivision borders county-owned property, Sound Park. The County worked with the Point Harbor Beach community to install a gate in the existing fence line to provide secondary egress from the community in the event of an emergency.
CUR18	Educate homeowners and builders on the benefits of sprinkler systems in residential structures	Wildfire	1.1	Moderate	Fire Marshal/Planning	General Fund	On going	Carried Forward	Ongoing through the fire marshal and planning department. The County requested special legislation to address life safety issues in residential structures greater than 5,000 sq. feet, to include a requirement for residential sprinkler system. The request was denied.
CUR19	Increase public awareness and understanding of the locations and proper way to dispose of hazardous waste	Hazardous Materials Incident	1.1	Moderate	Public Works	General Fund	On going	Carried Forward	PW continues to sponsor an annual household hazardous waste day
CUR20	Periodically survey the public to evaluate if public outreach efforts are effective in identifying potential flood hazards, public concern, and ways to mitigate against hazards	Coastal Hazards, Flood, Hurricane & Tropical Storm	1.1	Moderate	Planning	General Fund	On going	Carried Forward	The floodplain manager and the assistant planning director will work together to create a survey.
CUR21	Develop a joint public outreach document that addresses all hazards (published by the Planning and Emergency Management Departments)	All Hazards	1.1	High	Planning/Emergency Management	General Fund	On going	Carried Forward	The planning department and the emergency management department publish documents in the "Focus on Currituck" publication. New release of CRS Manual for 2018 requires greater public outreach efforts; revising public outreach campaign by August of 2018.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
CUR22	Evaluate effectiveness of Currituck's warning systems	All Hazards	1.1	High	Emergency Management	General Fund	On going	Carried Forward	Number of individuals registering for Currituck Alert provides a baseline for effectiveness of mass notification. Planning a campaign to increase awareness of ENS and increase number of subscribers.
CUR23	Educate and assist vulnerable populations in developing personal preparedness plans	All Hazards	1.1	High	Emergency Management	General Fund	On going	Carried Forward	Continuous
CUR24	Partner with other County Departments, State, local agencies to educate and inform vulnerable populations about special needs registry with Social Services through community outreach (survey, website, social media, water bill)	All Hazards	1.1	High	DSS, EM, PIO	General Fund	On going	Carried Forward	Continuous
CUR25	Create curriculums for all hazards preparedness to better educate the public	All Hazards	1.1	High	Emergency Management	General Fund/Grants	less than 5 years	Carried Forward	No progress
CUR26	Continue to educate elected officials and the public on the need for and benefits of sustained shoreline management strategies.	Coastal Hazards, Flood, Hurricane & Tropical Storm, Severe Weather	1.1	High	Planning	General Fund	On going	Carried Forward	Need status
CUR27	Educate property owners on the natural and beneficial functions of floodplains, watersheds, and other natural/coastal areas.	Coastal Hazards, Flood, Hurricane & Tropical Storm	3.2	Moderate	Planning	General Fund	On going	Carried Forward	We hope to include this information in our updated outreach project
CUR28	Educate the development and agricultural communities as well as the public on the impacts of turbidity on floodplain/natural areas and mitigating best management practices	Coastal Hazards, Flood, Hurricane & Tropical Storm	3.2	Moderate	Planning	General Fund	On going	Carried Forward	We will try to include this in the updated outreach project.
CUR29	Develop outreach materials and offer training on Low Impact Development (LID) best management practices that can be distributed to the public and engineering communities.	Coastal Hazards, Flood, Hurricane & Tropical Storm	3.2	High	Planning	General Fund	less than 5 years	Carried Forward	The stormwater manual addresses this. Training has not been offered yet.

Table 7.2 – Mitigation Action Plan, Dare County

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
DAR1	Identify Funding to improve stormwater drainage and land management preparation for flooding	Hurricane & Tropical Storm, Flood, Coastal Hazards	3.3	7-High	Dare County Planning	General Fund, Grant Funds	1-3 years	Carry Forward	Group saw need to expand participants to include adding Soil and Water staff to help identify funding sources.
DAR2	Expand the number of lifeguarded beaches in unincorporated Dare to bring lifeguards to all villages in addition to ocean rescue response personnel.	Coastal Hazards	3.3	3-Medium	National Park Service Dare County	General Fund, Grant Funds	2-3 years	New	N/A
DAR3	Update Dare County's 2001 comprehensive stormwater management plan.	Hurricane & Tropical Storm, Flood, Coastal Hazards, Severe Weather, Transportation Infrastructure Failure	3.1	6-High	Dare County Planning	General Fund, Grant Funds	1-3 years	New	N/A
DAR4	Grow Local Emergency Planning Committee membership by expanding industry participation while fully implementing Community Right to Know reporting requirements to enhance knowledge of hazardous material risk across the region	Radiological Emergency, Hazardous Materials Incident	3.3	5-High	Dare County Emergency Management	General Fund, Grant Funds	1-2 years	New	N/A
DAR5	Expand involvement with the North Carolina Information Sharing and Analysis Center to ensure actionable intelligence on immediate and emerging threats to the region are identified and shared with first responders, private sector, emergency management, local law enforcement and other partner agencies in a timely manner.	Terrorism, Radiological Emergency	4.2	3-Medium	Dare County Emergency Management, Dare Sheriff's office	General funds	1-3 years	New	N/A
Property Protection									
DAR6	Utilize existing post storm information and GIS mapping to identify the most vulnerable structures in the County.	Hurricane & Tropical Storm, Severe Weather, Coastal Hazards, Flood	3.3	5-High	Dare County Planning, Dare County Emergency Management	General Fund, Grant Funds	1 year	Carry Forward	Group saw the need to revisit this effort.
DAR7	Become a FIREWISE Community that is able to protect people, property, and natural resources from wildland fire.	Wildfire	3.3	7-High	Dare County Emergency Management. Fire Marshal, US Fish & Wildlife, NC Forestry	Grant funds, General Fund	1-3 years	New	N/A
DAR8	Maintain or increase the number of flood insurance policies in place across Dare County when new flood hazard maps become effective and many properties are reclassified as Shaded X and/or X zone no longer requiring flood insurance associated with a federally insured mortgage.	Hurricane & Tropical Storm, Severe Weather, Coastal Hazards, Flood	3.3	5-High	Dare County Planning. Emergency Management	General Fund	1-2 years	New	N/A
DAR9	Pursue the installation of flood gauges at all towns and villages. Have those gauges tied into the county alert and notification system allowing users to be alerted to changing conditions as they occur.	Hurricane & Tropical Storm, Severe Weather, Coastal Hazards, Flood	2.2	5-High	Dare County Emergency Management	Grant Funds, NC Emergency Mgmt.	2 years	New	N/A

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
DAR10	Complete a cybersecurity risk assessment from an external subject matter expert. Based on risk assessment outcomes develop and require all employees, volunteers and elected officials to complete cybersecurity awareness training before being given access to county information technology systems. Develop and offer cybersecurity awareness training for citizens. Develop and conduct cybersecurity exercises.	Terrorism, Cyber Attack	3.3	5-High	Dare County Emergency Management Dare County Information Technology	General Fund	2 years	New	N/A
DAR11	Work with all landowners including federal, state, and private to ensure proper maintenance and use of existing drainage systems to minimize impacts and reduce standing water on all property.	Hurricane & Tropical Storm, Flood, Coastal Hazards, Transportation Infrastructure Failure	1.1	7-High	Dare County Planning -- Soil and Water Conservation Board	Grants, tax or tax incentive program	1-3 years	New	N/A
Natural Resource Protection									
DAR12	Study and document sound side erosion rates and water level changes	Hurricane & Tropical Storm, Severe Weather, Coastal Hazards, Flood	3.2	3-Low	NC Division of Coastal Mgmt.	Grants, Volunteer	3- 5 years	New	N/A
DAR13	Encourage the use of natural barriers over hard structure to control shoreline erosion and protect built infrastructure.	Hurricane & Tropical Storm, Flood, Coastal Hazards, Transportation Infrastructure Failure	3.3	4-Medium	Dare County Planning -- Soil and Water Conservation Board	General Fund	3-5 years	New	N/A
DAR14	Protect natural floodplain function and resilient areas as open space to provide flood and coastal hazard risk reduction and potentially increase CRS 420 open space credit	Hurricane & Tropical Storm, Severe Weather, Coastal Hazards, Flood	3.2	4-Medium	Dare County Planning -- Soil and Water Conservation Board	General Fund	1-3 years	New	N/A
Structural Projects									
DAR15	Protect transportation routes and improve traffic flow along NC 12. Improve NC 12 to a two-lane road and coordinate traffic signals.	Hurricane & Tropical Storm, Flood, Coastal Hazards	2.2	7-High	Dare County Planning, Dare County Emergency Management, NCDOT	NCDOT	1 -3 years	Carry Forward	Group saw the need to revisit this effort and reshape the action for the new plan.
DAR16	Advocate the replacement of the Lindsey Warren (Alligator River) Bridge	Hurricane & Tropical Storm, Flood, Coastal Hazards	2.1	7-High	Dare Board of Commissioners, NCDOT	NCDOT	1 year	Carry Forward	Group saw the need to rename this effort and reshape the action for the new plan.
DAR17	Prioritize and Fund Critical Drainage Projects that improve stormwater drainage and land management preparation for flooding.	Hurricane & Tropical Storm, Flood, Coastal Hazards	2.1	7-High	NCDOT, Dare County Planning, Dare Soil & Water Board	Grant Fund, local stormwater assessments	1-3 years	Carry Forward	Group saw the need to refocus this effort and reshape the action for the new plan to include northern Roanoke Island flooding and expanded “pumping plan”.
DAR18	Take action on the results of the Moffit-Nicholas/ NCDOT Northern Roanoke Island drainage study.	Hurricane & Tropical Storm, Flood, Coastal Hazards, Transportation Infrastructure Failure	3.3	7-High	Dare Board of Commissioners, NCDOT	Grant Fund, local stormwater assessments	2 years	New	N/A
DAR19	Complete physical security assessment at all public facilities and large crowd (500+ people) gathering venues and events. Based on results, make physical security improvements and/or implement measures to protect lives from likely threats.	Terrorism	3.3	3-Low	Dare County Emergency Management. Dare Sheriff's Office	General fund	1-3 years	New	N/A
DAR20	Improve water supply and delivery systems to save water and reduce drought impacts by eliminating breaks and leaks. Encourage drought-tolerant landscape design to reduce dependence on irrigation. Encourage permeable driveways and surfaces to reduce runoff and promote groundwater recharge.	Drought, Flood	2.1	7-High	Dare County Water Department	Water enterprise fund	3-5 years	New	N/A

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Emergency Services									
DAR21	Establish secondary water supplies/points for fire protection efforts.	Hurricane & Tropical Storm, Flood, Wildfire	2.2	4-Medium	Dare County Fire Marshal	Grant Funds	3-5 years	Carry Forward	Group saw the need to revisit this effort and reshape the action for the new plan with a focus on improving water utility infrastructure capability and resilience.
DAR22	Acquire generators or other forms of redundant power supply to ensure that critical facilities and infrastructure remain operational where normal power supply is not available	All Hazards	2.2	5-High	Dare County Fire Marshal, Public Works, Emergency Mgmt.	Grant Funds	1-2 years	Carry Forward	Group saw the need to revisit this effort and develop an actionable critical facility emergency power plan.
DAR23	Study and identify all key secondary roadways used by workforce that flood routinely and develop plans to mitigate flood hazards. These are transit corridors that support year-round resident populations like Colington Road, NC 345, and Kitty Hawk Road.	Hurricane & Tropical Storm, Flood, Coastal Hazards, Severe Winter Storm, Severe Weather, Tornado, Wildfire, Transportation Infrastructure Failure	2.2	5-High	NCDOT, Dare County Planning	General fund	2 years	New	N/A
DAR24	Complete commodity flow study to identify hazardous materials that are routinely transported across the region.	Radiological Emergency, Hazardous Materials Incident	3.3	3-Low	Dare County Emergency Management	Grant funds	3-5 years	New	N/A
Public Education & Awareness									
DAR25	Coordinate with NC Floodplain Mapping on public dissemination of updated floodplain maps	Hurricane & Tropical Storm, Flood, Coastal Hazards	4.2	4-Medium	NC Floodplain Mapping, Dare County Planning	General Fund	1 year	Carry Forward	Group saw the need to retain this effort and reshape the action for the new plan.
DAR26	Lobby State Legislators to require realtors to disclose flood zones.	Hurricane & Tropical Storm, Flood, Coastal Hazards	4.1	3-Medium	Dare County Planning	General Fund	3 years	Carry Forward	Group saw the need to retain this effort and revisit how best to move it forward in the new plan.
DAR27	Maintain or increase the number of flood insurance policies in place across Dare County when new flood hazard maps become effective and many properties are reclassified as Shaded X and/or X zone no longer requiring flood insurance associated with a federally insured mortgage.	Hurricane & Tropical Storm, Flood, Coastal Hazards	3.3	5-High	Dare County Planning. Emergency Management	General Fund	1-2 years	New	N/A
DAR28	Expand hazardous weather awareness to include tornados and winter storms by expanding NWS partnership opportunities to include SKYWARN training and community forums	Hurricane & Tropical Storm, Extreme Heat, Flood, Coastal Hazards, Severe Winter Storm, Severe Weather, Tornado, Wildfire, Drought	1.1	6-High	National Weather Service, Dare County Emergency Management	General Fund	2 years	New	N/A
DAR29	Increase the use of the NWS alert feature of the County mass notification system so that residents and visitors have direct access to all issued weather alerts.	Hurricane & Tropical Storm, Extreme Heat, Flood, Coastal Hazards, Severe Winter Storm, Severe Weather, Tornado, Wildfire, Drought	1.1	6-High	Dare County Emergency Management	General Fund	1 year	New	N/A
DAR30	Expand the “Love The Beach Respect The Ocean” beach safety campaign by expanding participation with the Chamber of Commerce, Property Managers, as well as hotel, restaurant, and beach equipment rental companies	Coastal Hazards	1.1	5-High	Dare County Emergency Management, Public Relations	General Fund	1-3 years	New	N/A
DAR31	Take actions needed to ensure equipment and personnel are readily available to implement the Dare County Emergency Pumping Plan at multiple locations simultaneously.	Hurricane & Tropical Storm, Flood, Coastal Hazards, Severe Weather, Transportation Infrastructure Failure	2.2	7-High	Dare County Planning, Emergency Management, NC Forestry	General Fund, grants	1 year	New	N/A

Table 7.3 – Mitigation Action Plan, Town of Duck

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
DCK1	Continue to fund enforcement of current hazard mitigation regulations.	All Hazards	3.1	High	Town Staff, Town Council	General Fund	Annual, Ongoing	Carry Forward	Town Council continues to annually fund a Code Enforcement Position and Certified Floodplain Manager as well as continuing education training.
DCK2	Adopt and apply development policies that balance protection of natural resources and fragile areas with residential and economic development	Hurricane & Tropical Storm, Coastal Hazards, Flood, Severe Weather, Wildfire	1.2	High	Town Staff, Town Council	General Fund	6 Month, Annual	Carry Forward	Town Staff is working with OBX CRS Users Group on the development of a new floodplain ordinance with higher regulatory standards for areas within the Special Flood Hazard Area (SFHA) as well as areas that are not located within the SFHA to address known flood risks. These standards are being prepared in expectation of the adoption of new Flood Insurance Rate Maps from FEMA in 2020. Town Council adopted a Resolution establishing a policy related to the Emergency Pumping of Floodwaters September, 2018. The Town had an emergency floodwater management discharge plan approved by the NC Division of Water Quality in May, 2019.
DCK3	Develop policies that minimize threats to life, property, and natural resources resulting from development located in or adjacent to hazard areas, such as those subject to erosion, high winds, storm surge, flooding, or sea level rise.	Hurricane & Tropical Storm, Coastal Hazards, Flood, Severe Weather, Wildfire	1.2	High	Town Staff, Town Council	General Fund	6 Month, Annual	Carry Forward	Adoption of revised Flood Insurance Rate Maps and Flood Damage Prevention Ordinance, local participation in CAMA LPO program, Participation in the FEMA Community Rating System, enforcement of NC State Building Code Revisions and amendments including wind-borne debris provisions. The Town has also revised policies related to oceanfront development including additional setbacks for accessory structures, new dune walkway standards, and remedies for structures encroaching on the ocean beach. Annual beach profile surveys initiated in 2017 continue to assess changing shoreline patterns.
DCK4	Develop location, density, and intensity criteria for new, existing development and redevelopment including public facilities and infrastructure so that they can better avoid or withstand natural hazards.	Hurricane & Tropical Storm, Coastal Hazards, Flood, Severe Weather, Wildfire	3.1	High	Town Staff, Town Council	General Fund	Annual Review	Carry Forward	Town Code revisions including lot coverage regulations, limitations on residential dwelling size, increased setbacks for accessory structures, additional elevation requirements for V-Zone structures and incentives for use of permeable and semi-permeable materials for driveways and parking have been adopted. Town Council adopted additional limitations on the scale of development through house size limitations and increased setback requirements January, 2019
DCK5	As a FEMA CRS commuity, we will take advantage of the various mitigation strategies promoted by this program	Hurricane & Tropical Storm, Coastal Hazards, Flood	3.3	High	Town Staff, Town Council	General Fund	Annual	Carry Forward	The Town continues to develop actions and strategies that will lower its CRS rating and therefore provide lower flood insurance premiums to property owners within the Town. See also DCK3.
DCK6	Support programs and initiatives to annually assess shoreline changes (erosion and accretion)	Hurricane & Tropical Storm, Coastal Hazards, Flood	3.2	High	Town Council	General Fund	Annual, As Needed	Carry Forward	The Town has been monitoring high oceanfront erosion areas by documenting storm damage and taking photos/Go Pro and aerial drone video. A beach erosion study has been completed for the Town by the USACOE and Coastal Planning and Engineering which documents erosion patterns and existing conditions. The Town enacted an additional tax to support beach management activities, and annual beach profile surveys were initiated in 2017 to assess changing patterns. These surveys are expected to soon be supplemented with aerial drone technology providing 3D imaging analysis that will further enhance the Town's ability to track shoreline change. These techniques may likely be carried over to assess soundside shoreline changes as well.
DCK7	Stay informed, involved and supportive relative to Federal, State, and/or regional studies, initiatives and efforts concerning beach re-nourishment and maintenance	Hurricane & Tropical Storm, Coastal Hazards, Flood	3.2	High	Town Staff, Town Council	General Fund	Annual	Carry Forward	The Town participates in the annual program established by the Dare County Shoreline Commission to provide funds for beach maintenance. The Town started discussions in 3/2019 regarding beach re-nourishment in conjunction with Dare County and the Towns of Kill Devil Hills, Kitty Hawk and Southern Shores.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
DCK8	Develop a Fire Ordinance consistent with State regulations and unique to the Town.	All Hazards	3.1	Medium	Public Safety, Town Staff, Town Council	General Fund	6 Month	New	Public Safety and Town staff are currently working on the development of a Fire Prevention Ordinance that will address fire inspections, mutual aid, allowable and prohibited fires, life safety provisions.
DCK9	Update CAMA Land Use Plan	All Hazards	3.3	High	Town Staff, Planning Consultant, NC Division of Coastal Management	General Fund	9 Month	New	The Town of Duck is currently working on updating its Comprehensive CAMA Land Use Plan. When completed, the plan will contain existing and emerging background information, assessments of issues and opportunities, and development of future goals and objectives. Key topics include natural resources, community resiliency, economic development, stormwater management, and multi-modal transportation.
Property Protection									
DCK10	Identify areas most at risk and investigate strategies to reduce risk from wild land/urban interface fires	Wildfire	1.2	High	Fire Department, Town Staff	General Fund	1-2 Years	Carry Forward	Fire department staff will be utilizing resources to include utilizing new GIS mapping tools to identify areas that may be vulnerable in order to determine effective risk reduction strategies.
Natural Resource Protection									
DCK11	Increase the amount of open space throughout the town by seeking land donations or making land purchases. Develop an open space plan to further enhance these areas.	Hurricane & Tropical Storm, Coastal Hazards, Flood	3.3	Medium	Town Council	General Fund	Annual Review	Carry Forward	The Town owns an 11-acre park in the center of the Village Commercial area which is partially maintained as open space. As the Town is 90 percent developed, there are few areas available to purchase and maintain as open space. Additionally, Town funds for property acquisitions are limited. Future activities in this area will largely depend on the success of the Town in acquiring property with available grants.
DCK12	Protect the oceanfront recreation area through active beach maintenance, nourishment, and public engagement	Hurricane & Tropical Storm, Coastal Hazards, Flood, Severe Weather	3.2	High	Town Council, Town Staff	General Fund, Dare County Occupancy Tax, Municipal Service Districts, Bonds	Annual Maintenance, 5 Year Renourishment	New	The Town has begun discussions related to renourishment of 1.7 miles of oceanfront beach. During these discussions, surveys and data for the entire oceanfront will be considered to determine whether other areas are subject to vulnerability and in need of nourishment as well. In the interim, during the planning process for renourishment, the Town continues to fund annual beach planting, limited sand fencing and supports a volunteer planting program to engage residents, owners and visitors in the protection of the ocean shoreline.
DCK13	Continue to work with State and Federal Agencies to promote living shoreline opportunities along the soundfront	Hurricane & Tropical Storm, Coastal Hazards, Flood, Severe Weather	3.3	High	Town Council, Town Staff	General Fund, Grants	2-3 Years	New	The Town is working with an engineering consultant on the design and permitting of a living shoreline project in a vulnerable area along Currituck Sound. The Town is seeking grant assistance to fund a portion of the project costs.
DCK14	Increase coastal resiliency through research and progressive planning	Hurricane & Tropical Storm, Coastal Hazards, Flood, Severe Weather	3.3	High	Town Council, Town Staff, NCDOT	General Fund, Grants	Present to 5 Years, Annual Review	New	The Town has been working with Woods Hole Oceanographic Institution to improve flooding predictions. With the help and engagement of citizen scientists, flood events data is being collected and used to help evaluate and improve models for flooding from ocean and sound storms as well as rainfall. If successful, these models will help guide the Town's flood management policies in the future. The Town is also partnering on a grant-funded vulnerability assessment with researchers at the Program for the Study of Developed Shorelines at Western Carolina University.
Structural Projects									
DCK15	Improve stormwater drainage in vulnerable areas	Hurricane & Tropical Storm, Coastal Hazards, Flood	3.3	High	Town Staff, Town Council	General Fund	Annual	Carry Forward	Town Staff continues to identify and resolve localized roadway flooding issues as funding and resources become available. The Town has identified low lying areas through GIS mapping and associated flood risks to those areas resulting from rain events. The Town has submitted an emergency floodwater management plan that was reviewed and approved by NCDWR to address stormwater flooding in these areas. The Town also continues to implement stormwater management projects along NC12 to mitigate flooding and standing water. Drainage Projects along NC12 at Duck Ridge Village Court, Station Bay Marina and along the Duck Trail are being considered funding in the budget for fiscal year 2019-20.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
DCK16	Lobby the NC Board of Transportation and the NC Department of Transportation and NC Turnpike Authority for the construction of the Mid-County Bridge.	Hurricane & Tropical Storm, Coastal Hazards, Flood	3.3	High	Town Council, NCDOT	NCDOT	Annual	Carry Forward	The Town Council has issued several resolutions to support the construction of the Mid-Currituck Bridge and to identify the Town's preferred design alternative for the project. The Town has sent letters to NCDOT and NC Turnpike Authority Staff providing comments on the project studies that have been underway for several years. The Town frequently discusses the project at regular Town Council meetings and is kept informed of the status of the project by Town staff and residents who serve on a local committee to support construction of the bridge.
DCK17	Address drainage issues on NC 12 as applicable and provide funding for necessary stormwater improvements.	Hurricane & Tropical Storm, Coastal Hazards, Flood, Severe Weather	3.3	High	Town Staff, Town Council	General Fund, NCDOT	Annual	Carry Forward	Engineering is ongoing to rectify localized drainage problems on parts of NC 12 and funding is being provided in the CIP annually. Completed projects include pedestrian improvements along the west side of NC12 in the Village which include a sidewalk with both landscaping and stormwater features, and Duck Trail improvements north of Waxwing Lane and Station Bay Drive. FY 2019-2020 budget includes funding for improvements along the east side of NC12 from Duck Deli to the north end of the Village, the east and west side of NC12 at Wee Winks, south of Four Seasons Lane and at NC12 and Station Bay Marina. Collaboration with NCDOT continues as needed.
Emergency Services									
DCK18	Participate in the Dare/Currituck County Local Emergency Preparedness Committee (LEPC)	All Hazards	4.1	High	Public Safety	General Fund	Quarterly	New	Dare and Currituck County Emergency Management initiated meetings in 2017 for consideration of forming a joint LEPC. The Outer Banks Regional LEPC was established in order to improve capabilities to meet all threats and hazards not just HAZMAT. Public safety personnel is and will continue to participate in meetings and joint trainings to improve multi-jurisdictional emergency response to all hazards.
DCK19	Annual Review of Emergency Operations Plan	All Hazards	2.2	High	Public Safety, Town Staff	General Fund	Annual	New	Continue to review the Town's Emergency Operations Plan annually in order to address any lessons learned, priorities, procedures, or additions to ensure effective implementation of the plan.
DCK20	Develop Standard Operating procedure for Crisis Track	Hurricane & Tropical Storm, Coastal Hazards, Flood	3.3	Medium	Public Safety, Town Staff	General Fund	6-12 Months, Annual	New	Public Safety and Town Staff will develop a standard operating procedure for instructional purposes on the process and use of the County Hurricane Assessment software, Crisis Track, to include annual staff and volunteer training.
Public Education & Awareness									
DCK21	Collaborate with Duck Fire and Town Staff to educate the homeowners, developers and landscapers on designing fire safe communities.	Wildfire	1.1	High	Fire Department, Town Staff	General Fund	6 Month-2 Years	Carry Forward	Fire department staff is initiating a phased approach with Phase I implementation focusing on education and awareness. Future phases will look at regulatory implementation and a formalized plan.
DCK22	Continue education efforts to promote dune maintenance.	Hurricane & Tropical Storm, Coastal Hazards, Flood	1.1	High	Town Staff, Division of Coastal Management	General Fund, Grant Fund	Annual	Carry Forward	Town distributes information and promotes the proper installation of sand fence and encourages the planting of native vegetation. The Town implemented volunteer based beach planting program November, 2017 with funding expected to be continued. The program has garnered support from residents, non-residents and local volunteer groups.
DCK23	Keep effective construction techniques for coastal communities available online	Hurricane & Tropical Storm, Coastal Hazards, Flood	1.1	High	Town Staff	General Fund	Annual	Carry Forward	Town of Duck Floodplain webpage reworked 9/18 to include FEMA/NC Department of Insurance publications on Coastal Construction Techniques.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
DCK24	Mitigate ocean overwash and sound erosion by identifying vulnerable areas, developing public outreach information and disseminating this information to the public.	Hurricane & Tropical Storm, Coastal Hazards, Flood	1.1	High	Town Staff	General Fund	6 Months-Annual	Carry Forward	The Town has been monitoring high oceanfront erosion areas by documenting storm damage and taking photos/go pro and aerial drone video. A beach erosion study has been completed for the Town by the USACOE and Coastal Planning and Engineering which documents erosion patterns and existing conditions. As a result of these findings, annual beach profile surveys were initiated in 2017 to assess changing patterns and will continue annually. These surveys are being supplemented with aerial drone technology to develop 3D imaging analysis. The Town still needs to develop a method to track sound side erosion. Information regarding these findings are disseminated through social media, the Town website and direct email correspondence to oceanfront owners and to soundfront owners once that database is completed.
DCK25	Provide residents information and links to technical assistance concerning beach nourishment, re-nourishment and maintenance activities, including options such as sand fencing	Hurricane & Tropical Storm, Coastal Hazards, Flood	1.1	High	Town Staff, Town Council	General Fund	Annual	Carry Forward	The Town website, social media and direct email communication is utilized to disseminate information. The Town provides information and issues CAMA permits to oceanfront property owners seeking to maintain their primary and frontal dunes.
DCK26	Continue to provide effective public information and education materials to disseminate data on hazards, and educate beachgoers on beach safety (rip currents, beach holes, beach fires, etc.)	All Hazards	1.1	High	Town Council, Town Manager, Public Information Officer, Ocean Rescue	General Fund	Annual	Carry Forward	Continue collaboration through the County's Joint Information Center (JIC) and Emergency Management tools to include methods such as regroup and other joint marketing techniques designed for large scale public dissemination. Continue annual and in-season evaluations and reviews regarding public safety staffing, life-guard stand locations, and effective means to communicate threats (ocean conditions, storms hazardous conditions); i.e. social media, life guard advisories, use of flag notification systems and signage at beach access locations.
DCK27	Continue development and improvement related to the dissemination of public information to stakeholders	All Hazards	1.1	High	Town Staff, Town Council	General Fund	Biannual	Carry Forward	The Town effectively utilizes its website, social media, and direct email and telephone communications to communicate threats to and from its stakeholders (i.e.; property owners, residents, business owners, and vacationers), however continual research and development of new and effective means of communication are constantly pursued. Collaboration with the County's Joint Information Center (JIC) and Emergency Management has helped with the development of new techniques and technology to disseminate information. Ongoing collaboration with Duck Merchant's Association is maintained through quarterly and monthly meetings. Databases for the purpose of direct email communications with oceanfront and soundfront owners are maintained and updated regularly. The direct email database is slated for expansion to include the all residents and owners within the Town.
DCK28	Develop Annual Outreach Event regarding Fire Safety	All Hazards	1.1	High	Public Safety, Town Staff	General Fund	Biannual	New	Public Safety and Town Staff are currently working on the development of an annual outreach program to educate and inform business owners on proper and safe fire prevention in connection with and addition to annual and multi-year inspections.

Table 7.4 – Mitigation Action Plan, Town of Kill Devil Hills

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
KDH1	Drainage System Maintenance - Continue mowing drainage ditches and conduct normal maintenance and storm event driven maintenance	Flood, Hurricane & Tropical Storm, Coastal Hazards	2.2	High	Public Services, NCDOT	General Fund	Annually	Carry Forward	Continue to maintain ditches and other storm water systems to reduce/eliminate standing water. This is constantly updated and prioritized quarterly.
KDH2	Erosion and Sediment Control - Continue to enforce local and state regulations	Flood, Coastal Hazards	3.2	High	Planning Department	General Fund	Annually	Carry Forward	Review and Enforcement of State Sedimentation regulations and staff serving as S&E inspector
KDH3	Maritime Forest Environmental Zoning District - Continue to enforce the Maritime Forest Environmental Zoning District	Wildfire	3.2	High	Planning Department	General Fund	Annually	Carry Forward	Action modified. Participate in control burn of the marsh and other portion of Maritime forest to prevent forest fires.
KDH4	Flood Response - Coordinate efforts to expedite reconstruction and rebuilding efforts in cooperation with Dare County Emergency Management staff.	Flood, Hurricane & Tropical Storm, Coastal Hazards, Winter Storm	3.1	High	Planning Department	General Fund	1-3 years	Carry Forward	In state of Emergency, offer no cost permits for damage repair and work with Dare County to coordinate mitigation grants.
KDH5	Fire Protection - Implement Water Systems Master Plan	Wildfire	3.3	High	Public Services, Water Department	Water Fund	1-5 years	Carry Forward	Continue replacing waterlines in accordance with the Water Master Plan. Require flow test for new development sites.
KDH6	Storm water Management - Continue to implement the storm water management plan. Local Planning and Regulations.	Flood, Coastal Hazards	3.3	High	Public Services	General Fund	6 months	Carry Forward	Development of regulatory requirements for maintenance. Develop regulations for onsite storm water management at large single family dwelling. Maintain and use staff BMP inspection certificates.
KDH7	Map Information - Maintain updated flood map information for citizens and customers. Map Erosion areas annually to help inform the public of high erosion areas.	Flood, Hurricane & Tropical Storm, Coastal Hazards	1.1	High	NC Division of Emergency Management, Planning Department	NC Division of Emergency Management	1 year	Carry Forward	Maintain current and historic flood maps. Provide education information to citizens annually. Map erosion prone areas to better regulate development.
KDH8	Continue to participate in CRS	Flood, Hurricane & Tropical Storm, Coastal Hazards	3.3	High	Planning Department	General Fund	Annually	Carry Forward	Work to increase score in CRS program specifically for public outreach and education
KDH9	Add freeboard to the Flood Damage Prevention Ordinance for development in and outside the SFHA	Flood, Hurricane & Tropical Storm, Coastal Hazards	3.1	High	Planning Department	General Fund	1 year	New	Update the Flood Damage Prevention Ordinance in conjunction with updated flood maps.
Property Protection									
KDH10	Relocation - Expedite permitting for the relocation of repetitive loss situations	Flood, Hurricane & Tropical Storm, Coastal Hazards	1.2	Medium	Planning Department	General Fund	3-5 years	Carry Forward	Incomplete
KDH11	Acquisition - Encourage repetitive loss properties to consider acquisition as a possible solution	Flood, Hurricane & Tropical Storm, Coastal Hazards	1.2	Low	Planning Director, Board of Commissioners	NC Division of Emergency Management, FEMA	5+ years	Carry Forward	Incomplete by lack of funding
KDH12	Critical Facilities Protection - Take appropriate actions to prevent and/or minimize damages to critical facilities. Use generators or other forms of redundant power to ensure that critical facilities and infrastructure remain operational.	All Hazards	2.1/2.2	High	Police, Fire & Rescue, Public Works, NC Dominion Power	General Fund	1-3 years	Carry Forward	Utilize shutters on windows in municipal buildings. Test and fuel alternative power sources and install alternative energy sources on all Town buildings.
Natural Resource Protection									

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
KDH13	Open Space Preservation - Support efforts to preserve natural areas	Flood, Hurricane & Tropical Storm, Coastal Hazards, Severe Weather	3.3	High	Planning Department	General Fund	3-5 years	Carry Forward	Incomplete due to lack of funding
KDH14	Wetlands Protection - Continue to utilize the zoning ordinance and the Land Use Plan to protect wetlands, implement and enforce CAMA AEC regulations and refer applicants to US Army Corps of Engineers for Section 404 wetlands.	Flood, Hurricane & Tropical Storm, Coastal Hazards	3.2	High	USACE, Planning Department, NCDEQ	General Fund	Annually	Carry Forward	Protect wetlands and look into living shorelines in public esturarine areas.
KDH15	Reservoirs - 1. Continue protection efforts concerning the Fresh Pond. 2. Maintain liaison with NC Division of Coastal Management concerning the development of the Kill Devil Hills Land Use Plan	Flood, Hurricane & Tropical Storm, Coastal Hazards, Winter Storm	3.1	High	Planning Department, CAMA	General Fund	1 year	Carry Forward	Updating CAMA Land Use Plan and Maintain AEC at Fresh Pond
KDH16	Surface Water Quality - Preserve surface water quality and enhance water quality through storm water management and zoning.	Flood, Hurricane & Tropical Storm, Coastal Hazards	3.2	High	Planning Department, Public Services	General Fund	3-5 years	Carry Forward	Continue to maintain storm water system and improve run off. Follow Town Storm water Master Plan to reduce dependency on NCDOT Ocean Outfalls for drainage.
Structural Projects									
KDH17	Dune and Beach Maintenance - Continue ongoing beach nourishment efforts	Flood, Hurricane & Tropical Storm, Coastal Hazards	3.2	High	Planning Director, Board of Commissioners	General Fund	Monitor Annually, nourish every 5 years	Carry Forward	Initial Beach Nourishment Project completed in 2016. Ongoing stabilization and re-nourishment in accordance with the adopted Shore Protection Project Maintenance Plan.
Emergency Services									
KDH18	Hazard Warning - Facilitate evacuation	All Hazards	1.1	High	Dare County Control Group	General Fund	Annually	Carry Forward	Utilize the Regroup Emergency Alert System to the fullest potential for all hazards and emergency information.
KDH19	Health and Safety Maintenance - Develop ongoing protocols to assure the maintenance of critical public services	All Hazards	2.1	High	Police, Fire & Rescue, Public Works, Dare County Emergency Management	General Fund	Annually	Carry Forward	Conduct annual training session with all emergency response departments. Develop a plan for action. Develop a multi-jurisdictional response plan.
KDH20	Emergency Services - Hurricane Exercises	Hurricane & Tropical Storm	2.1	High	Planning Department	General Fund	1 year	New	Continue to participate in countywide emergency operation hurricane exercises. Update local plan accordingly.
Public Education & Awareness									
KDH21	Hazard Recovery - Coordinate efforts to expedite recovery.	All Hazards	1.1	High	Planning Department, Board of Commissioners	General Fund	1 year	Carry Forward	Work with Dare County Emergency Management on information dissemination after an event and develop a website for post hazard information
KDH22	Insurance - Maintain outreach efforts and continue making flood insurance available to the Town's residents	Flood, Hurricane & Tropical Storm, Coastal Hazards	1.1	High	Planning Department, Town Clerk	General Fund	1 year	Carry Forward	Update materials and distribute to property owners and residents and specialty groups
KDH23	Compile and maintain current information in the Kill Devil Hills Floodplain Management Library	Flood, Hurricane & Tropical Storm, Coastal Hazards	1.1	High	CRS Coordinator	General Fund	Annually	Carry Forward	Scan current and past flood maps; scan elevation certificates for future reference and future property owners; scan building permits
KDH24	Outreach Projects - Initiate outreach projects to inform the public on Town and County initiatives that will reduce hazard related losses of property and life	All Hazards	1.1	High	Planning Department, Dare County Emergency Management	General Fund	1 year or Annually	Carry Forward	Provide printed educational materials for citizens regarding hazards. Create videos for hazard awareness and safety. Post education and prevention techniques on website.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
KDH25	Circulate brochure specifically on NFIP	Flood, Hurricane & Tropical Storm, Coastal Hazards	1.1	High	Planning Department	General Fund	Annually	Carry Forward	Work to increase score in CRS program specifically for public outreach and education
KDH26	Conduct contractors meeting	All Hazards	3.1	High	Planning Department	General Fund	1 year	Carry Forward	Work to increase score in CRS program specifically for public outreach and education
KDH27	Outreach Projects - Hold annual outreach meeting for citizens to discuss hazards and how to protect themselves. Hold annual outreach to engineer and developers on how to construct to a higher standard to prevent damage.	All Hazards	1.1	High	Planning Department	General Fund	1 year	New	Schedule annual meeting to discuss hazards and prevention
KDH28	Create educational brochure on the dangers of extreme heat and cold and steps the public can take to protect themselves	Extreme Heat, Winter Storm	1.1	Medium	Planning Department	General Fund	1-2 years	New	Develop education program
KDH29	Mitigation education	All Hazards	1.1	Medium	Planning Department	General Fund	2-3 years	New	Develop mitigation possibilities and present to governing board annually

Table 7.5 – Mitigation Action Plan, Town of Kitty Hawk

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
KH1	Establish town plans for mitigation and recovery through information on disaster planning recovery and reconstruction.	All Hazards	3.1	High	Town Manager	1 year	Carry forward	Carry forward	Should establish a separate mitigation plan, or add on to Emergency Preparedness, Response and Recovery Plan.
KH2	Revise Town's Flood Damage Prevention Ordinance in conjunction with new maps to increase the required freeboard in AE zones and regulate elevation requirements in Shaded X zones	Hurricanes, Nor'easters, Floods, Thunderstorm	3.1	Med	Planning & Inspections/Town Council	3 months	New	New	
Property Protection									
KH3	Clean out culverts, ditches, and waterways to relieve standing water and facilitate the stormwater drainage	Hurricanes, Nor'easters, Floods, Thunderstorm	2.1	High	Public Works	Ongoing	Carry Forward	Carry Forward	Partially complete. Waterways cleaned out, ditches and culverts still need to be addressed
KH4	Establish long-term plan for funding and implementation of beach renourishment	Hurricanes, Nor'easters, Floods, Thunderstorm, Erosion	3.2	Med	Town Council/Town Manager	1 year	New	New	
KH5	Expedite permitting for the relocation of repetitive loss situations	Hurricanes, Nor'easters, Floods, Thunderstorm, Erosion	1.2	Low	Planning & Inspections	Ongoing	New	New	
Natural Resource Protection									
KH6	Construct and maintain living shoreline projects in most vulnerable soundside areas	Hurricanes, Nor'easters, Floods, Thunderstorm, Erosion	3.2	Med	Town Council/Town Manager	3 years	New	New	
KH7	Encourage open space preservation/conservation	Flood, Hurricane & Tropical Storm, Coastal Hazards, Severe Weather	3.3	Med	Planning & Inspections	Ongoing	New	New	
Structural Projects									
KH8	Implement stormwater drainage improvements per the studies/plan	Hurricanes, Nor'easters, Floods, Thunderstorm	3.3	High	Town Manager/Public Works	Ongoing	Carry Forward	Carry Forward	Partially complete
Emergency Services									
KH9	Update and improve protocols and procedures (local, county, and state) by which citizens in KH are made aware of impending storm events and expected impacts	Hurricanes, Nor'easters, Floods, Thunderstorm	1.1	High	Town Manager	1 year	Carry Forward	Carry Forward	Partially complete. Has been some discussion of a town alert, in addition to the existing county one.
KH10	Work w/ Dare Co. to improve the communication systems between all public safety departments within the towns, county, and state so that in the event of a disaster, all entities will be able to communicate with one another.	All Hazards	4.2	Med	Town Manager/Fire Department/Police Department	2 years	Carry forward	Carry forward	
KH11	Review vulnerabilities of all critical facilities as a component of annual review of Emergency Preparedness, Response and Recovery Plan	All Hazards	2.1	High	Town Manager, Fire Department/Police Department	1 year	New	New	
KH12	Maintain post-disaster debris management contract with qualified provider.	Flood, Hurricane & Tropical Storm, Coastal Hazards, Severe Weather	3.1	Med	Town Manager/Public Works	Ongoing	New	New	
Public Education & Awareness									
KH13	Increase awareness of availability of flood insurance through various methods (mailings, flyers, etc.)	Hurricanes, Nor'easters, Floods, Thunderstorm	1.1	Med	Planning & Inspections	Twice Annually	New	New	
KH14	Provide information on flood damage protection techniques to citizens and property owners.	Hurricanes, Nor'easters, Floods, Thunderstorm	1.1	Med	Planning & Inspections	Ongoing	New	New	
KH15	Initiate outreach projects to inform the public on Town and County initiatives that will reduce hazard related losses of property and life	All Hazards	1.1	Med	Planning & Inspections	2 years	New	New	

Table 7.6 – Mitigation Action Plan, Town of Manteo

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
MAN1	Continue to stay current with all Community Rating System reporting requirements to ensure continued program participation.	Hurricane, Severe Thunderstorm, Flood	3.3	7 - High	Planning Department	General Fund	Ongoing	Carry Forward	Ongoing effort
MAN2	Replace heat strips on *utility lines running under* the Cora Mae Basnight Bridge	Severe Winter Storm	2.1	3 - Medium	Utilities Department	Water Sewer Enterprise Fund	2025	New	January 2020, the Town repaired insulation surrounding the pipes as funds for heat strips are not yet available.
Property Protection									
MAN3	Maintain and improve Town wide stormwater system for appropriate performance.	Hurricane, Severe Thunderstorm, Flood	2.1	7 - High	Planning Department	Stormwater Fund	2025	Carry Forward	Revised to expand upon ditching to include other maintenance and improvement efforts
MAN4	Replace or retrofit critical and high risk failities that are located below base flood elevation	Flood, Hurricane, Coastal Hazards	2.1	7 - High	Planning Department	HMG Grant	Ongoing	New	
MAN5	Generator for Town Hall for continued services during disasters. The Town stands up an EOC at Town Hall during disasters.	All Hazards	2.1	7 - High	All Departments	HMG Grant	2020-2021	New	Application pending
Natural Resource Protection									
MAN6	Upgrade and improve stormwater and wastewater systems to improve water quality in Shallowbag Bay	Flood, Hurricane, Coastal Hazards	2.1	7 - High	Planning Department	Stormwater Fund/Clean Water Trust Fund	Ongoing	New	Major project in 2018 to install oil grit separators on lines for 14 acre outfall. Town stormwater fund now reubilding.
MAN7	Protect natural wetland areas	Flood, Hurricane, Coastal Hazards	3.2	7 - High	Planning Department	National Wetlands Conservation Grant Program/Clean Water Management Trust Fund	Ongoing	New	
MAN8	Cora Mae Basnight Bridge-water sewer line repair and replacement	All Hazards	2.1	3 - Medium	Utilities Department	Water Sewer Enterprise Fund	2025	New	
Structural Projects									
MAN9	Continue to encourage projects undertaken by Town Departments that will lessen the vulnerability of the Town and its residents to natural hazards.	All Hazards	3.3	7 - High	ALL	HMG Grant	Ongoing	Carry Forward	Revised to include all Town Department efforts
MAN10	Phase V stormwater improvements for west side of Highway 64	Flood, Hurricane, Coastal Hazards	2.1	7 - High	Planning Department	Stormwater Fund	Ongoing	New	July 2019, hired contractor to clean and conduct inspection of major section of west side stormwater system
MAN11	Capital Improvement Plan development with resiliency as a priority	All Hazards	3.3	7 - High	Administration Department	General Fund	2022	New	
MAN12	Boardwalk, bulkhead and docks replacement with higher standards/higher quality materials	All Hazards	2.1	7 - High	Planning Department	CAMA Access, General Fund	Ongoing	New	Received CAMA access grant to replace decking on almost 30 year old section of the boardwalk
MAN13	Floodproofing of East, West Hammock, and Ballast Point, Peninsula lift stations	Flood, Hurricane, Coastal Hazards	2.1	7 - High	Utilities Department	HMG Grant	2025	New	2019 Elevated electrical units in East Hammock station above flooding level
MAN14	Implement 2018 lightening study for water and sewer plant	Severe Weather	2.1	7 - High	Utilities Department	Water Sewer Enterprise Fund	2025	New	
MAN15	Repair and maintain Town Waterfront Gazebo with higher standards/higher quality materials for improved resiliency	Flood, Hurricane, Coastal Hazards	1.2	7 - High	Town Marina/Maritime Museum	CAMA Access, General Fund	Ongoing	New	
MAN16	Full replacement of waterfront lift station	Flood, Hurricane, Coastal Hazards	2.1	7 - High	Utilities Department	Clean Water State Revolving Fund	2021 (bidding)	New	

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Emergency Services									
MAN17	Continue to enhance the Water and Sewer Department's back-up generator system for all lift stations	All Hazards	2.2	7 - High	Utilities Department	HMG Grant	Ongoing	Carry Forward	11 total liftstations. 3 have generators. Need 7 generators.
MAN18	Participate in and conduct Emergency Management training for appropriate Town elected officials and staff.	All Hazards	2.2	7 - High	All Departments	General Fund	Ongoing	Carry Forward	Revised from "Mayor and other council members to participate in Dare County Emergency Management training sessions." to include various training opportunities
MAN19	Develop new Town of Manteo Emergency Operations Plan to supersede Manteo Police Emergency Plan	All Hazards	3.3	7 - High	Planning Department	General Fund	Ongoing	Carry Forward	New plan developed in 2019. Updates to plan coming in 2020.
MAN20	Implement essential spare equipment (standby equipment) program for water sewer plant	All Hazards	2.1	7 - High	Utilities Department	Water Sewer Enterprise Fund	Ongoing	New	
MAN21	Generator for Water and Sewer Plant to power to full operational	All Hazards	2.1	7 - High	Utilities Department	HMG Grant	2025	New	
Public Education & Awareness									
MAN22	Develop Communications Plan for hazards.	All Hazards	1.1	7 - High	All Departments	General Fund	Ongoing	Carry Forward	Action was revised to encompass all-hazards outreach from "Send a flood protection flyer to all property owners in Manteo through a community newsletter, utility bill or other document. The flyer would include a general identification of the local flood hazard, flood safety, flood insurance, property protection, flood plain development permit requirements, and drainage system maintenance." *Town will hire a PIO (new position) in early 2020.
MAN23	Educate Residents on water saving techniques	Drought	1.1	7 - High	All Departments	Water Sewer Enterprise Fund	Ongoing	New	

Table 7.7 – Mitigation Action Plan, Town of Nags Head

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
NGH1	Petition FEMA through the Town's state and regional NFIP representatives to consider adopting realistic regulations regarding the determination of destroyed structures. Specifically, this would apply to structures which are located on the public beach that are not eligible for flood insurance until they collapse.	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	3.1	Low	Planning, Town Manager	General Fund	5+ years	Carry Forward	There has been no action on this item at this time.
NGH2	Explore seeking authority and adopting regulations which would allow qualified Town staff to inspect sewer treatment facilities and on-site septic systems after a storm. These regulations should also allow staff to request the corrective actions necessary to ensure proper operation of these systems.	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	2.2	Low	Planning, Town Manager	General Fund	5+ years	Carry Forward	A legal authority memo was produced in conjunction with the University of Georgia and NC Sea Grant to explore the town's legal authority to regulate beyond state standards.
NGH3	Lobby for a state policy and strategy on beach nourishment and beach re-nourishment through joint efforts with other local governments and organization. This includes an annually funded state program to support local nourishment activities.	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	4.1	High	Board of Commissioners	General Fund	3-5 years	Carry Forward	Revised. No action taken as of this date.
NGH4	Develop a long-term plan for shoreline management which includes the oceanfront and estuarine shoreline. This may include financing, permitting, ongoing project implementation (in coordination with Dare County and other Dare County municipalities), and monitoring of changing shoreline conditions.	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	4.1	High	Town Engineer	General Fund, Dare County Shoreline Fund	3-5 years	Carry Forward	Revised. The Town has not yet started a long term beach nourishment strategy. The Town is conducting nourishment in 5-7 year cycles.
NGH5	Develop contingency plans for infrastructure or services that may be lost as a result of exposure to hazards. Potential infrastructure includes roads/streets, waterlines, wastewater, stormwater, and other key utilities.	All Hazards	2.2	Medium	Planning, Town Engineer, Public Works	General Fund/Stormwater	5+	Carry Forward	Revised. The Town has identified alternative means of access to several properties along the ocean front where property owners agreed to work cooperatively. The Town modified development regulations to assist with providing access to properties where a Town road has been damaged or lost.
NGH6	Evaluate the Nags Head Woods Fire Plan annually and coordinate information with Nature Conservancy staff and seek grant funding for fuel reduction activities.	Wildfire	3.3	Medium	Town Manager, Fire, Police	General Fund, Grant Funds	1 year	Carry Forward	Staff discusses and reviews the Nags Head Woods Fire Plan annually for update and to discuss areas for fuel reduction. Staff seeks grant opportunities as needed.
NGH7	Plan and participate with partners to evaluate the need and maintenance of wild land urban interface areas including removal of dead wood in critically fire prone areas and controlled burn activities.	Wildfire	1.2	Medium	Public Safety – Fire/Nature Conservancy/NPS	General Fund, Grant Funds	1 year	New	
NGH8	Explore the feasibility of becoming a Firewise Community.	Wildfire	3.3	Medium	Fire	General Fund	2-3 years	New	
NGH9	Purchase and install weather stations to track rainfall and weather in the Town that will be helpful in identifying changing weather patterns and future stormwater planning and modeling needs. Explore partnerships with agencies where this weather information would be relevant (i.e. NC Climate Center).	Coastal Hazards, Drought, Flood, Hurricane and Tropical Storm, Severe Weather	3.3	High	Planning, Town Engineer	General Fund, Grant Funds	2-3 years	New	
NGH10	Work with Dare County to expand Town representation on the Local Emergency Planning Committee.	All Hazards	4.2	Low	Fire	General Fund	1 year	New	
NGH11	Acquire equipment and materials and retrofit critical facilities to ensure critical facilities and infrastructure remain operational during events.	All Hazards	2.1	High	Town Manager, Fire, Police, Public Works, Planning,	General Fund	3-5 years	New	

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Property Protection									
NGH12	Purchase property, utilizing grants when possible, to acquire property for the purpose of mitigating damage and co-locating (dual use) Town facilities.	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	1.2	High	Planning, Town Engineer, Town Manager	General Fund/Grants	2-3 years	Carry Forward	Staff seeks any viable opportunity, on a case by case as needed basis, for funds to acquire properties for the purposed of mitigating damage, improvement water quality, preserving open space, protecting natural resources, and co-locating Town facilities.
NGH13	Identify and evaluate solutions to mitigate areas of repetitive flooding.	Coastal Hazards, Flood, Hurricane and Tropical Storm	1.2	High	Planning, Town Engineer, Public Works	General Fund/Stormwater	1 year	Carry Forward	The master planning process is identifying CIP projects designed to alleviate chronic flooding issues. Several areas for repetitive flooding have already been addressed.
NGH14	Pursue the installation of flood gauges, through partnership with Dare County and the State, that will notify citizens and Town officials of changing water levels.	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	1.1	High	Planning, Town Engineer, Town Manager	General Fund/Grants	1 year	New	
NGH15	Support public and private mitigation projects that reduce the potential damaging effects of hazards on the town. Homes that are pre-firm and repetitive loss structures should be prioritized.	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	1.2	High	Planning, Town Engineer, Town Manager	General Fund/Grants	1 year	New	
Natural Resource Protection									
NGH16	Seek methods to remove structures located on the public beach which degrade the recreational and natural quality of the environment, create public health and safety hazards, and impede the ability of life safety personnel to move along the shoreline.	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	3.2	High	Town Manager, Planning, Town Engineer	General Fund	5+ years	Carry Forward	The Town has been working with property owners on a case by case basis to remove structures from the public beach. This approach is a slow and incremental process, but there have been several successful removals.
NGH17	The town will identify, acquire, and seek grant funding of property for the purposes of open space, improving water quality, protecting natural resources, and recreational purposes.	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	1.2	High	Town Manager, Planning, Town Engineer	General Fund, Grant Funds	2-3 years	Carry Forward	Revised. The Town will continue to identify and acquire properties for open space as opportunities become available. There have been several properties acquired for open space and stormwater.
NGH18	Consider incentives rewarding developers, property owners, and builders that set aside additional open space in perpetuity.	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	3.3	Low	Planning	General Fund	3-5 years	Carry Forward	Revised. No action taken as of this date.
Structural Projects									
NGH19	Nourish the Town's beaches as a means to mitigate damage to oceanfront properties and infrastructure. This includes the pursuit of potential funding sources to supplement Town funds and programmatic permitting to assist with future nourishment projects.	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	3.2	High	Town Manager, Town Engineer	Dare County Shoreline Fund, Town Municipal Service Districts	3-5 years	Carry Forward	The Town has just completed a second successful nourishment project.
NGH20	Investigate innovative solutions to unconventional drainage problems. This may include the implementation of groundwater management techniques and low impact development practices which address stormwater runoff at or near its source. Possible solutions will consider improvements to address both water quality and water quantity. Continue to evaluate and assess existing infrastructure for replacement and improvement to include drainage systems maintained by NCDOT that may be impacted by other Town initiatives (i.e. beach nourishment).	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	3.3	High	Town Engineer, Public Works, Planning	General Fund/Stormwater	1 year	Carry Forward	Revised. The Town continues to implement innovative projects. Since the completion of Vista Colony, a similar project has been completed in Nags Head Acres. Other areas of the Town are in consideration.
NGH21	Improve fire protection and access in Nags Head Woods with the installation of 'dry hydrants' and maintenance and improvements to Nags Head Woods Road.	Wildfire	3.3	Medium	Fire, Public Works	General Fund, Water Fund	3-5 years	Carry Forward	The Nags Head Woods road is maintained by Nags Head Public Works and roadway material is added as needed to maintain an acceptable driving surface.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Emergency Services									
NGH22	Adhere to the Incident Command Structure to maintain and improve emergency operations and communications. This includes the annual update of the critical facilities list in the Emergency Operations Plan (EOP) and purchase of additional emergency operations communication equipment.	All Hazards	2.2	Medium	Fire, Police, Town Manager	General Fund	5+ years	NEW	
Public Education & Awareness									
NGH23	Continue to educate property owners to maintain fire safe landscaping and vegetation adjacent to structures.	Wildfire	1.1	Low	Fire	General Fund	5+ years	Carry Forward	This is accomplished on a case by case basis as needed. In addition, during fuel reduction burns staff meets with the community to explain the need for reduction of fuel loads.
NGH24	Develop outreach materials to educate the public and increase awareness on hazards, how to develop and retrofit their properties against hazards, and individual tasks that can help them better prepare and respond to hazards. Staff should explore alternative options to traditional on-site meetings. This may include increased use of social media, the public access channel and short videos and handouts.	All Hazards	1.1	High	Planning, Town Manager, Town Engineer, Fire/Ocean Rescue	General Fund	2-3 years	Carry Forward	The Town has utilized social media, videos, the website, and mailed information to inform residents about the new flood maps, flooding, stormwater, hurricane preparedness, and other coastal hazards.
NGH25	Educate and assist vulnerable populations in preparing for and recovering from impacts by hazards. This may include hazard awareness, evacuation planning, or disaster relief.	All Hazards	1.1	Low	Fire/Ocean Rescue, Police, Planning, Town Manager	General Fund	3-5 years	New	

Table 7.8 – Mitigation Action Plan, Town of Southern Shores

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
SOS1	Enforcement of the Zoning Ordinance as a hazard mitigation tool	All Hazards	3.1	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Planning and Code Enforcement Department continues to enforce the adopted Zoning Ordinance. Zoning Permits are issued for new development, changes in use, and new uses in order to ensure compliance.
SOS2	Identify "at risk" X Zone properties for added emphasis on flood risks and notify the responsible agencies about discrepancies between floodplain maps (FIRM vs SLOSH)	Hurricane, Tropical Storm, Severe Thunderstorm, Flood	1.2	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Planning and Code Enforcement Department continues to identify at risk properties following storm events by utilizing GIS data and in the field observations.
SOS3	Continue enforcement of the Flood Damage Prevention Ordinance	Hurricane, Tropical Storm, Severe Thunderstorm, Flood, Erosion	3.1	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Planning and Code Enforcement Department continues to enforce the Flood Damage Prevention Ordinance. Building permits are not issued unless plans demonstrate compliance with the established requirements
SOS4	Continue the enforcement of the NC State Fire Prevention Code, referenced by the Town Fire Code.	Wildfire	3.1	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Town's part-time Building Inspector enforces the NC State Fire Prevention Code and conducts required Fire Inspections to ensure compliance
SOS5	Continue enforcing the Lot Disturbance provisions of the Zoning Ordinance	Hurricane, Tropical Storm, Severe Thunderstorm, Flood, Erosion	3.1	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Planning and Code Enforcement Department continues to enforce the Lot Disturbance provisions of the Zoning Ordinance. No grading, filling, or other alteration of the topography or elevation of any unimproved lot, or demolition and clearing of improved property, nor any manmade change to any improved real estate resulting in the discharge of stormwater onto adjacent property and requiring a building permit, is undertaken without prior issuance of a lot disturbance permit
SOS6	Seek the maximum points available from the Community Rating System to keep flood insurance costs to the citizens as low as possible	Flood	3.3	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Planning and Code Enforcement Department continues to seek the maximum points available from the Community Rating System. The Town's last cycle visit was in 2015 which gave the Town a rating of Class 6 which is recertified annually until the next cycle visit in 2020. Communities with a Class 6 rating receive a 20% discount on insurance policies issued for properties in special flood hazard areas (SFHA's).
SOS7	Coordinate wildfire prevention efforts with tree preservation policies	Wildfire	3.1	Low	Planning/Code Enforcement, Fire Department	General Fund	Ongoing	Carry Forward	The Planning and Code Enforcement Department and Southern Shores Volunteer Fire Department issue permits and inspect the sites prior to any open burning.
SOS8	Continue enforcing Coastal Area Management Act (CAMA) regulations	Hurricane, Tropical Storm, Severe Thunderstorm, Flood, Erosion	3.1	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Planning and Code Enforcement Department continues to enforce the Coastal Area Management Act (CAMA) regulations. The Town's Local Permit Officers continue to review and issue Minor Permits in accordance with the Coastal Area Management Act (CAMA).
SOS9	Continue enforcing the state Erosion and Sedimentation Control regulations	Hurricane, Tropical Storm, Severe Thunderstorm, Flood, Erosion	3.2	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	When applicable, all new development must obtain a State-issued permit prior to issuance of a building/zoning permit.
SOS10	Identify factors that affect the severity of drought	Drought	3.3	High	Planning/Code Enforcement	General Fund	Ongoing	New	N/A
SOS11	Obtaining local data including tax parcels, building footprints, critical facility locations, and other information for use in risk analysis.	All Hazards	3.3	High	Planning/Code Enforcement	General Fund	Less than two years	New	N/A

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
SOS12	Modeling various "what-if" scenarios to estimate potential vulnerabilities in order to develop sea level rise mitigation priorities	Coastal Hazards	3.3	High	Planning/Code Enforcement	General Fund	Less than two years	New	N/A
Property Protection									
SOS13	Continue enforcement of the state building code, including wind load requirements	Hurricane, Nor'easter, Severe Thunderstorm, Winter Storms, Tornadoes, Earthquake	3.1	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Planning and Code Enforcement Department continues to enforce the state building code, including wind load requirements. All building plans must demonstrate compliance prior to issuance of a building permit. The Building Inspector continues to conduct inspections during construction and no Certificate of Occupancy is issued unless all requirements are satisfied.
SOS14	Conduct the Canal Inspection and Debris Removal program twice a year	Hurricane, Tropical Storm, Severe Thunderstorm, Flood, Erosion	2.1	High	Public Works, Southern Shores Civic Association	General Fund	Twice Per Year	Carry Forward	The Town's Public Works Dept. periodically inspects the Town's canal system and removes debris as needed. The Southern Shores Civic Association Boat Club conducts inspections of the canals every three to four weeks.
Natural Resource Protection									
SOS15	Continue implementation of the Waterways and Beaches Ordinance	Hurricane, Tropical Storm, Severe Thunderstorm, Flood, Erosion	3.2	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Planning and Code Enforcement Department continues to implement the Waterways and Beaches Ordinance. The Town Community Resource Officer and contracted lifeguard service conduct patrols of the beach to ensure compliance. All development along Town waterways is approved following demonstration of compliance. The Town continues to send Notices of Violation for canal obstructions when warranted
SOS16	Continue enforcement of the Beach and Dune Management Ordinance	Hurricane, Tropical Storm, Severe Thunderstorm, Flood, Erosion	3.2	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Police Dept., Town Community Resource Officer, and contracted lifeguard service conduct patrols of the beach to ensure compliance
Structural Projects									
SOS17	Continue to monitor plans for the Mid-Currituck Bridge to expedite evacuation	All Hazards	2.1	High	Administration, Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Town continues to monitor the NC Turnpike Authority plans for the Mid-Currituck Bridge to expedite evacuation. Lawsuits are likely to delay the project.
SOS18	Inspecting bridges and identifying if any repairs or retrofits are needed to prevent scour.	Flood		High	Administration, Public Works	NCDOT, General Fund	Annually	New	N/A
Emergency Services									
SOS19	Continue to have a standing Reconstruction Task Force	All Hazards	3.1	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	Ordinance amendment may be necessary so that appointments aren't required annually.
SOS20	Continue to provide an Emergency Operations Center	All Hazards	2.2	High	Administration	General Fund	Ongoing	Carry Forward	The Town continues to provide an Emergency Operations Center when needed for storm events and coordinates events with the Dare County Emergency Operations Center.
SOS21	Keep emergency plans current and provide staff with continuing education opportunities	All Hazards	2.2	Low	Administration	General Fund	Ongoing	Carry Forward	The Town updates its Emergency Management Plan annually and provides Town Staff with continuing education opportunities.
Public Education & Awareness									
SOS22	Educate citizens on expected impacts of hazards on daily lives	All Hazards	1.1	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Town utilizes a website, social media, and a bi-weekly newsletter to disseminate information regarding the impacts of hazards on daily lives.
SOS23	Educate citizens regarding the dangers of extreme heat and cold and the steps they can take to protect themselves when extreme temperatures occur	Extreme Heat	1.1	High	Administration, Planning/Code Enforcement	General Fund	Annually	New	N/A
SOS24	Encouraging residents in flood-prone areas to elevate homes.	Flood		High	Planning/Code Enforcement	General Fund	Ongoing	New	N/A

8 Plan Maintenance

Implementation and maintenance of the plan is critical to the overall success of hazard mitigation planning. This section discusses how the Mitigation Action Plans will be implemented by participating jurisdictions and outlines the method and schedule for monitoring, updating, and evaluating the plan. This section also discusses incorporating the plan into existing planning mechanisms and how the public will continue to be involved in the planning process. It consists of the following three subsections:

8.1 Implementation
8.2 Monitoring, Evaluation, and Enhancement
8.3 Continued Public Involvement

8.1 IMPLEMENTATION

Each jurisdiction participating in this plan update is responsible for implementing specific mitigation actions as prescribed in their Mitigation Action Plan (found in Section 7). In each Mitigation Action Plan, every proposed action is assigned to a specific local department or agency to ensure responsibility and accountability and increase the likelihood of subsequent implementation. This approach enables individual jurisdictions to update their own unique mitigation action list as needed without altering the broader focus of the regional plan.

In addition to the assignment of a local lead department or agency, an implementation timeline or a specific implementation date or window has been assigned to each mitigation action to help assess whether reasonable progress is being made toward implementation. The participating jurisdictions will seek outside funding sources to implement mitigation projects in both the pre-disaster and post-disaster environments. When applicable, potential funding sources have been identified for proposed actions listed in the Mitigation Action Plan.

An important implementation mechanism that is highly effective and low-cost is incorporation of the Hazard Mitigation Plan recommendations and their underlying principles into other plans and mechanisms. Where possible, plan participants will use existing plans and/or programs to implement the Mitigation Action Plan. It will be the responsibility of the HMPC representatives from each participating jurisdiction to determine and pursue opportunities for integrating the requirements of this plan with other local planning documents and ensure that the goals and strategies of new and updated local planning documents for their jurisdictions or agencies are consistent with the goals and actions of the Hazard Mitigation Plan and will not contribute to increased hazard vulnerability in the Plan Area. Methods for integration may include:

- Monitoring other planning/program agendas;
- Attending other planning/program meetings;
- Participating in other planning processes; and
- Monitoring community budget meetings for other community program opportunities.

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. Dare County Emergency Management will take the lead for the region in initiating all plan monitoring and update procedures. As such, Dare County, led by the Emergency Manager, 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; 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 County Boards of Commissioners and Town Councils, 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 flood mitigation, passing concerns on to appropriate entities, and provide relevant information for posting on County and local 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 Counties 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. The Dare County Emergency Manager will be responsible for convening the HMPC and initiating regular reviews. Regular maintenance will take place through quarterly meetings of the HMPC. The HMPC will also convene to review the plan after significant hazard events. If determined appropriate or as requested, an annual report on the plan will be developed and presented to local governing bodies of participating jurisdictions to report on implementation progress and recommended changes.

The five-year written update to this plan will be submitted to the NCEM and FEMA Region IV, unless disaster or other circumstances (e.g., changing regulations) require a change to this schedule. With this plan update anticipated to be adopted and fully approved by 2020, the next plan update for the Outer Banks Region will be completed by 2025.

8.2.3 Maintenance Evaluation Process

Evaluation of progress can be achieved by monitoring changes in vulnerabilities identified in the plan. Changes in vulnerability can be identified by noting:

- Decreased vulnerability as a result of implementing recommended actions;

- Increased vulnerability as a result of failed or ineffective mitigation actions; and/or
- Increased vulnerability as a result of new development (and/or annexation).

Updates to this plan will:

- Consider changes in vulnerability due to project implementation;
- Document success stories where mitigation efforts have proven effective;
- Document areas where mitigation actions were not effective;
- Document any new hazards that may arise or were previously overlooked;
- Incorporate new data or studies on hazards and risks;
- Incorporate new capabilities or changes in capabilities;
- Incorporate growth and development-related changes to 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 the Dare County Emergency Manager, 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 Dare County Emergency Management 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 Town 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 Town 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 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 below.

Currituck County Placeholder

Dare County Placeholder

Town of Duck Placeholder

Town of Kill Devil Hills Placeholder

Town of Kitty Hawk Placeholder

Town of Manteo Placeholder

Town of Nags Head Placeholder

Town of Southern Shores Placeholder

Annex A Currituck County Unincorporated Areas

A.1 PLANNING PROCESS

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

Table A.1 – HMPC Members

Representative	Agency/Department	Position or Title
Jason Litteral, CFM	Planning and Community Development	Planner II
Jennie Turner, CFM, CZO	Planning and Community Development	Planner II
Mary Newns	Emergency Management Department	Emergency Management/Communications Director
Rebecca Gay	Emergency Management Department	Deputy Emergency Management Coordinator
Randall Edwards	Public Information Department	Information and Communications Officer
Lora Eddie	Stakeholder	Coastal Engagement Coordinator, The Nature Conservancy
Warren Eadus	Stakeholder	President, Quible and Associates, P.C.
Anthony Dickinson	Stakeholder	Agent, Farm Bureau Insurance Group
Jason Summerton	Stakeholder	Broker-in-Charge, Twiddy & Company, 4WD area

A.2 COMMUNITY PROFILE

Geography

Currituck County is located in the northeastern corner of the Coastal Plain of North Carolina. Its land area encompasses the mainland and barrier islands. The County comprises a total land area of 261.91 square miles.

According to data from the U.S. Fish and Wildlife Service's National Wetlands Inventory, there are approximately 3,424 acres of wetlands in Currituck County, primarily forested/shrub wetlands.

Figure A.1 shows a base map of Currituck County.

Figure A.1 – Location Map, Currituck County



Source: U.S. Census Bureau

Population and Demographics

Table A.2 provides population counts and growth estimates for Currituck County as compared to the Region overall. Table A.3 provides demographic information for the County as compared to the Region.

Table A.2 – Population Counts, Currituck County, 2010-2017

Jurisdiction	2000 Census Population	2010 Census Population	2017 ACS Population Estimate	Total Change 2010-2017	% Change 2010-2017
Region Total	**48,157**	**57,467**	**60,659**	**3,192**	**5.55%**
Currituck County	18,190	23,547	25,247	1,700	7.22%

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2013-2017 5-Year Estimates

Table A.3 – Racial Demographics, Currituck County, 2017

Jurisdiction	White, %	Black, %	Asian, %	Other Race, %	Two or More Races, %	Persons of Hispanic or Latino Origin*, %
Region Total	**91.0**	**3.5**	**0.5**	**2.2**	**2.7**	**5.7**
Currituck County	90.2	5.4	0.4	1.2	2.7	3.6

Source: US Census Bureau, American Community Survey 2013-2017 5-Year Estimates
*Persons of Hispanic origin may be of any race, so also are included in applicable race categories

Asset Inventory

The following tables summarize the Critical Infrastructure and Key Resources (CIKR) and high potential loss facilities identified in IRISK for Currituck County. Critical facilities, which include a subset of identified assets form the CIKR dataset as well as facilities identified by the HMPC, are shown in Figure A.2 on the following page and summarized in Table A.6. The County provided information is not included in IRISK vulnerability assessments. Note that the IRISK counts are by building; where a critical facility identified by IRISK comprises a cluster of buildings, each building is counted and displayed.

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

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	EM	Healthcare	Government Facilities	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Currituck County	431	20	1	758	3	144	0	29	117	1	0	161	4	16	19	**1,704**

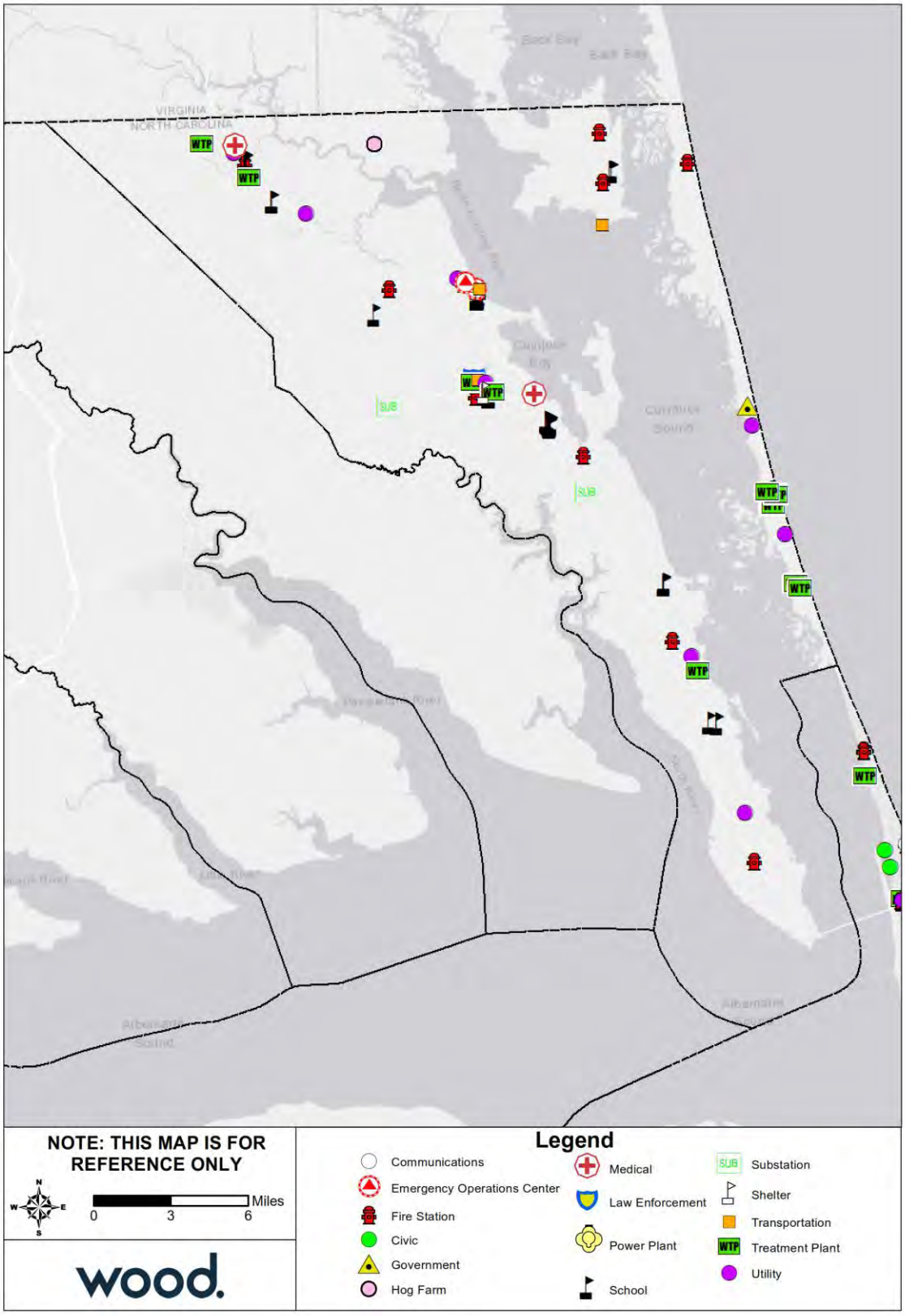
Source: NCEM Risk Management Tool

Table A.5 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Currituck County	11	21	0	16	1	5	5	**59**

Source: NCEM Risk Management Tool

Figure A.2 – Critical Facilities, Unincorporated Currituck County



Source: NCEM IRISK Database, HMPC input, GIS Analysis

Table A.6 – Critical Facilities, Currituck County

Facility Type	Count
Emergency Operations Center	2
Fire Station	13
Government	2
Hog Farm	1
Medical	2
Police Station	5
School	60
Shelter	1
Substation	2
Transportation	3
Treatment Plant	26
Utility	9
Total	**126**

Source: NCEM IRISK Database, HMPC input, GIS Analysis

To supplement the asset inventory and provide a clearer picture of the current asset exposure in Unincorporated Currituck County, current parcel data was evaluated to identify recent development not included in NCEM's IRISK database. Based on this analysis, Currituck County has significantly greater asset exposure that what is reflected in IRISK, with a building value increase of over 22 percent.

Table A.7 – Recent Development Not Included in IRISK

Recent Improved Parcels		IRISK Buildings		Percent Change	
Count	Value	Count	Value	Building Count	Building Value
3,399	$664,833,300	17,069	$2,979,468,915	19.9%	22.3%

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

Note: This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

There are 13 listings on the National Register of Historic Places for Currituck County, including one historic district. These sites are listed in the table below.

Table A.8 – Historic Properties

Ref#	Property Name	Status Date	Category	City
09001104	Jarvisburg Colored School	12/11/2009	Building	Jarvisburg
12001156	Coinjock Colored School	1/9/2013	Building	Coinjock
15000238	Flyway Club	5/12/2015	Building	Knotts Island
72000959	Twin Houses	4/13/1972	Building	Shawboro
73001333	Currituck Beach Lighthouse	10/15/1973	Structure	Corolla
79001697	Currituck County Courthouse and Jail	5/10/1979	Building	Currituck
80002816	Currituck Shooting Club	5/28/1980	Building	Corolla
80002817	Whalehead Club	4/16/1980	Building	Corolla
80002818	Baum Site	12/8/1980	Site	Poplar Branch
80002819	Culong	2/1/1980	Building	Shawboro
80002820	Shaw House	4/17/1980	Building	Shawboro
98001210	Grandy School, (Former)	9/25/1998	Building	Grandy
99000911	Currituck Beach Lighthouse Complex (Boundary Increase)	1/12/2000	District	Corolla

Source: National Parks Service, National Register of Historic Places, October 2018

Housing

The table below details key housing statistics for Currituck County as compared to the Region overall. As a percent of 2010 housing, Currituck County's housing stock experienced more growth than the Regional average, gaining nearly 900 new units between 2010 and 2017.

Table A.9 – Housing Statistics, Currituck County, 2010-2017

Jurisdiction	Housing Units (2010)	Housing Units (2017)	Housing Units Percent Change (2010-2017)	Owner-Occupied, % (2017)	Vacant Units, % (2017)	Median Home Value (2017)
Region Total	**47,945**	**49,616**	**3.5%**	**74.5**	**49.6**	**$285,000**
Currituck County	14,453	15,326	6.0%	82.5	36.3	$244,500

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2013-2017 5-Year Estimates
Note: Owner-Occupied and vacant-unit measures are reported as a percent of the total number of housing units.

Economy

The following tables present key economic statistics for Currituck County as compared to the Region overall.

Table A.10 – Employment Statistics, Currituck County, 2017

Jurisdiction	Population in Labor Force	Percent Employed* (%)	Percent Unemployed* (%)	Percent Not in Labor Force* (%)	Unemployment Rate (%)
Region Total	**32,463**	**61.7**	**3.3**	**34.4**	**5.0**
Currituck County	12,960	59.9	3.0	36.0	4.8

Source: U.S. Census Bureau, American Community Survey 2013-2017 5-Year Estimates
Note: This table reports only the civilian labor force. The labor force in armed services accounted for 0.6% of the population 16 and over across the region. Currituck County had a slightly higher population in the armed forces at 1.1%. *Population employed, population unemployed, and Population not in labor force are reported as a percent of the total population aged 16 years and older.

Table A.11 – Percent of Employed Population by Occupation, Currituck County, 2017

Occupation	Management, business, science and arts (%)	Service (%)	Sales and Office (%)	Natural Resources, Construction, and Maintenance (%)	Production, transportation, and material moving (%)
Region Total	**30.6**	**18.7**	**27.8**	**14.0**	**8.9**
Currituck County	30.3	17.2	27.4	16.2	9.0

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

Land Use and Future Development

Currituck County land use, environment, and development regulations are the responsibility of the Planning and Zoning Division. This division is also in charge of enforcing the Unified Development Ordinance. Existing land use policies were established in the Currituck County 2006 Land Use Plan. The County's comprehensive plan is currently being updated, and the 2040 Land Use Development vision plan, Imagine Currituck, is in draft stage. Both the 2006 Land Use Plan and the draft Imagine Currituck plan were referenced for this land use and future development analysis.

Current Land Use

The County is currently divided into seven land use categories. These categories are shown below with their total acreage in Table A.12.

Table A.12 – Land Use, Currituck County

Land Use	Total Acres	Percent of County (%)
Commercial	1,539	1.0
Industrial	2,021	1.0
Institutional	10,129	6.0
Residential	14,083	9.0
Other	1,943	1.0
Total Developed	*29,715*	*18.0*
Agriculture	45,134	29.0
Undeveloped	83,062	53.0
Total	**157,911**	**100**

Source: Currituck County 2006 Land Use Plan

Most of the county is undeveloped (53%). Of the 18 percent that is developed, residential is the highest percentage land use. Institutional land use includes locations such as churches, hospitals, and schools. The other land use category includes golf courses, cemeteries, and parking lots, etc.

Future Development

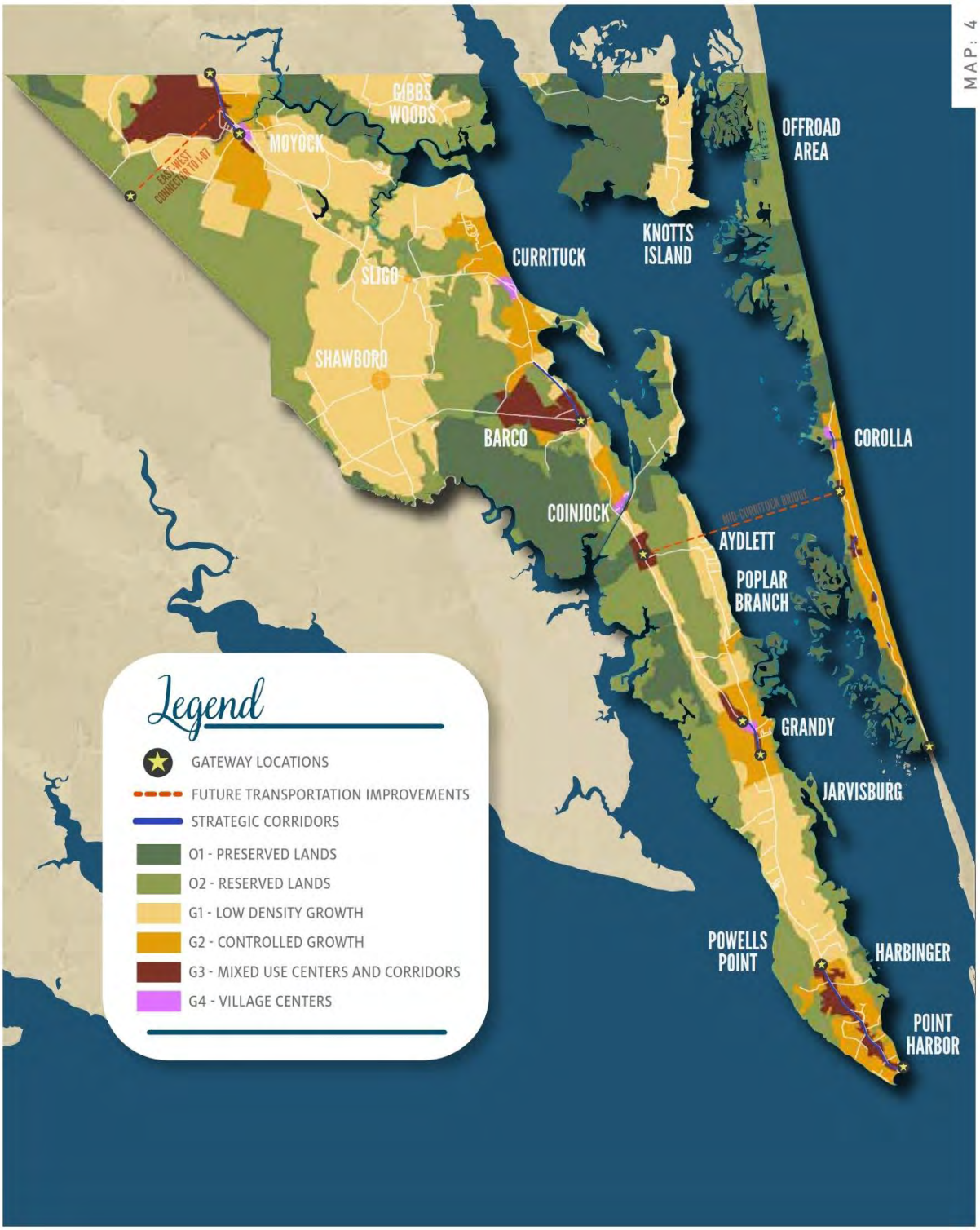
Future development and land use of the county is outlined in the Imagine Currituck draft plan. Instead of the seven Euclidean land use categories currently in effect throughout the county, the area will be split into six classifications under transect methodology. Each sector has a different balance between protected and developed land. These sectors will be

- O-1: Preserved Lands
- O-2: Reserved Lands
- G-1: Low Density Growth
- G-2: Controlled Growth
- G-3: Mixed-Use Center and Corridors
- G-4: Village Center

More information on future land use and development is available on the “Imagine Currituck” website. Figure A.3 on the following page shows the future land use of the County as envisioned in the Imagine Currituck draft plan. Changing the land classification system is the only major change between current and future land use in Currituck County.

The Imagine Currituck plan shows efforts to integrate land use and hazard mitigation planning; the land suitability analysis incorporates hazards areas, including flood areas, storm surge areas, and ocean erodible areas, into its assessment.

Figure A.3 – Currituck County Future Land Use Map from Imagine Currituck Draft Plan



Source: Imagine Currituck Draft Plan via www.imaginecurrituck.com

A.3 RISK ASSESSMENT

This section contains a hazard profile and vulnerability assessment for those hazards that were rated with a higher priority for Currituck County than for the Outer Banks Region as a whole. Risk and vulnerability findings are also presented here 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 Drought, Coastal Hazards, Flood, and Wildfire.

A.3.1 Drought

Drought was rated with a greater potential impact in Currituck County than for the Region overall to the greater amount of agricultural land at risk in Currituck County. Table A.13 details crop losses due to drought in the county from 2007 through 2017. Based on this data, Currituck County averages $56,060 annually in crop losses due to drought.

Table A.13 – Crop Losses Resulting from Drought, 2007-2017, Currituck

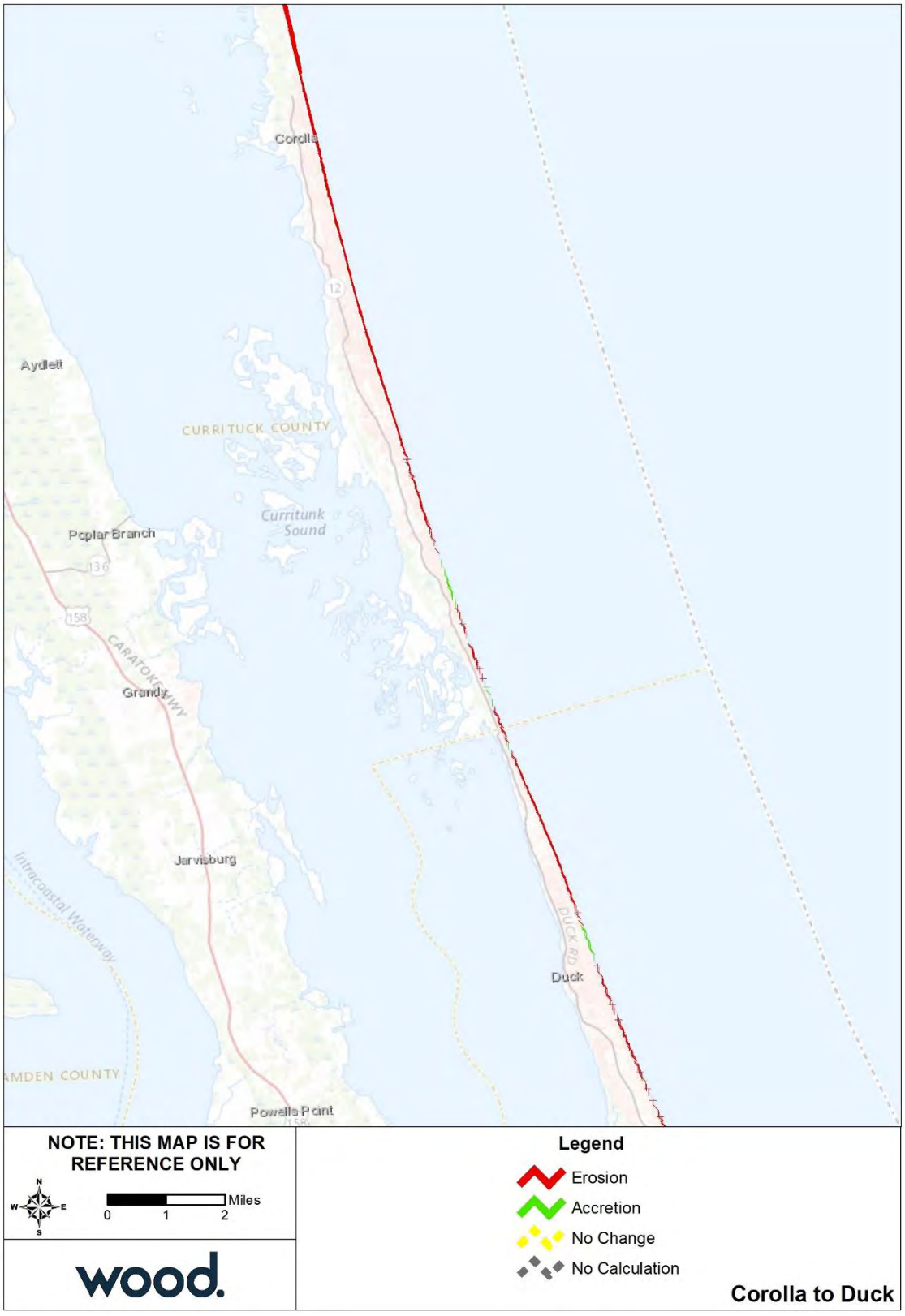
Year	Determined Acres	Indemnity Amount
2007	948.60	$84,250.00
2008	1,590.10	$75,505.00
2009	388.90	$18,154.00
2010	703.08	$33,932.00
2011	3,055.63	$240,606.00
2013	699.40	$55,230.00
2014	123.80	$1,534.00
2015	947.37	$71,537.10
2016	156.60	$18,449.50
2017	395.70	$17,466.00
Total	**9,009.18**	**$616,663.60**

Source: USDA Risk Management Agency

A.3.2 Coastal Hazards

Figure A.4 on the following page shows coastal erosion rates along developed areas of the Currituck County oceanfront coastline from Corolla to the County's southern border according to data from the DCM 2019 Long-Term Average Annual Erosion Rate Update Study. Most of the developed oceanfront coastline of Currituck County is experiencing erosion.

Figure A.4 – Erosion Rates, Currituck County



Source: North Carolina Division of Coastal Management

A.3.3 Flood

Table A.14 details the acreage of Currituck County's total area by flood zone on the 2006 DFIRM. Per this assessment, over 69 percent of the County falls within the mapped 1%-annual-chance floodplains.

Table A.14 – 2006 Flood Zone Acreage in Currituck County

Flood Zone	Acreage	Percent of Total (%)
Zone A	4,294.32	1.5%
Zone AE	123,599.46	43.4%
Zone VE	70,531.84	24.8%
Zone X (500-year)	15,108.54	5.3%
Zone X Unshaded	51,271.99	18.0%
Open Water	19,716.44	6.9%
Total	**284,522.59**	

Source: FEMA 2006 DFIRM

Figure A.5 reflects the mapped flood hazard zones for Currituck County, and Figure A.6 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood. These maps display the flood hazard according to the 2006 DFIRM, which is used in the IRISK database for vulnerability assessment. The County received a new effective DFIRM in 2018 which resulted in significant changes to the mapped flood hazard area. The 2018 effective DFIRM is shown in Figure A.7 and summarized in Table A.15.

Table A.15 – 2018 Flood Zone Acreage in Currituck County

Flood Zone	Acreage	Percent of Total (%)
Zone A	3,335.81	1.2%
Zone AE	156,091.14	54.8%
Zone VE	7,739.28	2.7%
Zone X (500-year)	6,877.98	2.4%
Zone X Unshaded	76,815.70	27.0%
Open Water	33,744.30	11.9%
Total	**284,604.21**	

Source: FEMA 2006 DFIRM

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the Currituck County, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. According to this assessment, roughly 43 percent of recent development in Currituck County is located in or near the SFHA.

Table A.16 – Recent Development at Risk to Flood, Currituck County

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
1,463	$303,181,700	43.0%	45.6%

Source: Parcel data retrieved November 2019; FEMA 2006 DFIRM

Table A.17 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector for the 1% annual chance flood event in Currituck County. Table A.18 provide building counts and estimated damages for High Potential Loss Properties exposed to the 1% annual chance flood.

Table A.17 – Critical Facilities Exposed to Flooding, Currituck County

Sector	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	36	$768,397
Critical Manufacturing	5	$21,547
Food and Agriculture	41	$136,631
Government Facilities	4	$107,252
Transportation Systems	5	$22,834
All Categories	**91**	**$1,056,661**

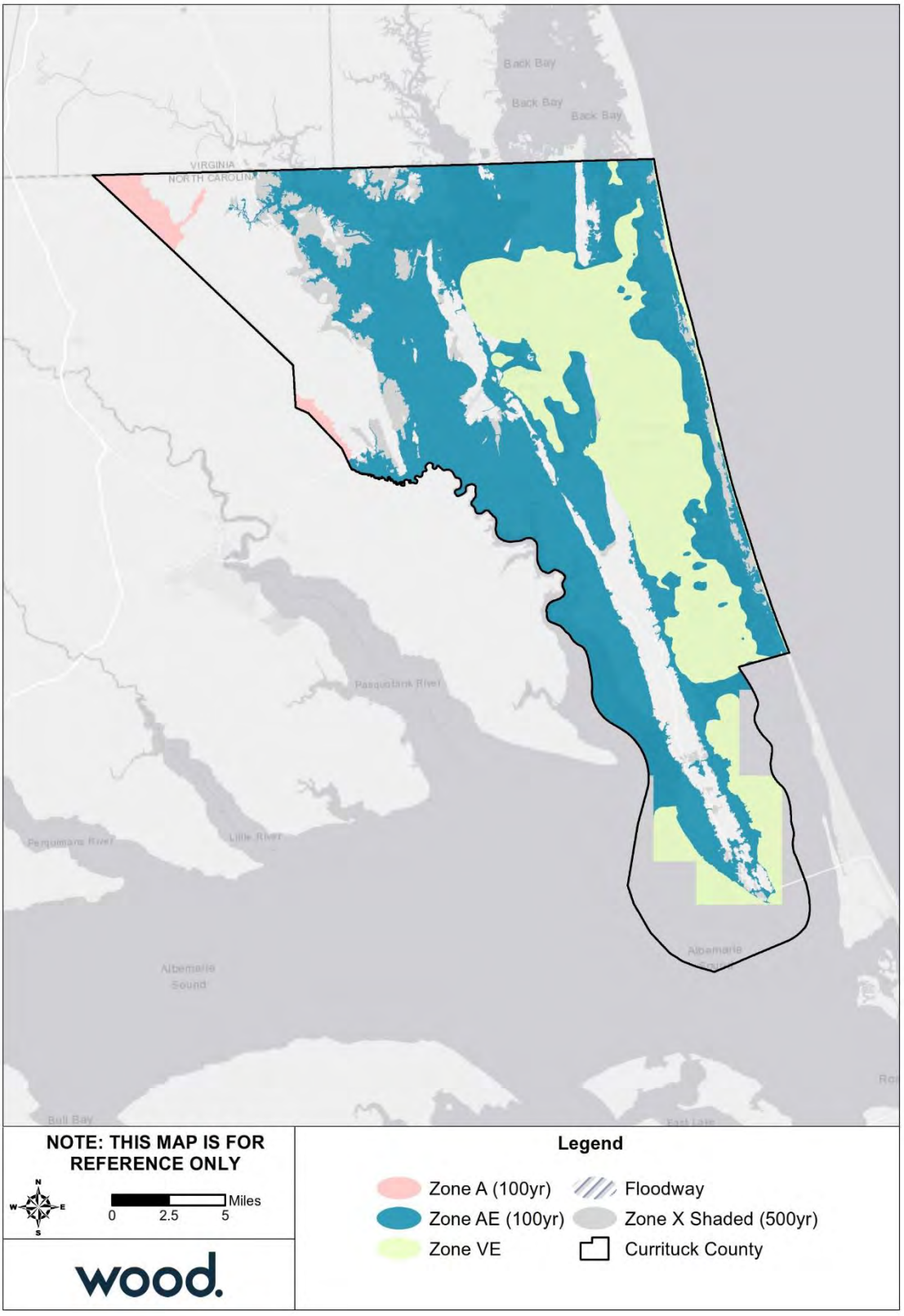
Source: NCEM Risk Management Tool

Table A.18 – High Potential Loss Properties Exposed to Flooding, Currituck County

Sector	Number of Buildings at Risk	Estimated Damages
Commercial	1	$175,132
Residential	5	$287,510
All Categories	**6**	**$462,642**

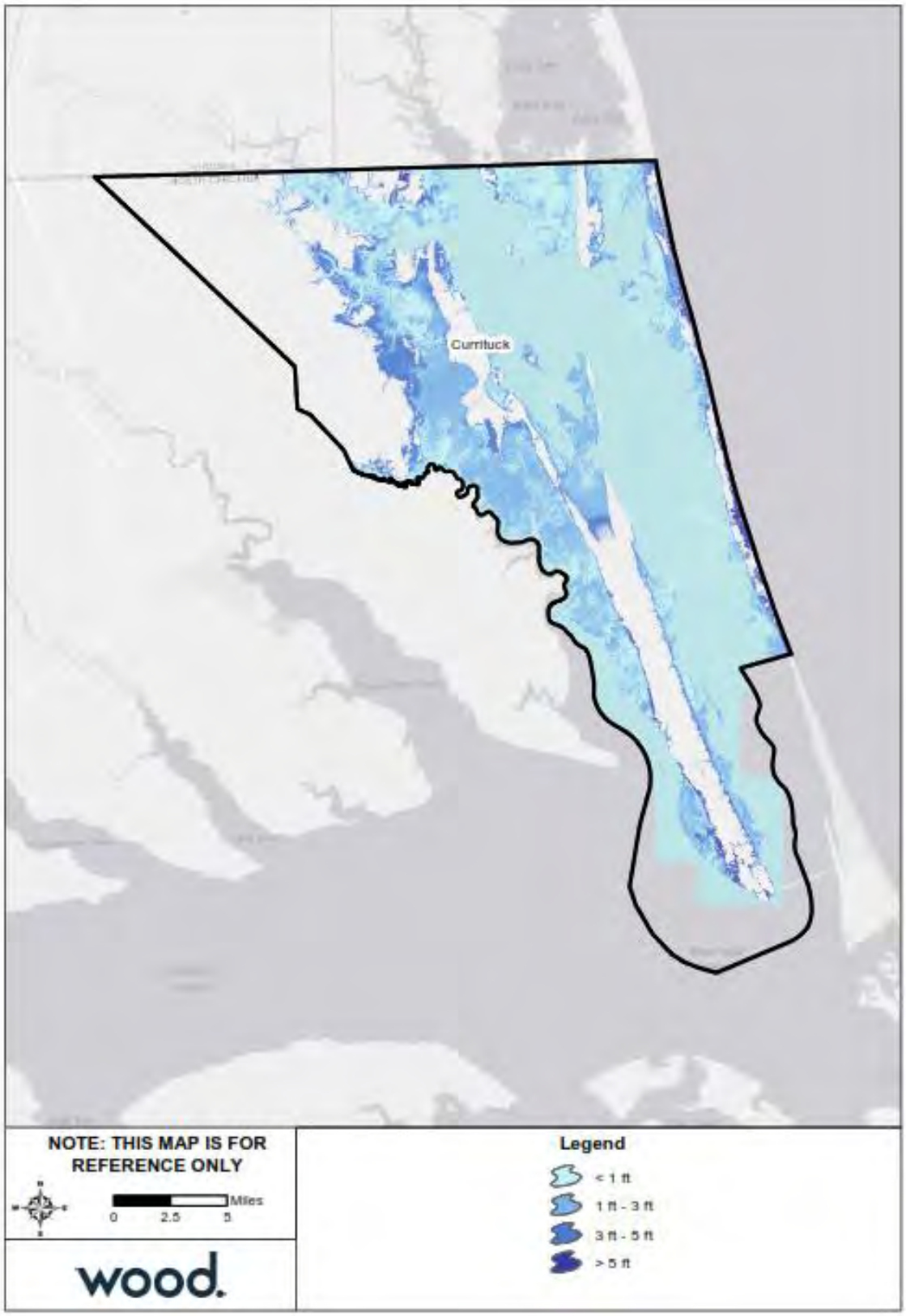
Source: NCEM Risk Management Tool

Figure A.5 – FEMA Flood Hazard Areas, 2006, Currituck County



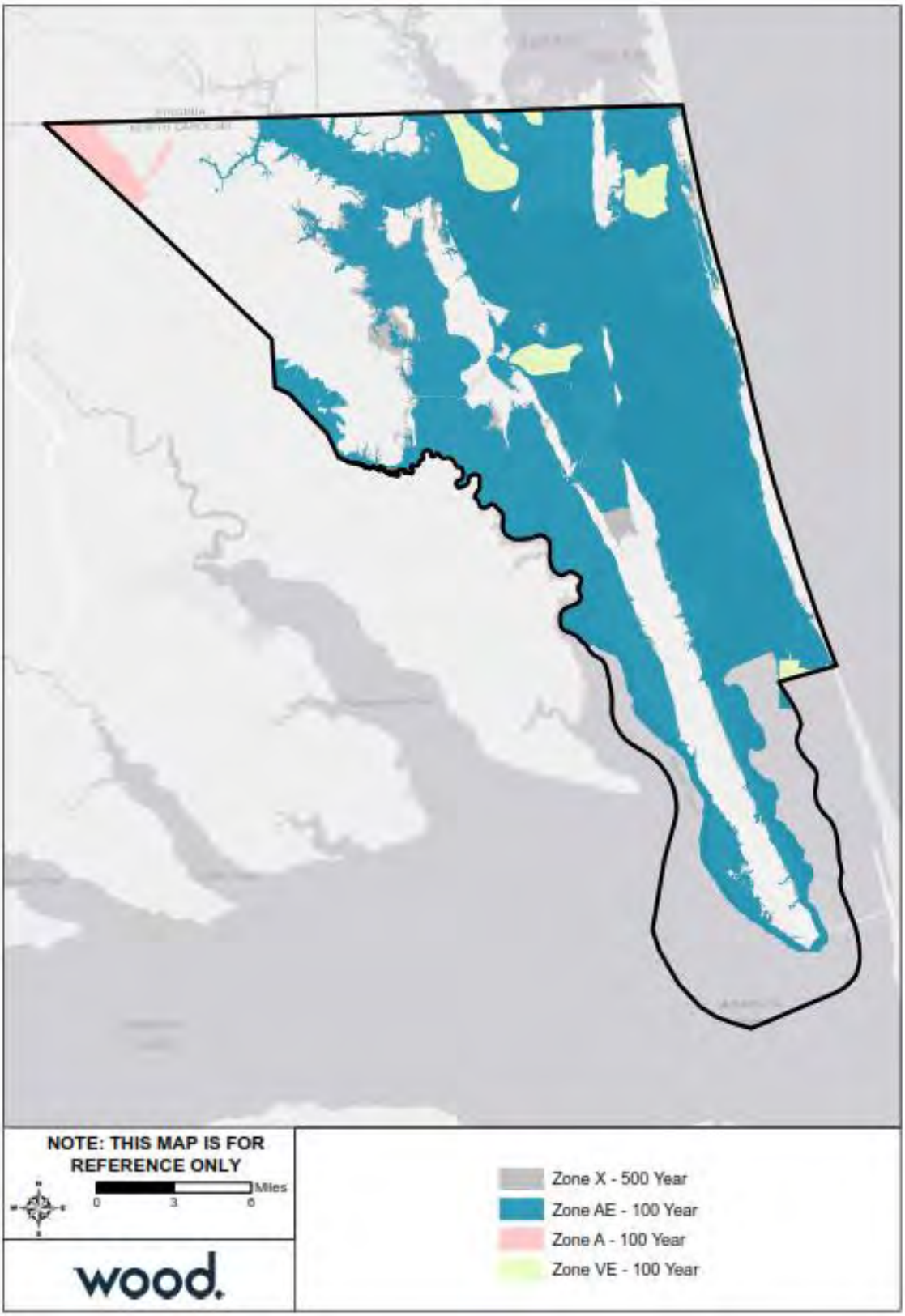
Source: FEMA 2006 DFIRM

Figure A.6 – Flood Depth, 1%-Annual-Chance Floodplain, 2006, Currituck County



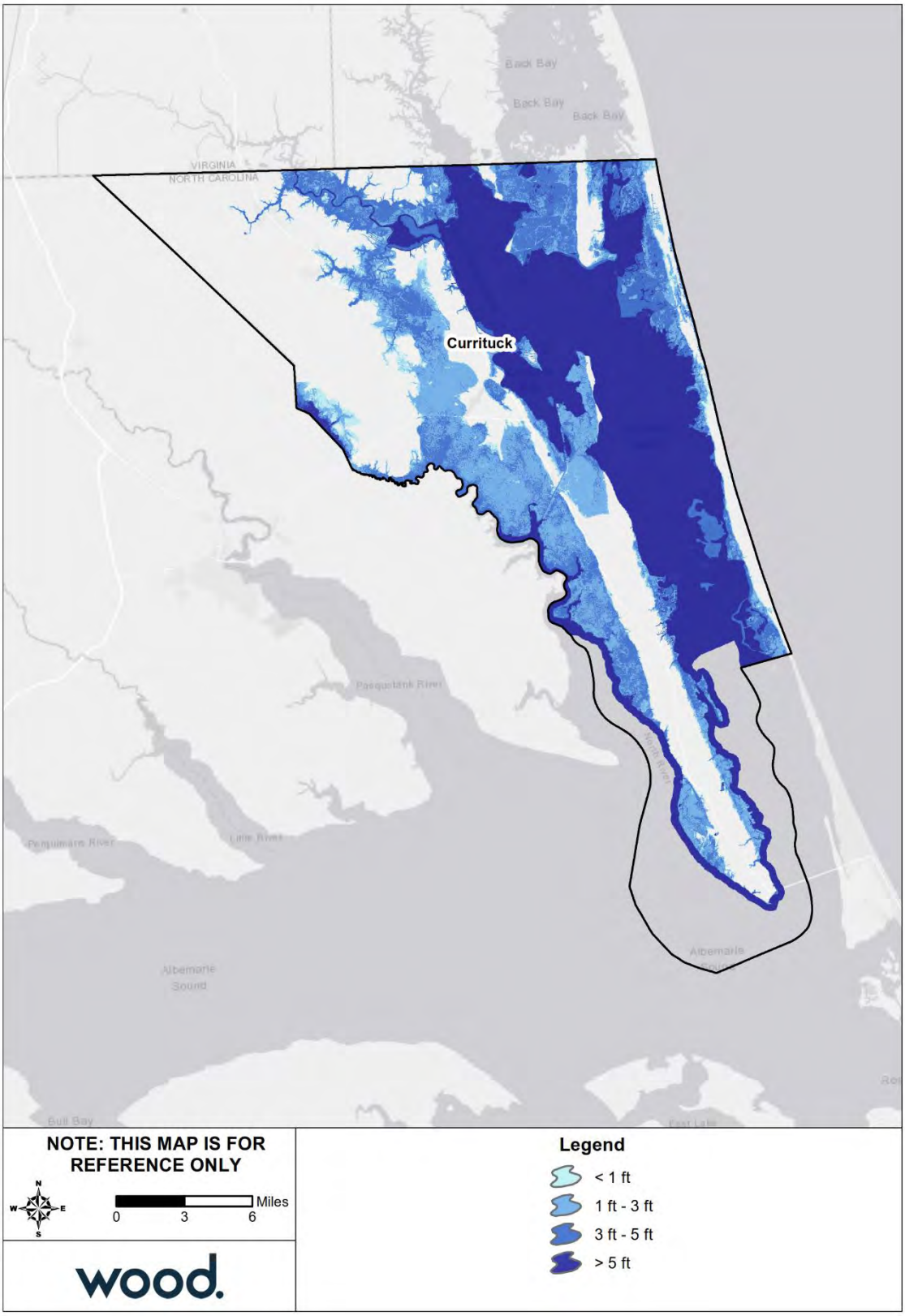
Source: FEMA 2006 DFIRM

Figure A.7 – FEMA Flood Hazard Areas, 2018, Currituck County



Source: FEMA 2018 DFIRM

Figure A.8 – Flood Depth, 1%-Annual-Chance Floodplain, 2018, Currituck County



Source: FEMA 2006 DFIRM

A.3.4 Wildfire

Table A.19 summarizes the acreage in Currituck County that falls within the Wildland Urban Interface (WUI), categorized by housing density. Areas in the WUI are those where development may intermix with flammable vegetation. Nearly 80 percent of Currituck County is not included in the WUI.

Table A.19 – Wildland Urban Interface Acreage, Currituck County

	Housing Density	Total Acreage	Percent of Total Acreage
	Not in WUI	*226,103.3*	*79.7%*
	LT 1hs/40ac	11,332.0	4.0%
	1hs/40ac to 1hs/20ac	6,998.6	2.5%
	1hs/20ac to 1hs/10ac	10,471.7	3.7%
	1hs/10ac to 1hs/5ac	9,712.2	3.4%
	1hs/5ac to 1hs/2ac	11,452.8	4.0%
	1hs/2ac to 3hs/1ac	7,562.7	2.7%
	GT 3hs/1ac	185.3	0.1%
	Total	**283,818.5**	

Source: Southern Wildfire Risk Assessment

Figure A.9 depicts the WUI for Currituck County. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure A.10 depicts the Fire Intensity Scale, which indicates the potential severity of fire based on fuel loads, topography, and other factors. Figure A.11 depicts Burn Probability based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts.

Potential fire intensity is highest along the soundside and North River shorelines; however, these areas have low to moderate burn probability and/or are largely outside of the WUI, meaning little to no development is at risk. The areas of greatest risk in the County are in and around small unincorporated communities including Harbinger, Powells Point, Coinjock, Currituck, and Moyock where moderate fire intensity and burn probability abut or surround WUI areas.

Table A.20 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard in Currituck County. Table A.21 provides counts and estimated damages for High Potential Loss Properties in Currituck County.

Table A.20 – Critical Facilities Exposed to Wildfire, Currituck County

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	12	$3,774,798
Chemical	1	$78,007
Commercial Facilities	489	$321,595,298
Communications	2	$1,603,225
Critical Manufacturing	109	$60,728,311
Emergency Services	8	$14,558,656
Energy	4	$20,363,915
Food and Agriculture	223	$14,503,941

Sector	Number of Buildings at Risk	Estimated Damages
Government Facilities	75	$115,026,856
Healthcare and Public Health	26	$13,563,814
Nuclear Reactors, Materials and Waste	1	$327,280
Transportation Systems	107	$68,696,604
Water	11	$1,252,630
All Categories	**1,068**	**$636,073,335**

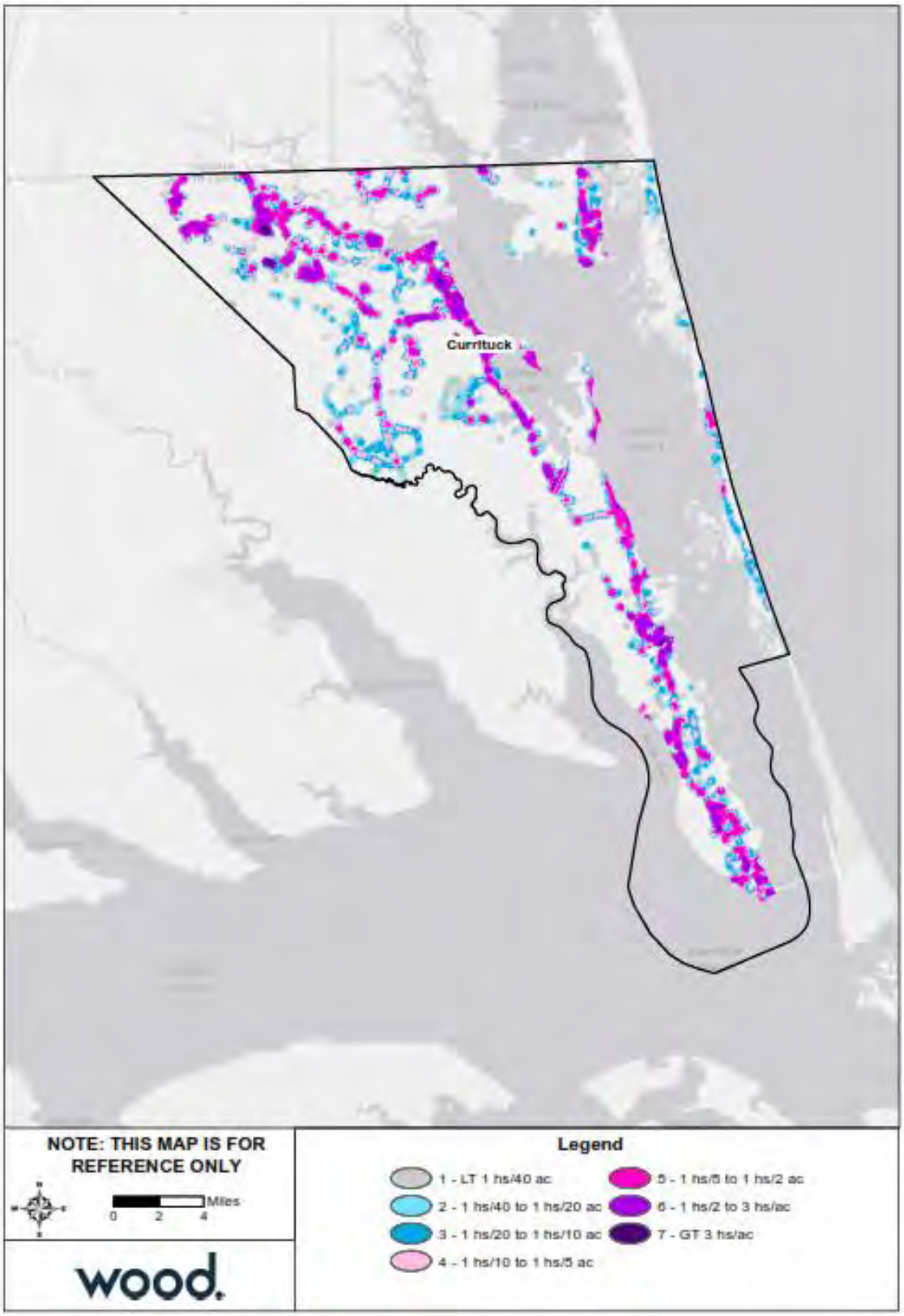
Source: NCEM Risk Management Tool

Table A.21 – High Potential Loss Properties Exposed to Wildfire, Currituck County

Category	Number of Buildings at Risk	Estimated Damages
Agricultural	1	$1,147,900
Commercial	8	$28,037,171
Government	8	$45,318,493
Religious	3	$12,244,019
Residential	3	$5,364,060
Utilities	2	$20,000,000
All Categories	**25**	**$112,111,643**

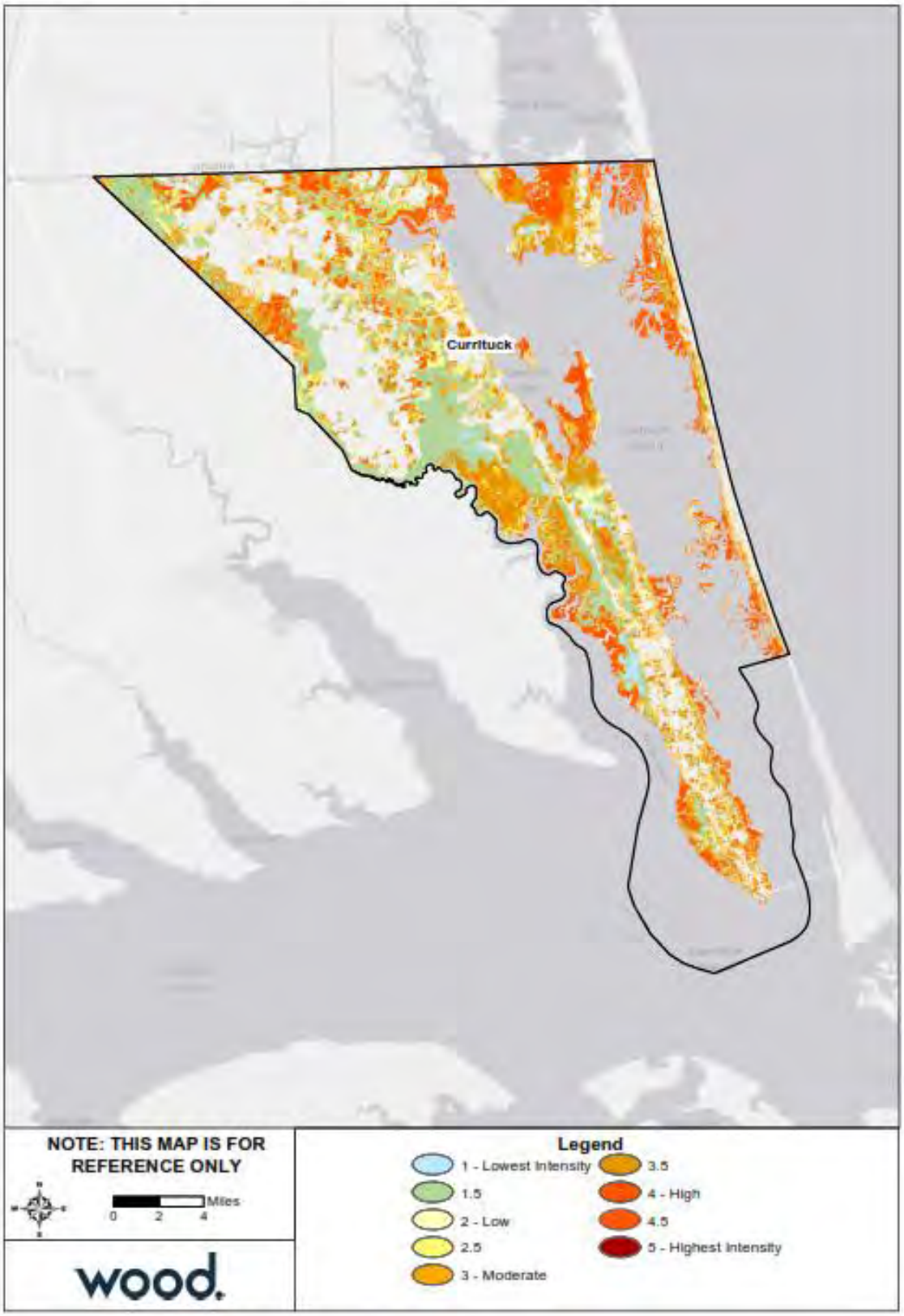
Source: NCEM Risk Management Tool

Figure A.9 – Wildland Urban Interface, Currituck County



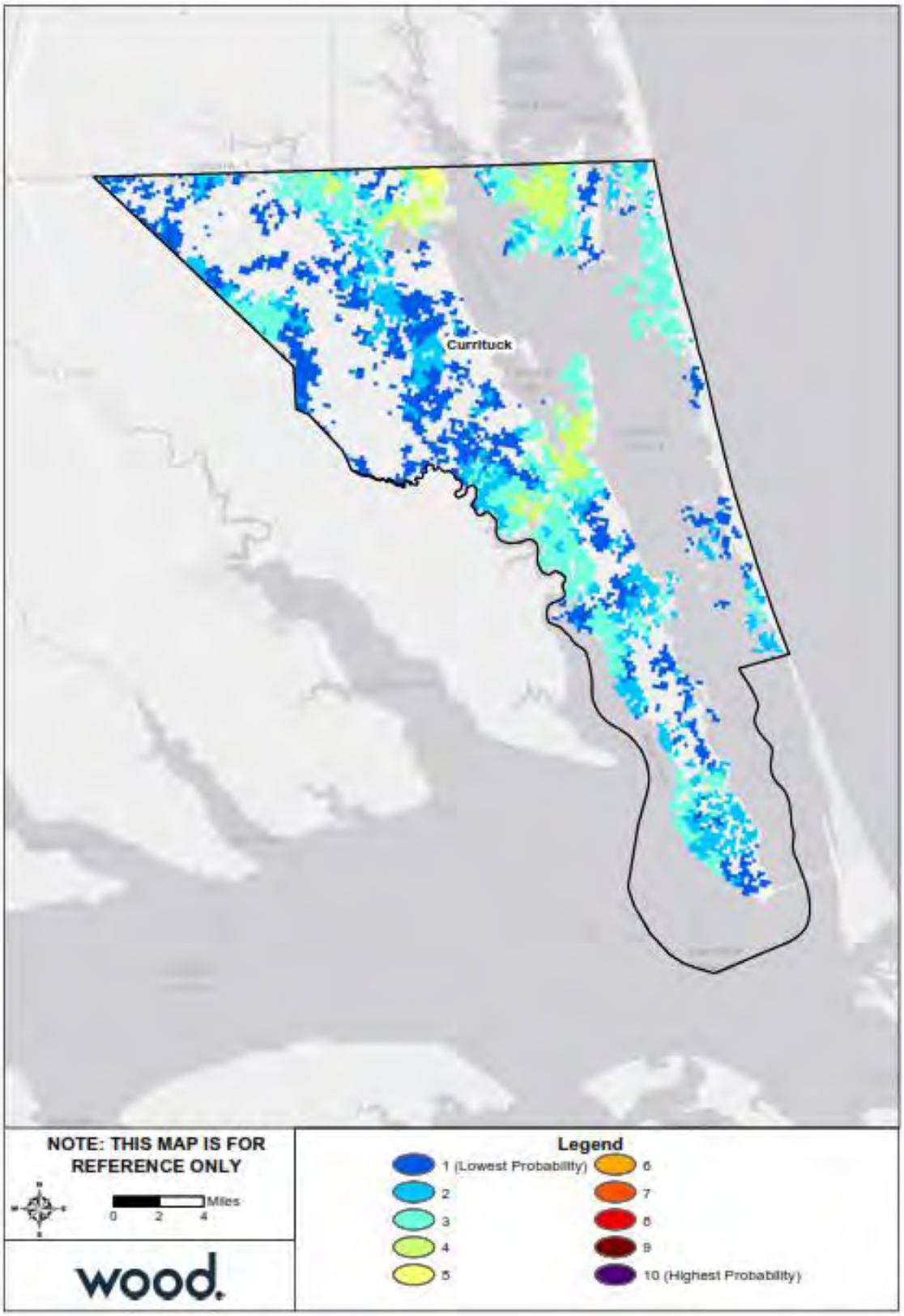
Source: Southern Wildfire Risk Assessment

Figure A.10 – Fire Intensity Scale, Currituck County



Source: Southern Wildfire Risk Assessment

Figure A.11 – Burn Probability, Currituck 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 Currituck 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, Currituck County has an overall capability rating of Moderate. The County's Self-Assessment of key capability areas is summarized in Table A.22 below.

Table A.22 – Capability Self-Assessment, Currituck County

Capability Area	Rating
Plans, Ordinances, Codes and Programs	High
Administrative and Technical Capability	High
Fiscal Capability	High
Education and Outreach Capability	Moderate
Mitigation Capability	Moderate
Political Capability	Moderate
Overall Capability	High

A.4.2 Floodplain Management

Currituck County joined the NFIP emergency program in 1974 and has been a regular participant in the NFIP since November 1984. 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.23 – NFIP Policy and Claims Data by Structure Type

Structure Type	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
Single Family	4,456	$2,714,413	$1,342,976,300	1,323	$19,022,562.92
2-4 Family	19	$9,608	$5,630,300	8	$155,401.48
All Other Residential	51	$17,614	$10,328,300	5	$69,279.51
Non-Residential	118	$174,410	$45,486,000	29	$687,062.66
Total	**4,644**	**$2,916,045**	**$1,404,420,900**	**1,365**	**$19,934,306.57**

Source: FEMA Community Information System, accessed December 2019

Table A.24 – 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	1,503	$1,014,145	$369,292,900	537	$6,637,829.15
A Zones	4	$4,736	$453,000	6	$87,749.00
V01-30 & VE Zones	23	$124,224	$6,121,700	10	$134,764.42
B, C & X Zone					
Standard	329	$578,331	$95,518,800	393	$6,288,386.82
Preferred	2,780	$1,191,609	$932,860,000	414	$6,779,957.11
Total	**4,639**	**$2,913,045**	**$1,404,246,400**	**1,360**	**$19,928,686.50**

Source: FEMA Community Information System, accessed December 2019

Table A.25 – 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	379	$442,458	$74,556,700	327	$5,139,658.27
A Zones	3	$4,394	$362,000	5	$58,179.72
V01-30 & VE Zones	4	$14,519	$595,000	4	$47,121.46
B, C & X Zone	304	$177,479	$89,935,600	64	$1,005,106.10
Standard	46	$71,229	$11,682,600	27	$523,965.88
Preferred	258	$106,250	$78,253,000	37	$481,140.22
Total	**690**	**$638,850**	**$165,449,300**	**400**	**$6,250,065.55**

Source: FEMA Community Information System, accessed December 2019

Table A.26 – NFIP Policy and Claims Data Post-FIRM

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	1,124	$571,687	$294,736,200	210	$1,498,170.88
A Zones	1	$342	$91,000	1	$29,569.28
V01-30 & VE Zones	19	$109,705	$5,526,700	6	$87,642.96
B, C & X Zone	2,805	$1,592,461	$938,443,200	743	$12,063,237.83
Standard	283	$507,102	$83,836,200	366	$5,764,420.94
Preferred	2,522	$1,085,359	$854,607,000	377	$6,298,816.89
Total	**3,949**	**$2,274,195**	**$1,238,797,100**	**960**	**$13,678,620.95**

Source: FEMA Community Information System, accessed December 2019

A.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
CUR1	Establish appropriate buffers/setbacks between critical facilities and other uses that may be incompatible	All Hazards	2.1	High	Planning	General Fund	On going	Carried Forward	Planning staff will coordinate with Emergency Management to evaluate current and planned critical facilities and determine where setbacks/buffers need to be maintained or increased. Need to re-evaluate this action in plan update.
CUR2	Maintain partnerships with adjacent counties and municipalities to leverage and share resources.	All Hazards	2.2	Moderate	Emergency Management	General Fund	On going	Carried Forward	Continuous - county-to-county mutual aid agreement
CUR3	Encourage clustering of residential lots outside of hazard areas in subdivision design/review and discourage development intensity and infrastructure improvements in known hazard areas	All Hazards	3.1	Moderate	Planning	General Fund	On going	Carried Forward	This is somewhat addressed by ordinance language but will be reinforced by policies in the new Land Use Plan.
CUR4	Direct development away from high-risk and vulnerable areas and establish redevelopment standards that decrease hazard risk	All Hazards	3.1	High	Planning	General Fund	On going	Carried Forward	We allow higher density development as an incentive for developers to place special flood hazard area portions of large tracts in perpetual conservation. Need to change to "Encourage" instead of "Direct." Conservation subdivision option in UDO. The new Coastal Resilience tool should also assist with this action.
Natural Resource Protection									
CUR5	Preserve natural environmental features to naturally absorb water run-off and serve as wind buffers	Coastal Hazards, Flood, Hurricane & Tropical Storm, Severe Weather	3.2	Moderate	Planning	General Fund	On going	Carried Forward	Our Unified Development Ordinance contains provisions for preserving existing vegetation for buffers as well as preservation of wetland areas. Our stormwater manual contains water quality standards as well.
CUR6	Retain vegetation and require buffers in areas adjacent to wetlands, water bodies and Maritime forests	Coastal Hazards, Flood, Hurricane & Tropical Storm, Severe Weather	3.2	Moderate	Planning	General Fund	On going	Carried Forward	This is ongoing through a combination of wetland buffers, implementation of CAMA regulations, and heritage tree protection standards.
CUR7	Evaluate allocating a portion of occupancy tax toward the dune protection program and shoreline restoration.	Coastal Hazards, Flood, Hurricane & Tropical Storm, Severe Weather	3.2	High	Planning	Occ Tax	On going	Carried Forward	We are currently offering $15,000 annually to the dune planting grant program.
CUR8	Work in conjunction with the Division of Coastal Management and the GIS Coordinator to track the extent of local beach erosion and annually produce a "State of the Beach" report	Coastal Hazards	3.3	Moderate	Planning	General Funds	On going	Carried Forward	There has been no progress towards completing this action.
CUR9	Create maps reflecting the historical migration of the marsh to track erosion	Coastal Hazards	3.3	Moderate	Planning, GIS	General Funds	On going	Carried Forward	There has been no progress towards completing this action.
Structural Projects									
CUR10	Seek funding for public hazard mitigation projects.	All Hazards	1.2	Moderate	Emergency Management	Grant	On going	Carried Forward	County will continue to seek mitigation funding. Submitted 7 properties for elevation under Flood Mitigation Assistance grant program (2018); application currently under review with FEMA. Submitted 8 properties for HMGP - elevation following Hurricane Matthew but projects were not considered cost beneficial. Grant writing and monitoring added to Soil & Water admin position. Also monitoring EPA flood reduction grants.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
CUR11	Continue to support efforts for planning, design, and construction of the Mid-County bridge project.	All Hazards	3.3	Moderate	Planning	NC Turnpike Authority	5 years	Carried Forward	Planning staff is working on terminus designs and studying impacts to properties on both sides of the bridge. Funding allocated in STIP for FY18; awaiting Record of Decision which should be issued spring/summer 2018.
CUR12	Identify bridges for retrofitting.	All Hazards	1.2	High	Planning	NCDOT	On going	Carried Forward	On going. Continuing to work with DOT to maintain roadways and the Wright Memorial Bridge.
CUR13	Secure funding, design, and construct an EOC/Public Safety Facility	All Hazards	3.3	High	Engineering/Emergency Management	General Fund/Grant	2 years	Carried Forward	Resolution for design-build project approved by BOC on March 5, 2018. Groundbreaking anticipated in late summer 2019.
Emergency Services									
CUR14	Maintain and work to improve radio communications and technology throughout public safety programs	All Hazards	4.2	High	Public Safety Agencies	General Funds and Grants	On going	Carried Forward	Continuous - Currently working on project to amplify the paging radio signal and broadcast it through a speaker system Inside fire departments. County is also pursuing county-wide broadband internet service.
CUR15	Provide continuous training and information for first responders in hazard response	All Hazards	4.1	High	Public Safety Agencies	General Funds and Grants	On going	Carried Forward	Ongoing
CUR16	Coordinate response to bridge incidents for the Wright Memorial Bridge	Transportation Infrastructure Failure	4.1	High	Public Safety Agencies	General Funds/Grants	On going	Carried Forward	Response agencies coordinate on a regular basis. OBX LEPC held exercise in Jan. 2019 in which agencies responded to multi-vehicle accident with hazardous materials on the Wright Memorial Bridge. The LEPC will use lessons learned to improve response.
Public Education & Awareness									
CUR17	Educate the public and inform them of the benefits of participation in the Fire Wise program.	Wildfire	1.1	High	Emergency Management	Grant	On going	Carried Forward	NCFS continues to promote FireWise. FireWise success story: Point Harbor Beach community only had one access into the subdivision. The subdivision borders county-owned property, Sound Park. The County worked with the Point Harbor Beach community to install a gate in the existing fence line to provide secondary egress from the community in the event of an emergency.
CUR18	Educate homeowners and builders on the benefits of sprinkler systems in residential structures	Wildfire	1.1	Moderate	Fire Marshal/Planning	General Fund	On going	Carried Forward	Ongoing through the fire marshal and planning department. The County requested special legislation to address life safety issues in residential structures greater than 5,000 sq. feet, to include a requirement for residential sprinkler system. The request was denied.
CUR19	Increase public awareness and understanding of the locations and proper way to dispose of hazardous waste	Hazardous Materials Incident	1.1	Moderate	Public Works	General Fund	On going	Carried Forward	PW continues to sponsor an annual household hazardous waste day
CUR20	Periodically survey the public to evaluate if public outreach efforts are effective in identifying potential flood hazards, public concern, and ways to mitigate against hazards	Coastal Hazards, Flood, Hurricane & Tropical Storm	1.1	Moderate	Planning	General Fund	On going	Carried Forward	The floodplain manager and the assistant planning director will work together to create a survey.
CUR21	Develop a joint public outreach document that addresses all hazards (published by the Planning and Emergency Management Departments)	All Hazards	1.1	High	Planning/Emergency Management	General Fund	On going	Carried Forward	The planning department and the emergency management department publish documents in the "Focus on Currituck" publication. New release of CRS Manual for 2018 requires greater public outreach efforts; revising public outreach campaign by August of 2018.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
CUR22	Evaluate effectiveness of Currituck's warning systems	All Hazards	1.1	High	Emergency Management	General Fund	On going	Carried Forward	Number of individuals registering for Currituck Alert provides a baseline for effectiveness of mass notification. Planning a campaign to increase awareness of ENS and increase number of subscribers.
CUR23	Educate and assist vulnerable populations in developing personal preparedness plans	All Hazards	1.1	High	Emergency Management	General Fund	On going	Carried Forward	Continuous
CUR24	Partner with other County Departments, State, local agencies to educate and inform vulnerable populations about special needs registry with Social Services through community outreach (survey, website, social media, water bill)	All Hazards	1.1	High	DSS, EM, PIO	General Fund	On going	Carried Forward	Continuous
CUR25	Create curriculums for all hazards preparedness to better educate the public	All Hazards	1.1	High	Emergency Management	General Fund/Grants	less than 5 years	Carried Forward	No progress
CUR26	Continue to educate elected officials and the public on the need for and benefits of sustained shoreline management strategies.	Coastal Hazards, Flood, Hurricane & Tropical Storm, Severe Weather	1.1	High	Planning	General Fund	On going	Carried Forward	Need status
CUR27	Educate property owners on the natural and beneficial functions of floodplains, watersheds, and other natural/coastal areas.	Coastal Hazards, Flood, Hurricane & Tropical Storm	3.2	Moderate	Planning	General Fund	On going	Carried Forward	We hope to include this information in our updated outreach project
CUR28	Educate the development and agricultural communities as well as the public on the impacts of turbidity on floodplain/natural areas and mitigating best management practices	Coastal Hazards, Flood, Hurricane & Tropical Storm	3.2	Moderate	Planning	General Fund	On going	Carried Forward	We will try to include this in the updated outreach project.
CUR29	Develop outreach materials and offer training on Low Impact Development (LID) best management practices that can be distributed to the public and engineering communities.	Coastal Hazards, Flood, Hurricane & Tropical Storm	3.2	High	Planning	General Fund	less than 5 years	Carried Forward	The stormwater manual addresses this. Training has not been offered yet.

Annex B Dare County Unincorporated Areas

B.1 PLANNING PROCESS

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

Table B.1 – HMPC Members

Representative	Agency/Department	Position or Title
Drew Pearson	Emergency Management	Director, Dare County Emergency Management
Donna Creef	Planning	Planning Director
Noah Gillam	Planning	Planner
Pat Weston	Citizen-Hatteras Island	Homeowners Association President, engaged citizen and community volunteer
Glenn Rainey	Citizen-Colington	Volunteer Fire Department Chief
Buddy Shelton	Citizen-Mainland Dare	Engaged Citizen and building inspector
John FInelli	Citizen-Martin Point	Homeowners Association member and planning board

B.2 COMMUNITY PROFILE

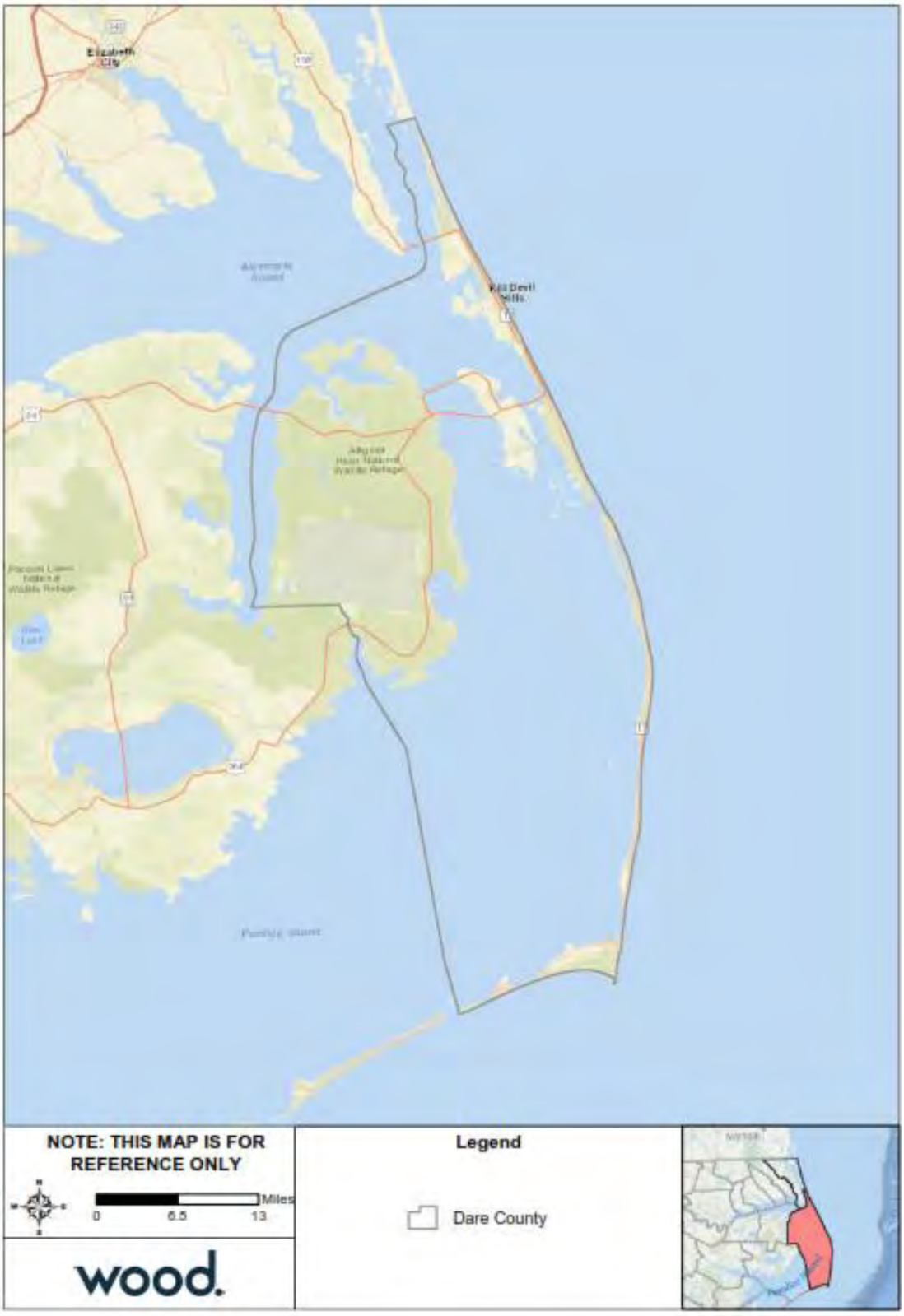
Geography

Dare County is located in the northeastern corner of the Coastal Plain of North Carolina. Its land area encompasses mainland, Roanoke Island, and barrier islands. The County comprises a total land area of 383.23 square miles, 354.64 square miles is unincorporated.

According to data from the U.S. Fish and Wildlife Service's National Wetlands Inventory, there are approximately 6,895 acres of wetlands in the unincorporated areas of Dare County.

Figure A.1 shows a base map of Dare County.

Figure B.1 – Location Map, Dare County



Source: U.S. Census Bureau

Population and Demographics

Table B.2 provides population counts and growth estimates for Dare County's unincorporated areas as compared to the Region overall. Table B.3 provides demographic information for Dare County's unincorporated areas as compared to the Region.

Table B.2 – Population Counts, Unincorporated Dare County, 2010-2017

Jurisdiction	2000 Census Population	2010 Census Population	2017 ACS Population Estimate	Total Change 2010-2017	% Change 2010-2017
Region Total	**48,157**	**57,467**	**60,659**	**3,192**	**5.55%**
Unincorporated Dare County	15,126	16,691	17,312	621	3.72%

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2013-2017 5-Year Estimates
Note: Unincorporated areas statistics calculated by subtracting jurisdiction counts from the county total.

Table B.3 – Racial Demographics, Unincorporated Dare County, 2017

Jurisdiction	White, %	Black, %	Asian, %	Other Race, %	Two or More Races, %	Persons of Hispanic or Latino Origin*, %
Region Total	**91.0**	**3.5**	**0.5**	**2.2**	**2.7**	**5.7**
Unincorporated Dare County	97.2	1.3	0.6	3.1	2.4	6.2

Source: US Census Bureau, American Community Survey 2013-2017 5-Year Estimates
*Persons of Hispanic origin may be of any race, so also are included in applicable race categories

Asset Inventory

The following tables summarize the Critical Infrastructure and Key Resources (CIKR) and high potential loss facilities identified in IRISK for Dare County. Critical facilities, which include a subset of identified assets form the CIKR dataset as well as facilities identified by the HMPC, are shown in Figure B.2 on the following page and summarized in Table B.6. The County provided information is not included in IRISK vulnerability assessments. Note that the IRISK counts are by building; where a critical facility identified by IRISK comprises a cluster of buildings, each building is counted and displayed.

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

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	EM	Healthcare	Government Facilities	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Dare County	18	14	0	553	0	100	1	11	101	1	1	51	5	10	13	**879**

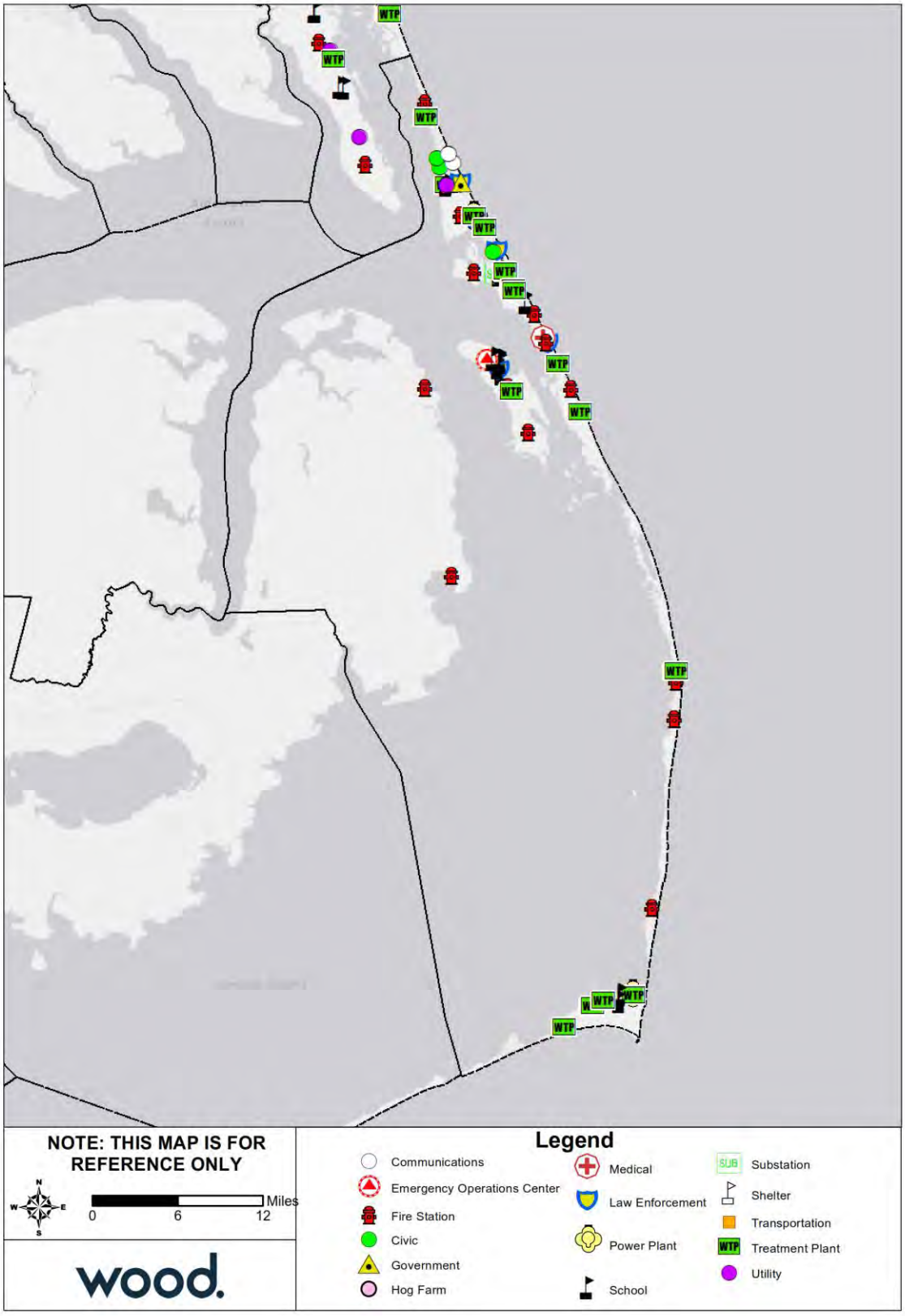
Source: NCEM Risk Management Tool

Table B.5 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Dare County	37	15	0	12	0	1	2	**67**

Source: NCEM Risk Management Tool

Figure B.2 – Critical Facilities, Unincorporated Dare County



Source: NCEM IRISK Database, HMPC input, GIS Analysis

Table B.6 – Critical Facilities, Unincorporated Dare County

Facility Type	Count
Emergency Operations Center	2
Fire Station	11
Power Plant	1
School	5
Treatment Plant	14
Total	**33**

Source: NCEM IRISK Database, HMPC input, GIS Analysis

To supplement the asset inventory and provide a clearer picture of the current asset exposure in Unincorporated Dare County, current parcel data was evaluated to identify recent development not included in NCEM's IRISK database. Based on this assessment, Dare County has experienced nearly a 9 percent increase in building value exposure compared to IRISK estimates.

Table B.7 – Recent Development Not Included in IRISK, Unincorporated Dare County

Recent Improved Parcels		IRISK Buildings		Percent Change	
Count	Value	Count	Value	Building Count	Building Value
945	$207,054,100	13,634	$2,386,317,125	6.9%	8.7%

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

Note: This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

There are 15 listings on the National Register of Historic Places for Dare County unincorporated areas, including one historic district. These sites are listed in the table below.

Table B.8 – Historic Properties, Unincorporated Dare County

Ref#	Property Name	Status Date	Category	City
01000558	Ballance, Ellsworth and Lovie, House	5/25/2001	Building	Hatteras
09000847	Midgett, Rasmus, House	10/21/2009	Building	Waves
13000780	E.M. CLARK (shipwreck and remains)	9/25/2013	Site	Cape Hatteras
13000781	DIXIE ARROW (shipwreck and remains)	9/25/2013	Site	Ocracoke
13000782	EMPIRE GEM (shipwreck and remains)	9/25/2013	Site	Cape Hatteras
15000541	LIGHT VESSEL 71 (shipwreck)	8/19/2015	Site	Buxton
15000806	U-701 (submarine) shipwreck and remains	11/12/2015	Site	Buxton
15000864	U-576 and BLUEFIELDS (shipwrecks and remains)	12/8/2015	Site	Hatteras
74002299	USS MONITOR	10/11/1974	Site	Cape Hatteras
75001253	Oregon Inlet Station	12/23/1975	Building	Rodanthe
76000164	Chicamacomico Life Saving Station	12/12/1976	Building	Rodanthe
78000266	Cape Hatteras Light Station	3/29/1978	District	Buxton
78000268	Hatteras Weather Bureau Station	2/17/1978	Building	Hatteras
93000997	Salvo Post Office	9/23/1993	Building	Salvo
100002802	C.S.S. CURLEW (side-wheel steamer)	8/31/2018	Structure	Mann's Harbor

Source: National Parks Service, National Register of Historic Places, October 2018

Housing

The table below details key housing statistics for Dare County unincorporated areas as compared to the Region overall. Growth in housing units as a percent change was greater in the unincorporated areas as compared to the Region overall.

Table B.9 – Housing Statistics, Unincorporated Dare County, 2010-2017

Jurisdiction	Housing Units (2010)	Housing Units (2017)	Housing Units Percent Change (2010-2017)	Owner-Occupied, % (2017)	Vacant Units, % (2017)	Median Home Value (2017)
Region Total	**47,945**	**49,616**	**3.5%**	**74.5**	**49.6**	**$285,000**
Unincorporated Dare County	12,351	13,052	5.7%	70.2	43.7	--

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2013-2017 5-Year Estimates
Note: Owner-Occupied and vacant-unit measures are reported as a percent of the total number of housing units.

Economy

The following tables present key economic statistics for Dare County unincorporated areas as compared to the Region overall.

Table B.10 – Employment Statistics, Unincorporated Dare County, 2017

Jurisdiction	Population in Labor Force	Percent Employed* (%)	Percent Unemployed* (%)	Percent Not in Labor Force* (%)	Unemployment Rate (%)
Region Total	**32,463**	**61.7**	**3.3**	**34.4**	**5.0**
Dare County	19,503	63.0	3.5	33.3	5.2

Source: U.S. Census Bureau, American Community Survey 2013-2017 5-Year Estimates
Note: This table reports only the civilian labor force. The labor force in armed services accounted for 0.6% of the population 16 and over across the region. *Population employed, population unemployed, and Population not in labor force are reported as a percent of the total population aged 16 years and older.

Table B.11 – Percent of Employed Population by Occupation, Unincorporated Dare County, 2017

Occupation	Management, business, science and arts (%)	Service (%)	Sales and Office (%)	Natural Resources, Construction, and Maintenance (%)	Production, transportation, and material moving (%)
Region Total	**30.6**	**18.7**	**27.8**	**14.0**	**8.9**
Dare County	30.9	19.8	28.0	12.5	8.8

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

Land Use and Future Development

The Dare County Planning Department is responsible for land-use planning in the unincorporated areas of the County. The County is currently updating their Land Use plan as of January 2020 and it has not yet been made available to the public. Current and future land use and development information provided below came from the 2009 Land Use Plan Update.

Current Land Use

Since the County has island geography and narrow strips of land, much of the development is located around the main transportation corridors. This resulted in the creation of multiple villages within unincorporated areas. There are 15 unincorporated "village" areas addressed in the 2009 Land Use Plan Update. These include Avon, Buxton, Frisco, Hatteras, Rodanthe, Waves, Salvo, Martin's Point, Colington, Roanoke Island, Wanchese, Manns Harbor, Mashoes, East Lake and Stumpy Point. The County is currently

divided into six land use categories. These categories are shown below with their total acreage in Table B.12.

Table B.12 – Land Use, Unincorporated Dare County

Land Use	Total Acres	Percent of County (%)
Residential	6,814	3.20
Commercial	1,057	0.50
Industrial	91	0.05
Institutional	2,056	0.97
Public	186,176	87.45
Total Developed	*196,195*	*92.17*
Undeveloped	16,681	7.83
Total	**212,876**	**100**

Source: Dare County 2009 Land Use Plan Update

Public land is undeveloped Federal, State, or County property. Institutional land use includes locations such as churches, hospitals, and schools. Most of the County is developed (92%) with 87 percent of the County land classified as public. Since most of the County is public land, there is competition for the remaining 13 percent. Much of the privately-owned land has already been developed.

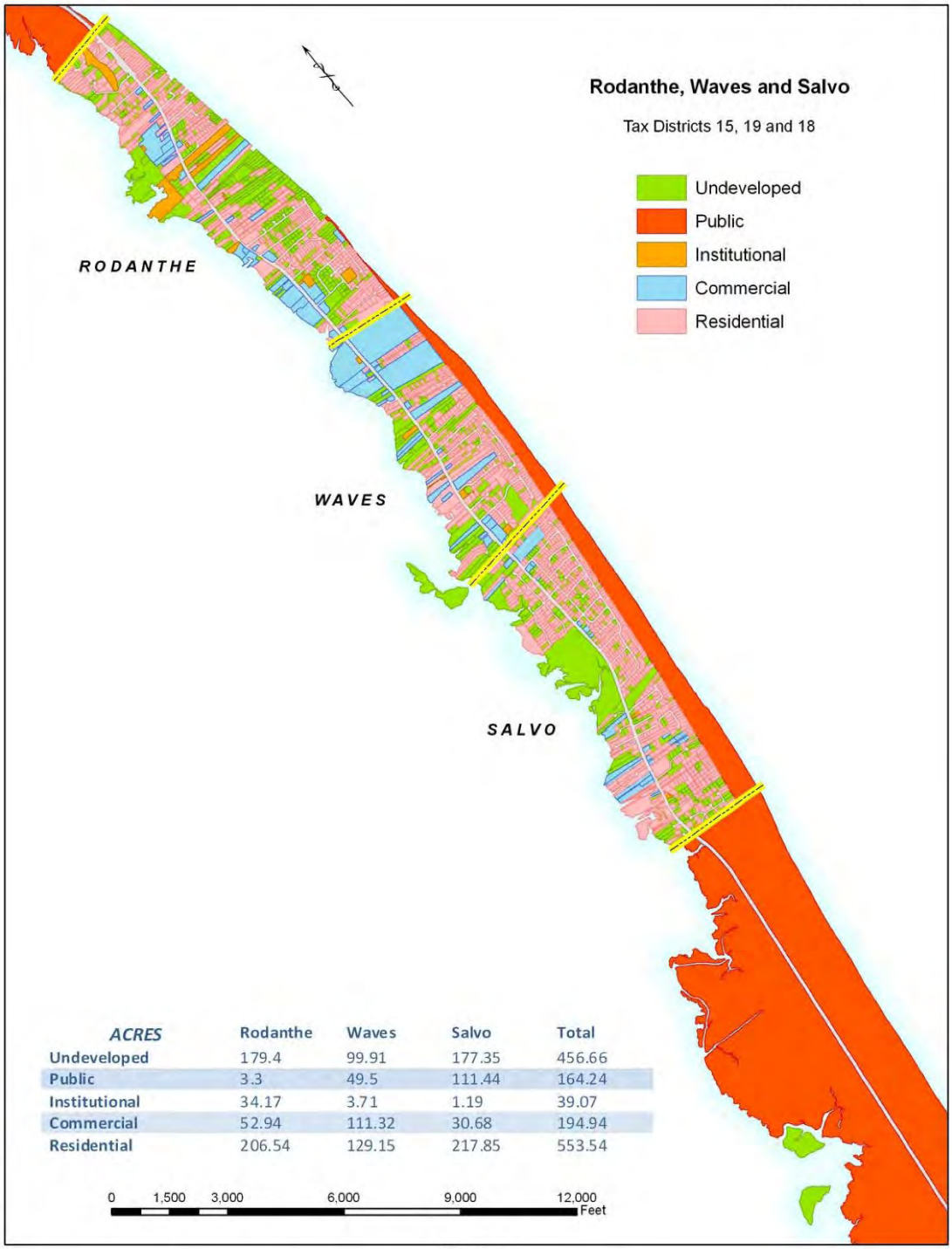
Future Development

As mentioned in the 2009 Land Use Plan Update, development will continue into the coming years with an emphasis on residential structures and limited commercial development. There is some re-development potential for some properties but that is difficult to predict. Development on Hatteras Island will most likely continue to outpace development in other areas of unincorporated Dare County.

Future development within the county will use the same six classifications as it already uses. Figure B.3 through Figure B.13 on the following pages show the future land use maps of unincorporated Dare County as envisioned in the 2009 Land Use Plan Update.

Figure B.3 – Dare County Future Land Use Map, Rodanthe, Waves, and Salvo

MAP 13A



ACRES	Rodanthe	Waves	Salvo	Total
Undeveloped	179.4	99.91	177.35	456.66
Public	3.3	49.5	111.44	164.24
Institutional	34.17	3.71	1.19	39.07
Commercial	52.94	111.32	30.68	194.94
Residential	206.54	129.15	217.85	553.54

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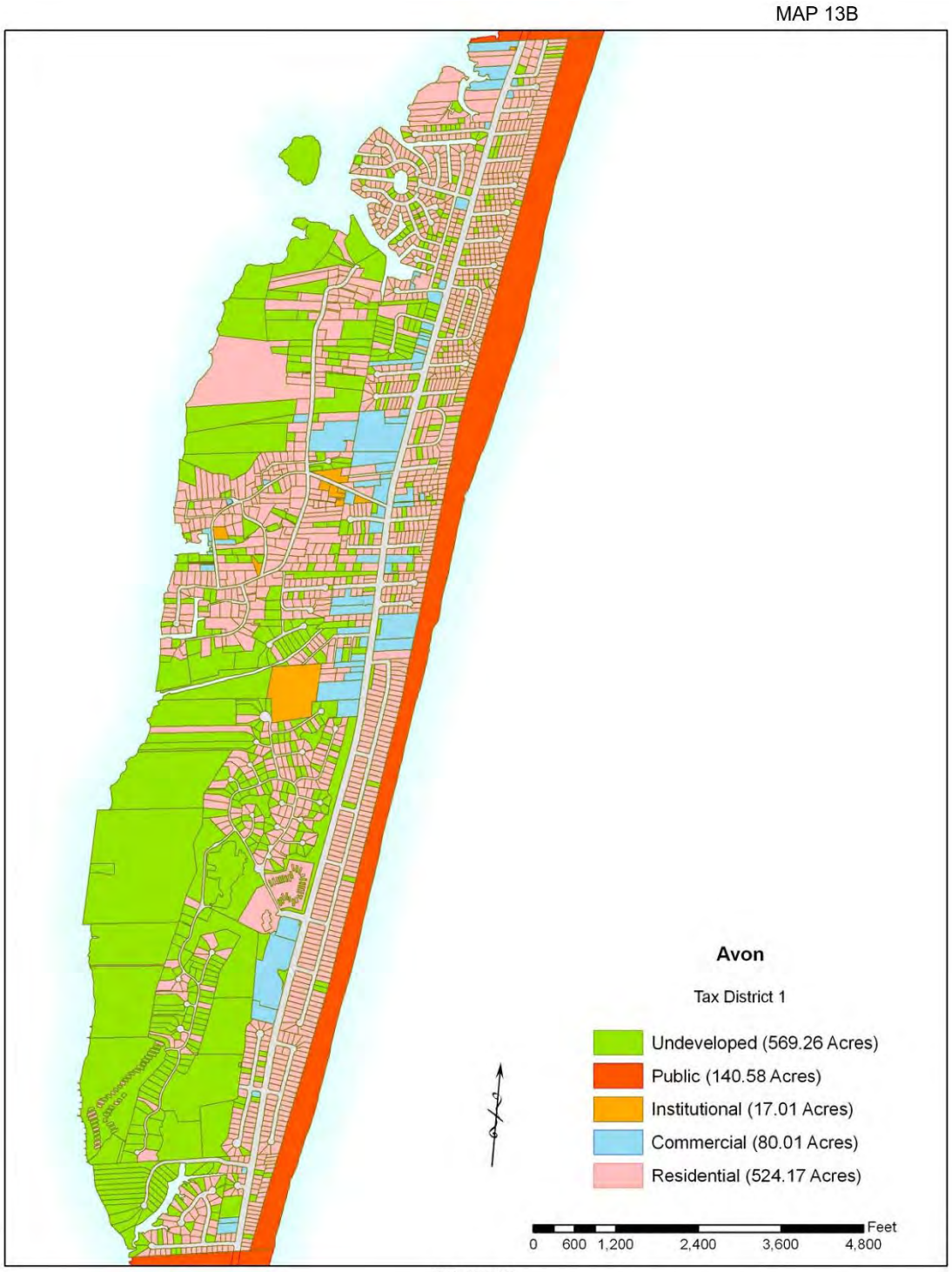
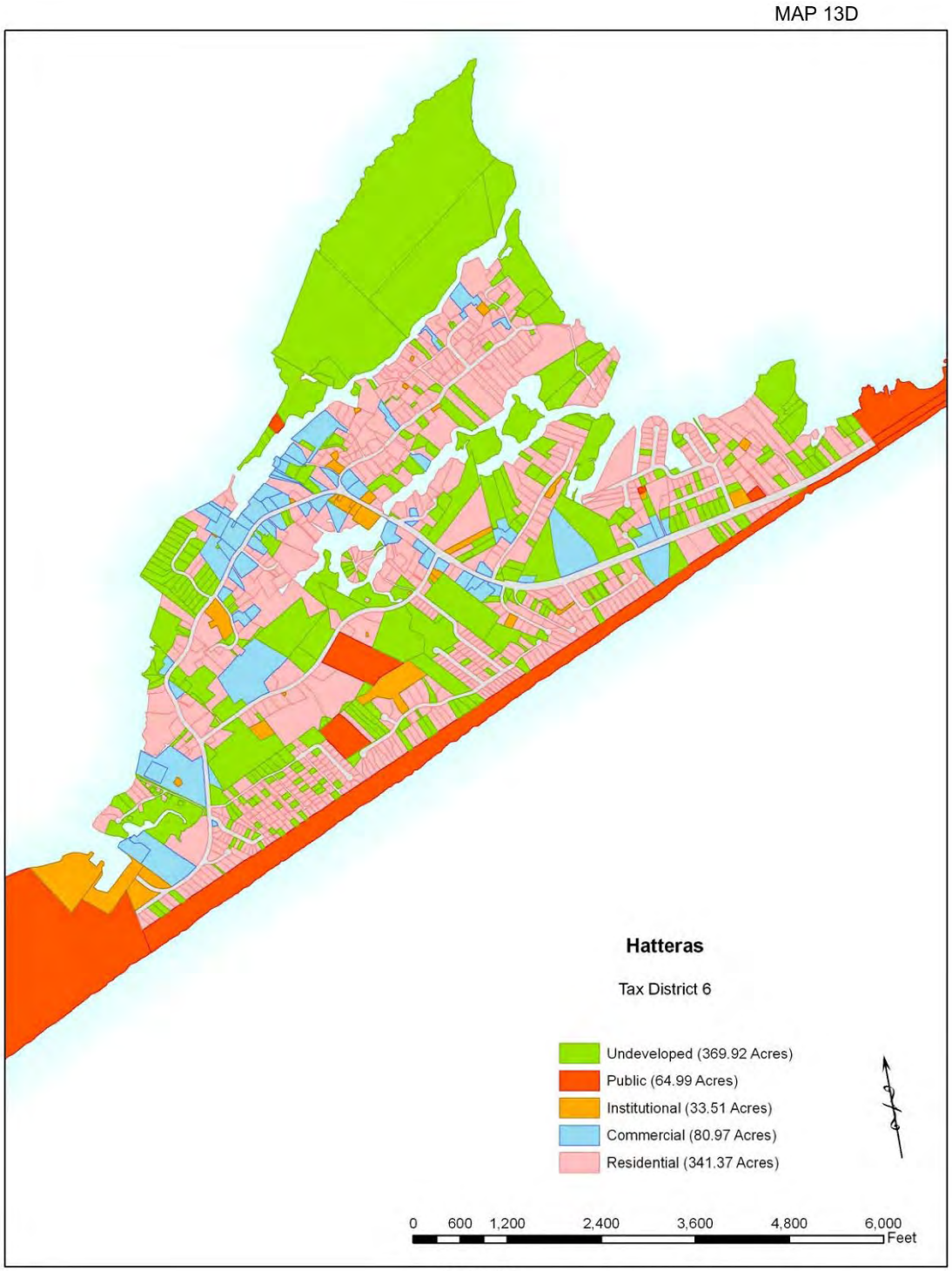
Source: Dare County 2009 Land Use Plan Update

Figure B.4 – Dare County Future Land Use Map, Avon



Source: Dare County 2009 Land Use Plan Update

Figure B.5 – Dare County Future Land Use Map, Hatteras



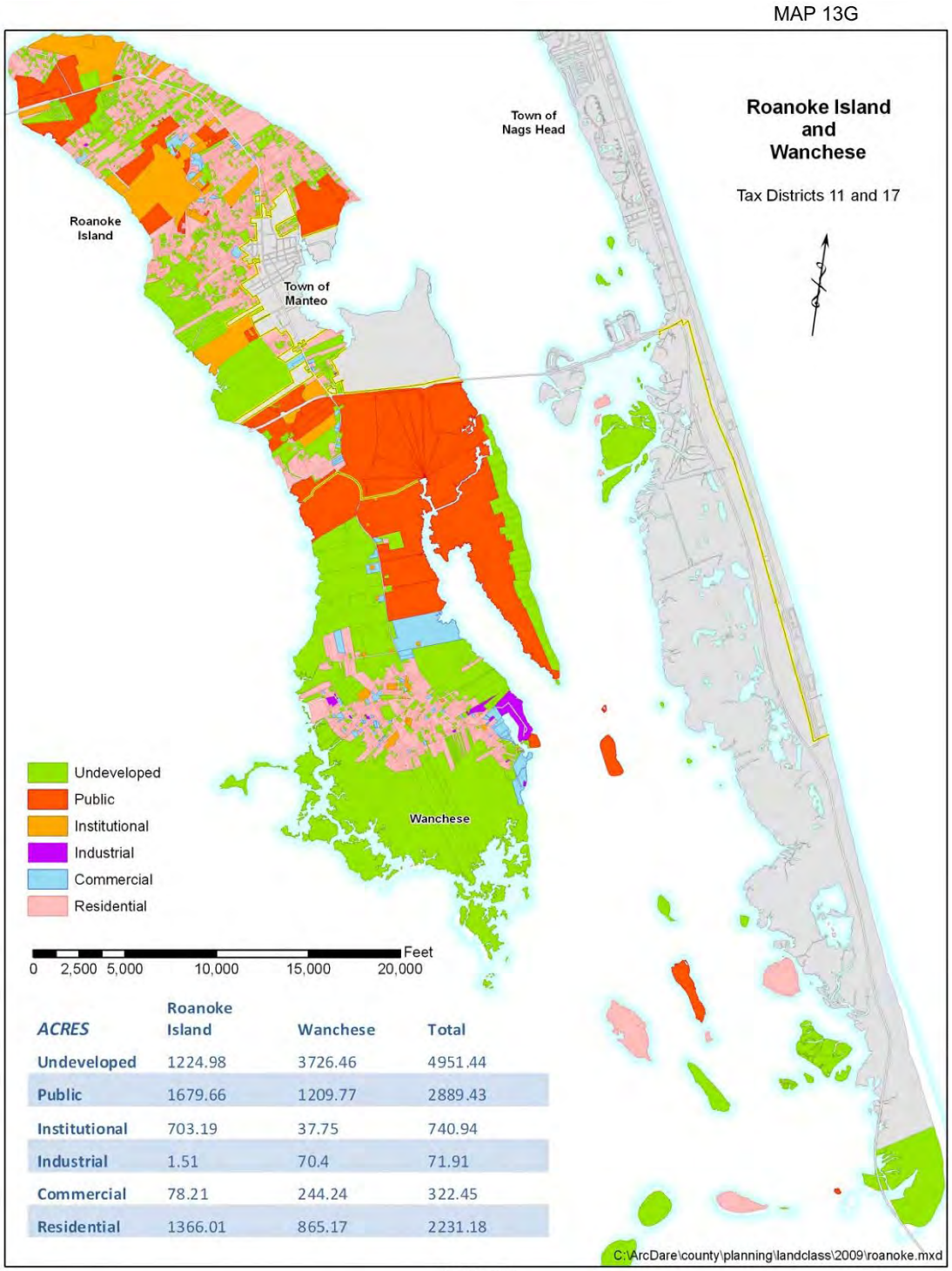
Source: Dare County 2009 Land Use Plan Update

Figure B.6 – Dare County Future Land Use Map, Martin's Point



Source: Dare County 2009 Land Use Plan Update

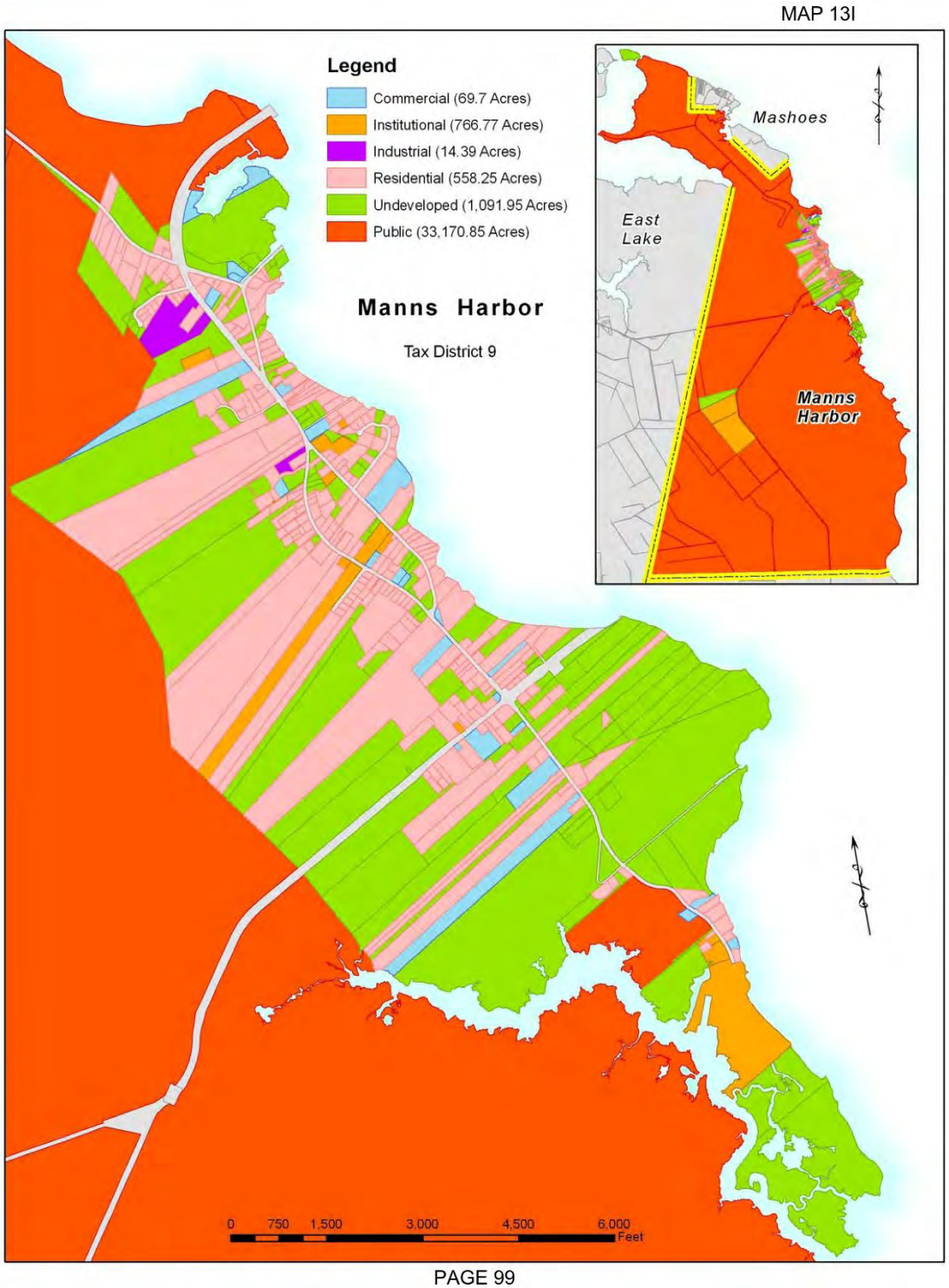
Figure B.7 – Dare County Future Land Use Map, Roanoke Island and Wanchese



ACRES	Roanoke Island	Wanchese	Total
Undeveloped	1224.98	3726.46	4951.44
Public	1679.66	1209.77	2889.43
Institutional	703.19	37.75	740.94
Industrial	1.51	70.4	71.91
Commercial	78.21	244.24	322.45
Residential	1366.01	865.17	2231.18

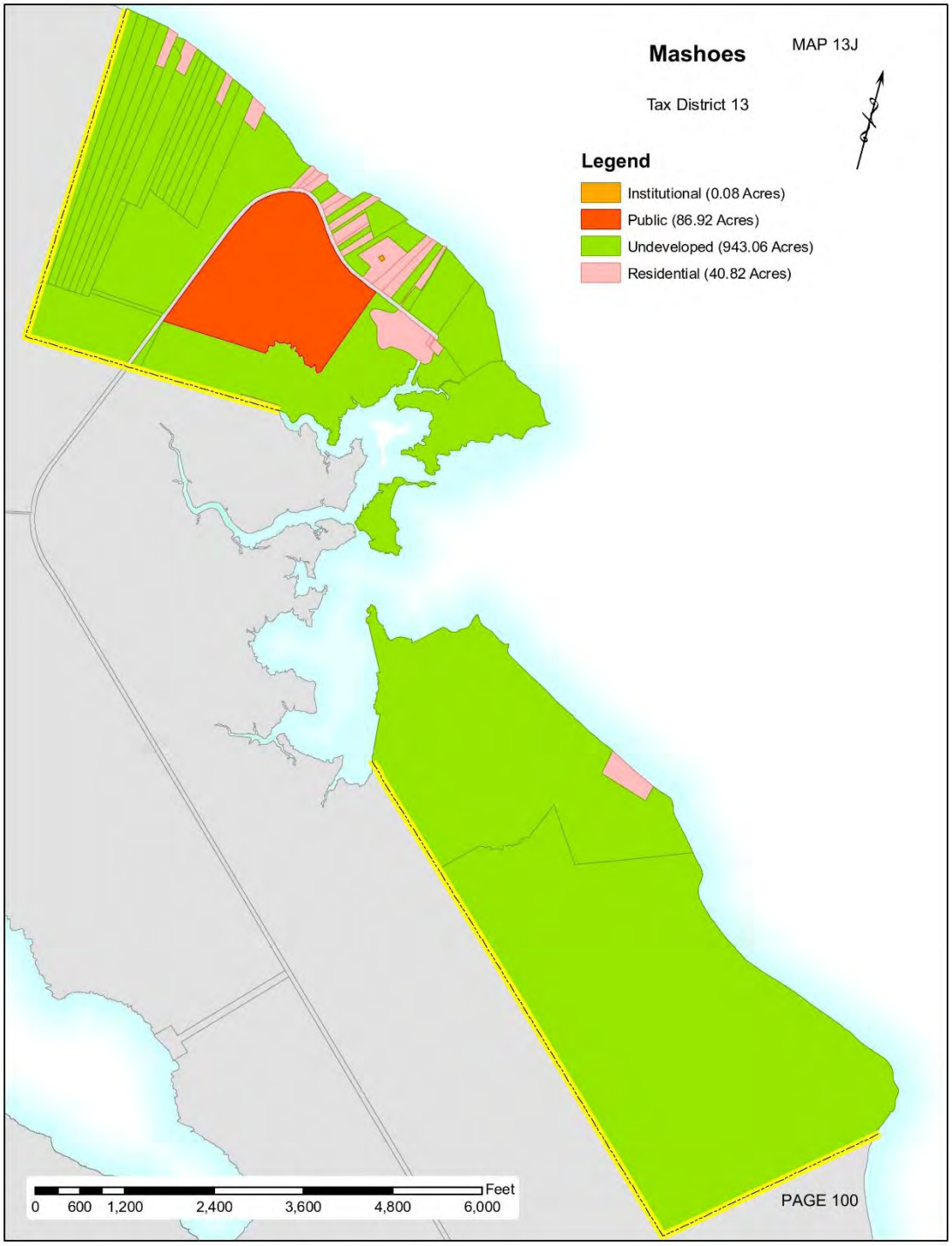
Source: Dare County 2009 Land Use Plan Update

Figure B.8 – Dare County Future Land Use Map, Manns Harbor



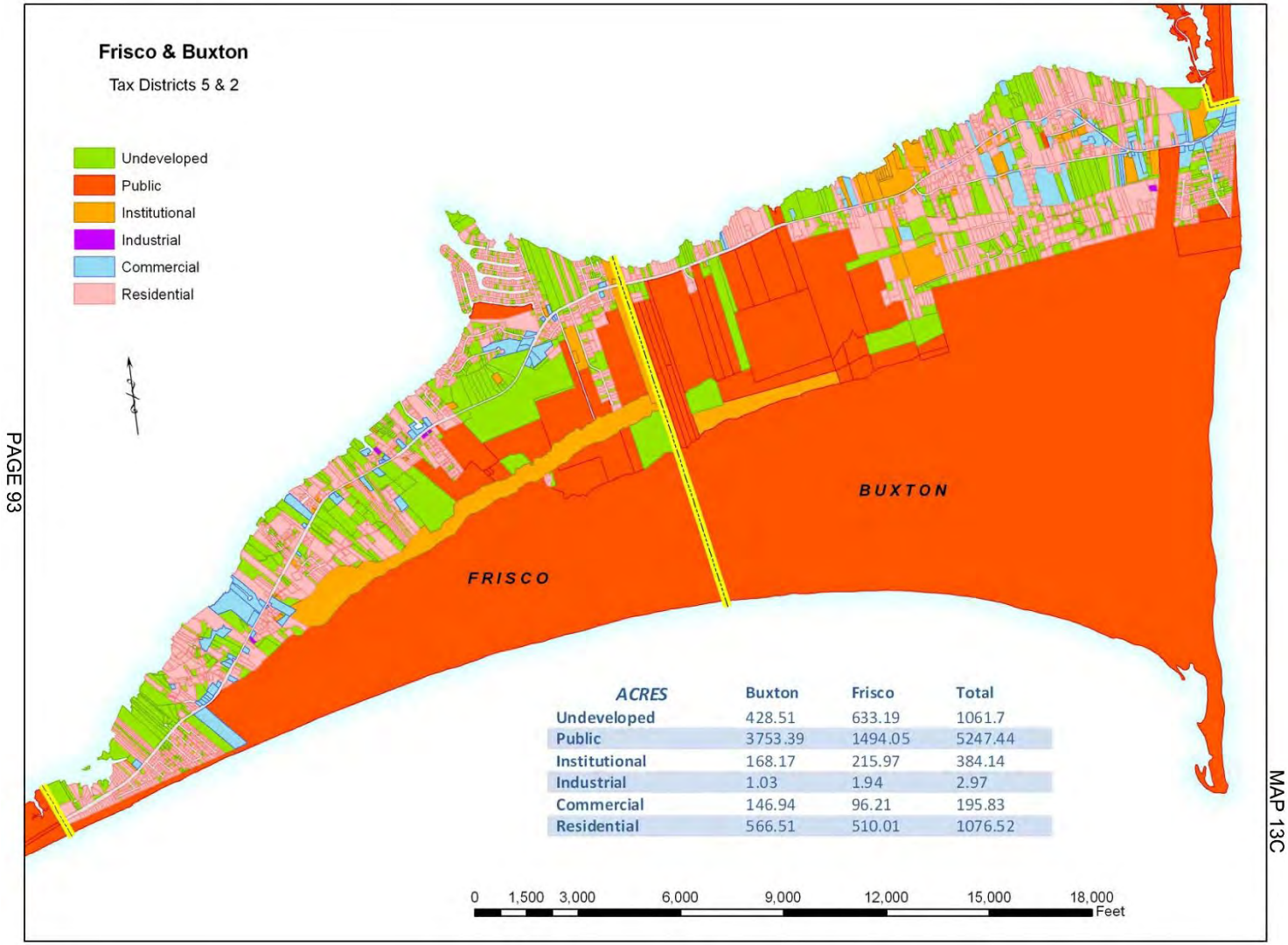
Source: Dare County 2009 Land Use Plan Update

Figure B.9 – Dare County Future Land Use Map, Mashoes



Source: Dare County 2009 Land Use Plan Update

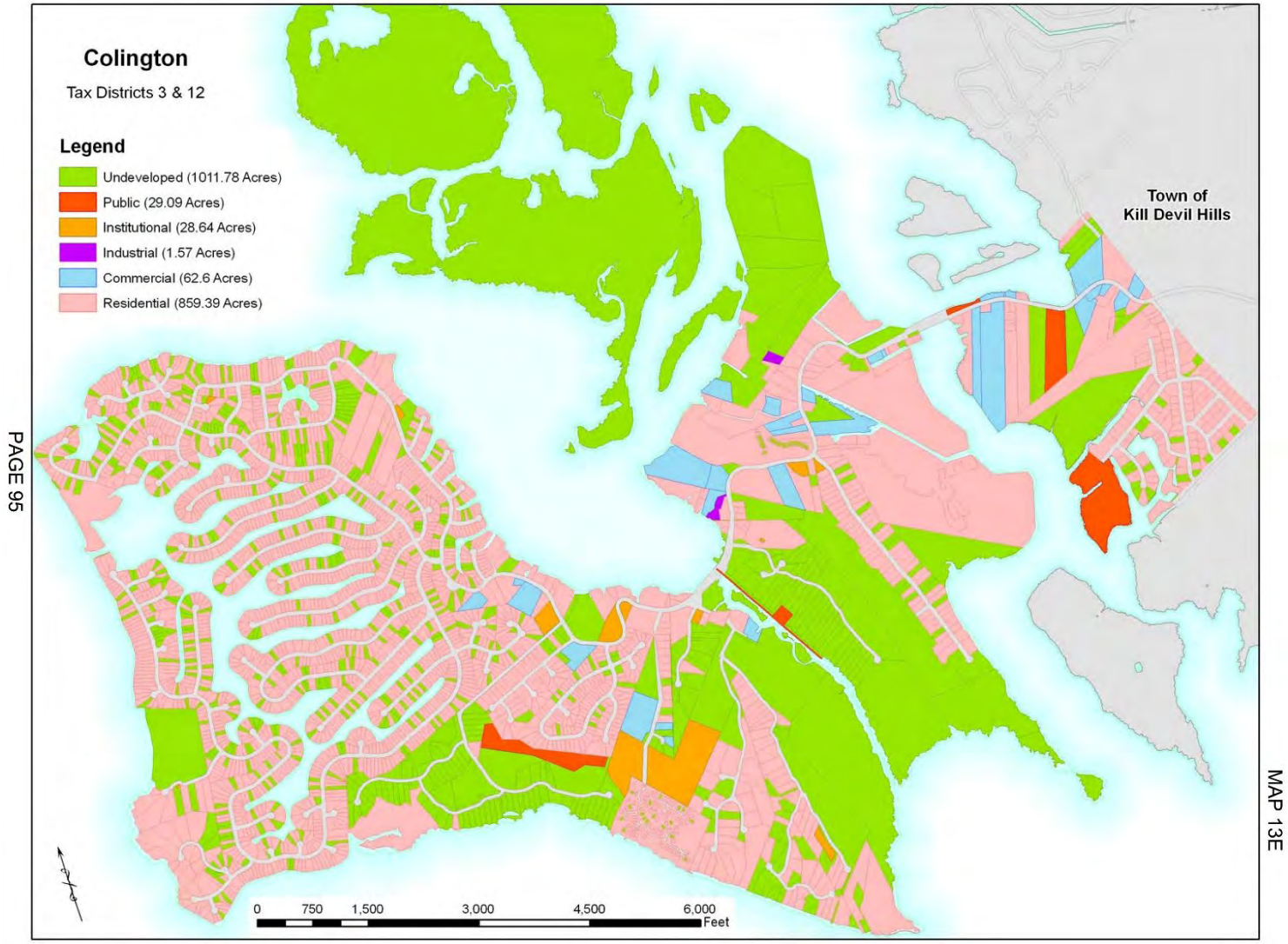
Figure B.10 – Dare County Future Land Use Map, Frisco and Buxton



ACRES	Buxton	Frisco	Total
Undeveloped	428.51	633.19	1061.7
Public	3753.39	1494.05	5247.44
Institutional	168.17	215.97	384.14
Industrial	1.03	1.94	2.97
Commercial	146.94	96.21	195.83
Residential	566.51	510.01	1076.52

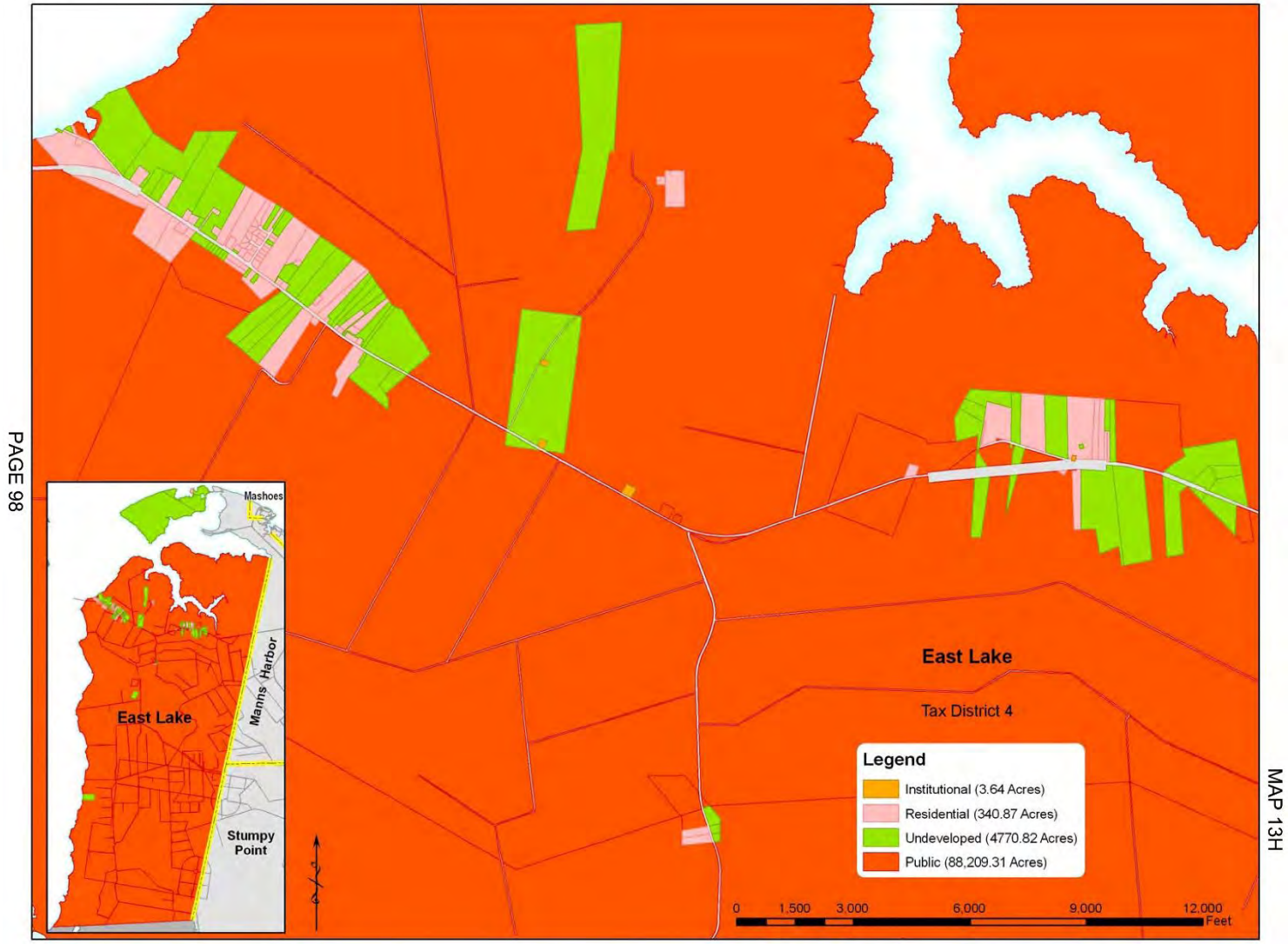
Source: Dare County 2009 Land Use Plan Update

Figure B.11 – Dare County Future Land Use Map, Colington



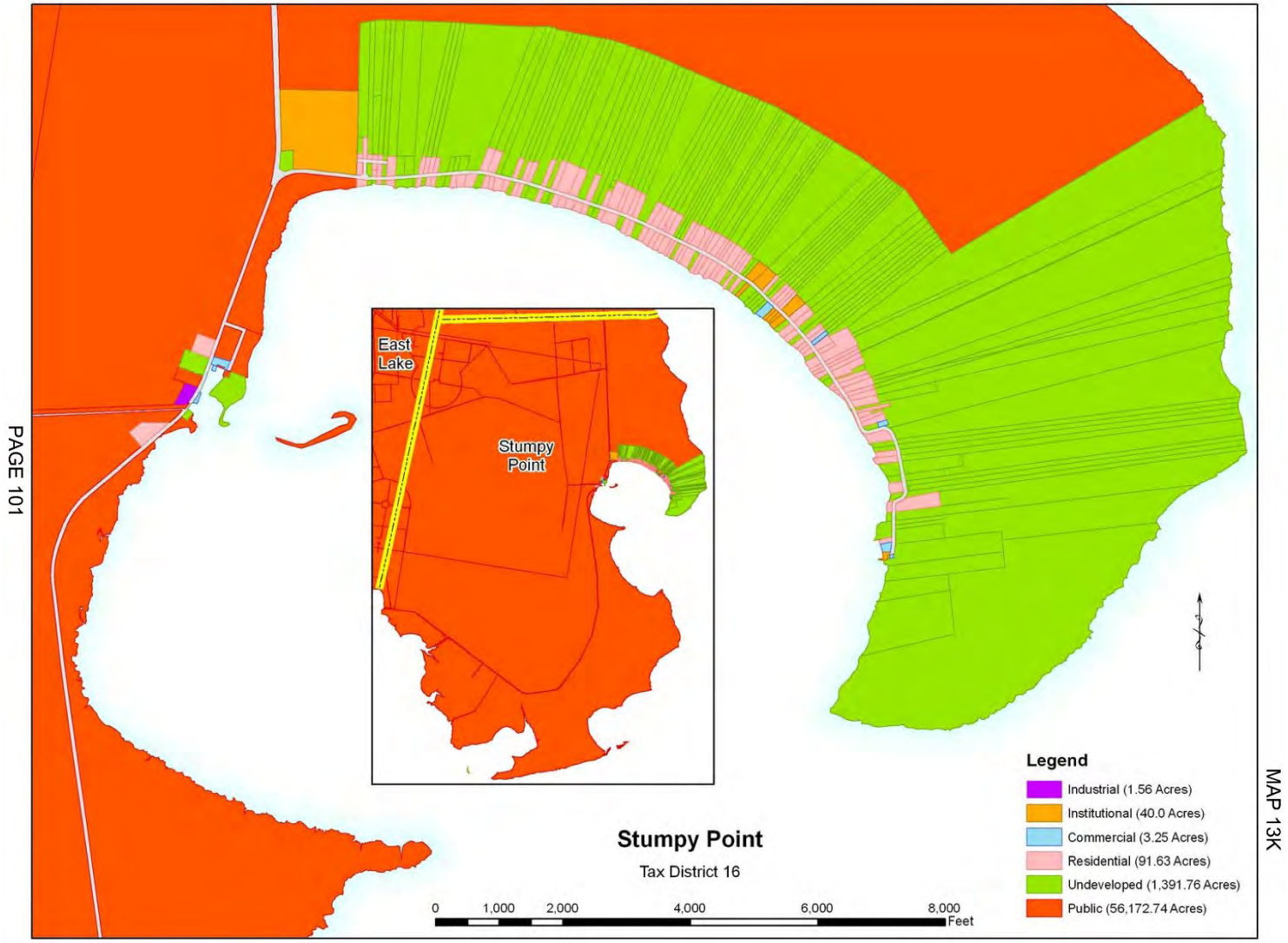
Source: Dare County 2009 Land Use Plan Update

Figure B.12 – Dare County Future Land Use Map, East Lake



Source: Dare County 2009 Land Use Plan Update

Figure B.13 – Dare County Future Land Use Map, Stumpy Point



Source: Dare County 2009 Land Use Plan Update

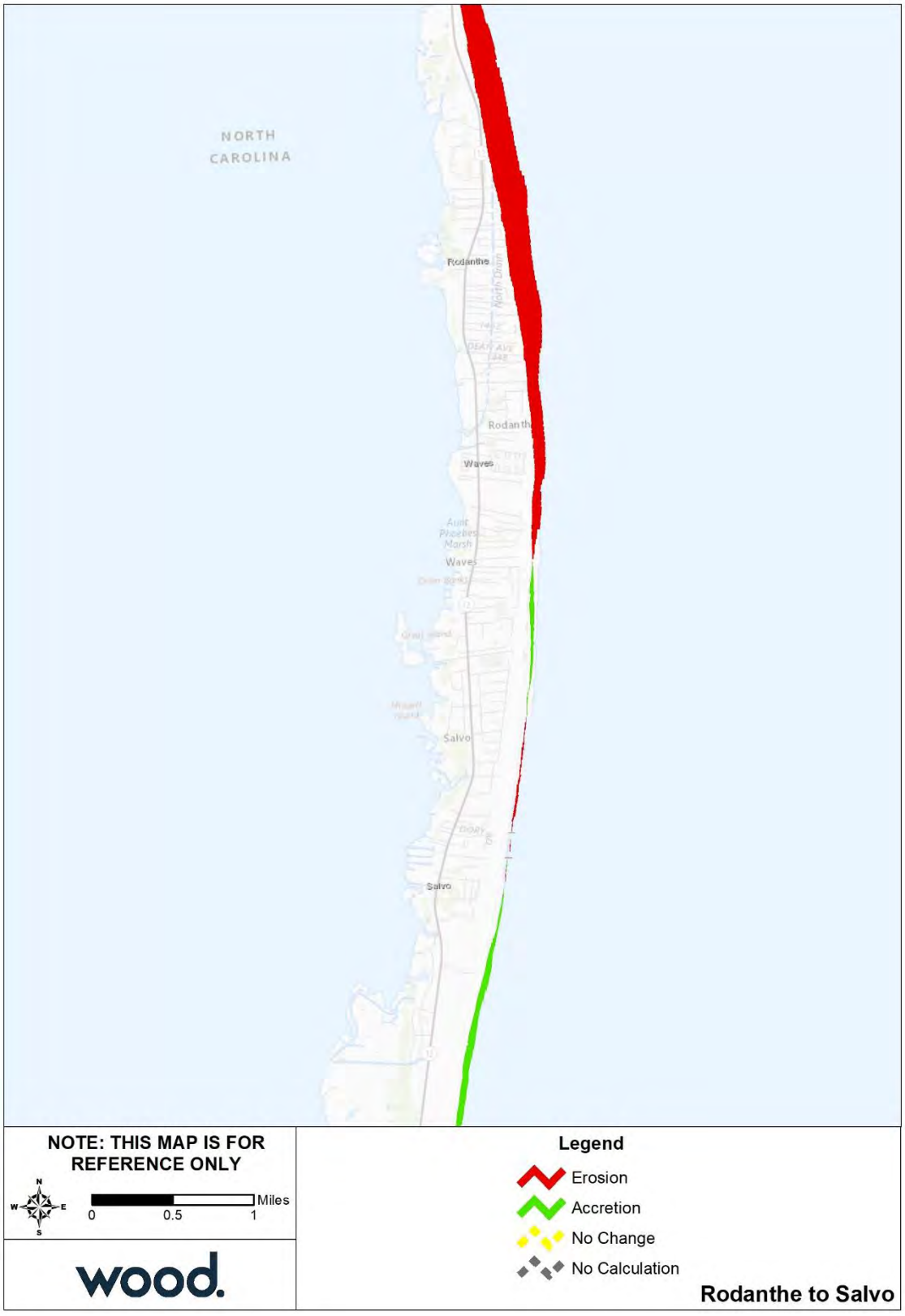
B.3 RISK ASSESSMENT

This section contains a hazard profile and vulnerability assessment for those hazards that were rated with a higher priority for Dare County unincorporated areas than for the Outer Banks Region as a whole. Risk and vulnerability findings are also presented here 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 Coastal Hazards, Flood, and Wildfire.

B.3.1 Coastal Hazards

Figure B.14 and Figure B.15 on the following page shows coastal erosion rates along developed areas of unincorporated Dare County oceanfront coastline according to data from the DCM 2019 Long-Term Average Annual Erosion Rate Update Study. Erosion is most severe along the oceanfront coastline of Rodanthe and Waves, the east-facing oceanfront coast near Buxton, and the south-facing oceanfront coast near Hattaras.

Figure B.14 – Erosion Rates, Rodanthe to Salvo



Source: North Carolina Division of Coastal Management

Figure B.15 – Erosion Rates, Hattaras Island



Source: North Carolina Division of Coastal Management

B.3.2 Flood

Table B.13 details the acreage of unincorporated Dare County's total area by flood zone on the effective DFIRM. Per this assessment, over 50 percent of the unincorporated area in the County falls within the mapped 1%-annual-chance floodplains.

Table B.13 – Flood Zone Acreage in Unincorporated Dare County

Flood Zone	Acreage	Percent of Total (%)
Zone A	25.2	0.0%
Zone AE	268,267.62	34.1%
Zone VE	126,595.88	16.1%
Zone X (500-year)	20,904.54	2.7%
Zone X Unshaded	21,814.31	2.8%
Open Water	348,447.44	44.3%
Total	**786,054.99**	--

Source: FEMA 2006 DFIRM

Figure B.16 reflects the effective mapped flood hazard zones for Dare County, and Figure B.17 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the unincorporated Dare County, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. According to this assessment, nearly 70 percent of recent development in Dare County is located in or near the SFHA.

Table B.14 – Recent Development at Risk to Flood, Dare County

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
660	$152,695,400	69.8%	73.7%

Source: Parcel data retrieved November 2019; FEMA 2006 DFIRM

This assessment does not evaluate flood impacts or provide damage estimates. However, this summary of recent development in or near the floodplain provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

Table B.15 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector for the 1% annual chance flood event in the unincorporated areas of Dare County. Table B.16 provide building counts and estimated damages for High Potential Loss Properties exposed to the 1% annual chance flood.

Table B.15 – Critical Facilities Exposed to Flooding, Unincorporated Dare County

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	6	$202,348
Commercial Facilities	356	$12,986,197
Critical Manufacturing	40	$604,424
Defense Industrial Base	1	$1,490

Sector	Number of Buildings at Risk	Estimated Damages
Emergency Services	5	$405,993
Energy	4	$698,943
Food and Agriculture	9	$78,267
Government Facilities	21	$498,574
Healthcare and Public Health	4	$224,443
Transportation Systems	31	$1,070,446
Water	1	$1,227
All Categories	478	$16,772,352

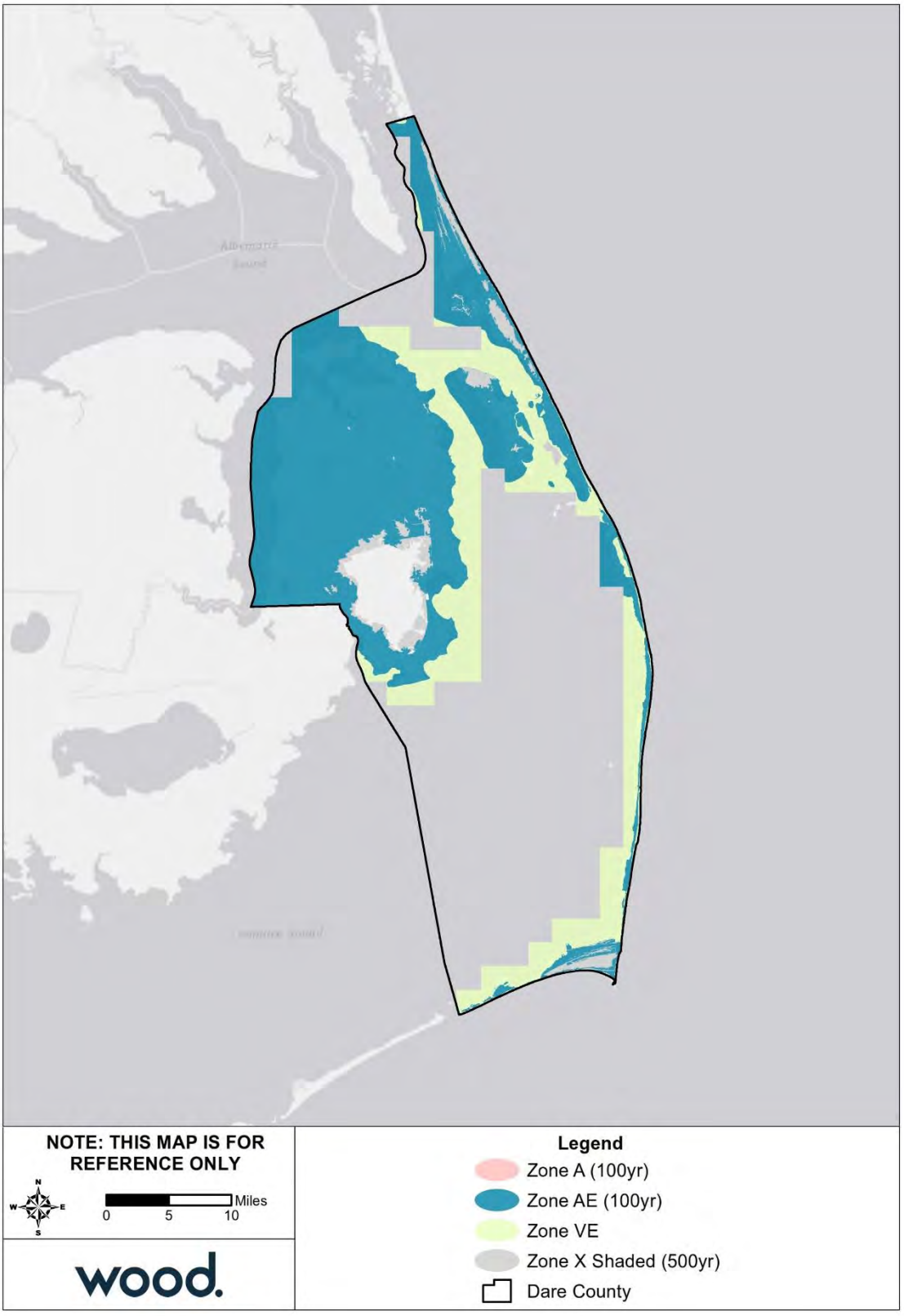
Source: NCEM Risk Management Tool

Table B.16 – High Potential Loss Properties Exposed to Flooding, Unincorporated Dare County

Sector	Number of Buildings at Risk	Estimated Damages
Commercial	6	$485,306
Government	1	$845,904
Religious	1	$137,950
Residential	15	$2,203,150
Utilities	1	$682,025
All Categories	**24**	**$4,354,335**

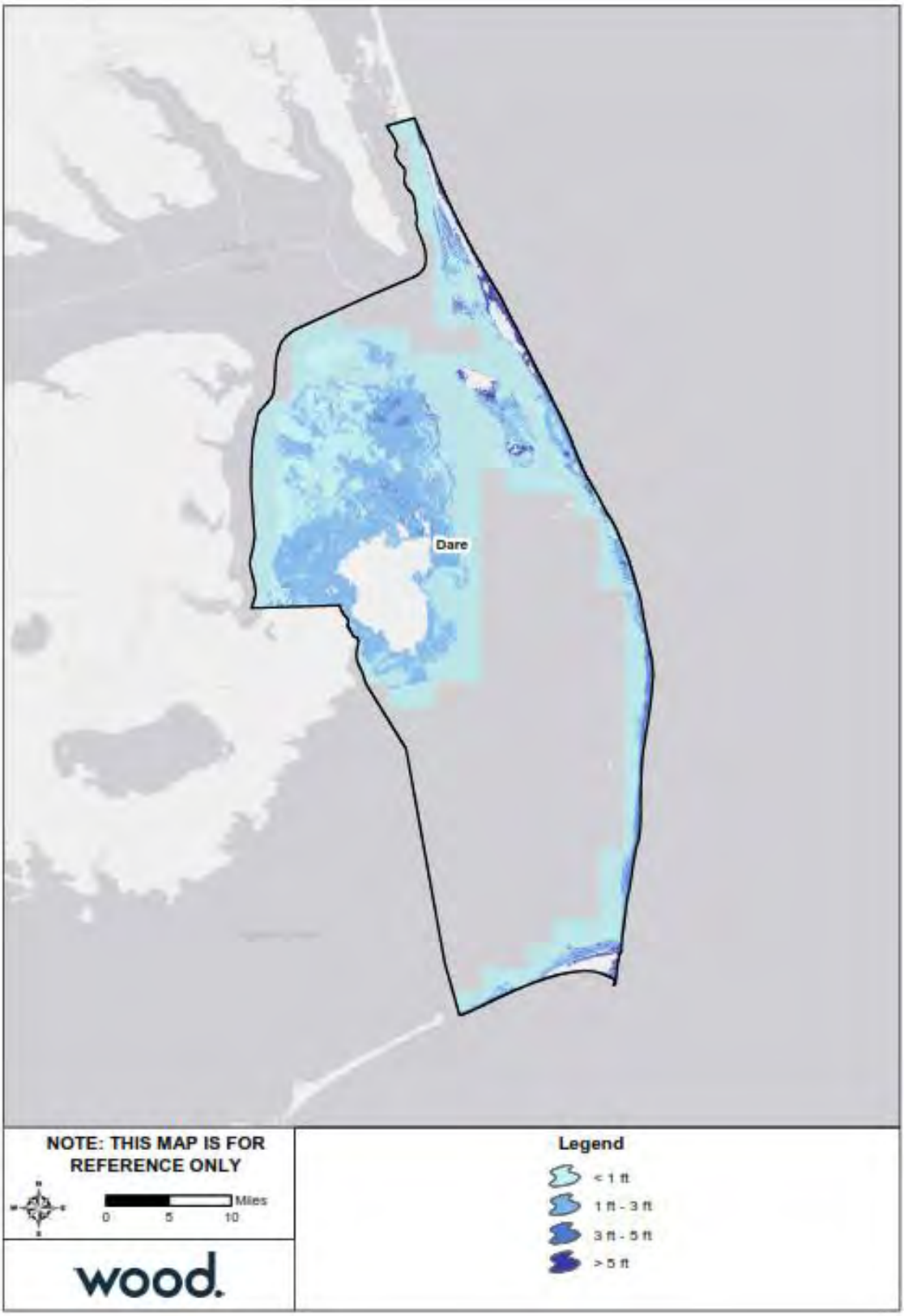
Source: NCEM Risk Management Tool

Figure B.16 – FEMA Flood Hazard Areas, Unincorporated Dare County



Source: FEMA Effective DFIRM

Figure B.17 – Flood Depth, 1%-Annual-Chance Floodplain, Unincorporated Dare County



Source: FEMA 2006 DFIRM

In 2015, Dare County prepared a Repetitive Loss Area Analysis (RLAA) to identify and evaluate all properties with multiple NFIP claims as well as surrounding properties with one historical NFIP claim and/or similar flood conditions. In total, the RLAA identifies 92 repetitive loss areas containing 314 unmitigated repetitive loss properties as well as 1,374 additional properties. The RLAA report contains maps of all repetitive loss area locations as well as a set of mitigation recommendations being pursued for these properties.

B.3.3 Wildfire

Table B.17 summarizes the acreage in unincorporated Dare 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 96 percent of unincorporated Dare County is not included in the WUI.

Table B.17 – Wildland Urban Interface Acreage, Unincorporated Dare County

	Housing Density	Total Acreage	Percent of Total Acreage
	Not in WUI	*756,645.2*	*96.2%*
	LT 1hs/40ac	2,795.3	0.4%
	1hs/40ac to 1hs/20ac	1,509.5	0.2%
	1hs/20ac to 1hs/10ac	2,243.9	0.3%
	1hs/10ac to 1hs/5ac	2,942.5	0.4%
	1hs/5ac to 1hs/2ac	5,795.7	0.7%
	1hs/2ac to 3hs/1ac	12,749.7	1.6%
	GT 3hs/1ac	2,187.1	0.3%
	Total	**786,868.9**	

Source: Southern Wildfire Risk Assessment

Figure B.18 depicts the WUI for unincorporated Dare County. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure B.19 depicts the Fire Intensity Scale, which indicates the potential severity of fire based on fuel loads, topography, and other factors. Figure B.20 depicts Burn Probability based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts.

Much of mainland Dare County has high potential fire intensity and moderate burn probability. There is minimal WUI in this area, but it is at significant risk. Along the barrier island, potential fire intensity is greatest on the soundside. There is a significant overlap of WUI, moderate to high fire intensity, and burn probability in Frisco, Buxton, and Avon.

Table B.18 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table B.19 provides counts and estimated damages for High Potential Loss Properties in unincorporated Dare County.

Table B.18 – Critical Facilities Exposed to Wildfire, Unincorporated Dare County

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	4	$2,906,134
Commercial Facilities	249	$108,920,857
Critical Manufacturing	80	$22,249,332

Sector	Number of Buildings at Risk	Estimated Damages
Defense Industrial Base	1	$149,040
Emergency Services	7	$4,959,551
Energy	1	$176,944
Food and Agriculture	14	$973,345
Government Facilities	52	$46,782,262
Healthcare and Public Health	6	$3,940,135
Postal and Shipping	1	$58,746
Transportation Systems	30	$7,521,481
Water	10	$2,034,108
All Categories	**455**	**$200,671,935**

Source: NCEM Risk Management Tool

Table B.19 – High Potential Loss Properties Exposed to Wildfire, Unincorporated Dare County

Category	Number of Buildings at Risk	Estimated Damages
Commercial	4	$13,626,678
Government	10	$54,826,421
Residential	9	$12,031,142
All Categories	**23**	**$80,484,241**

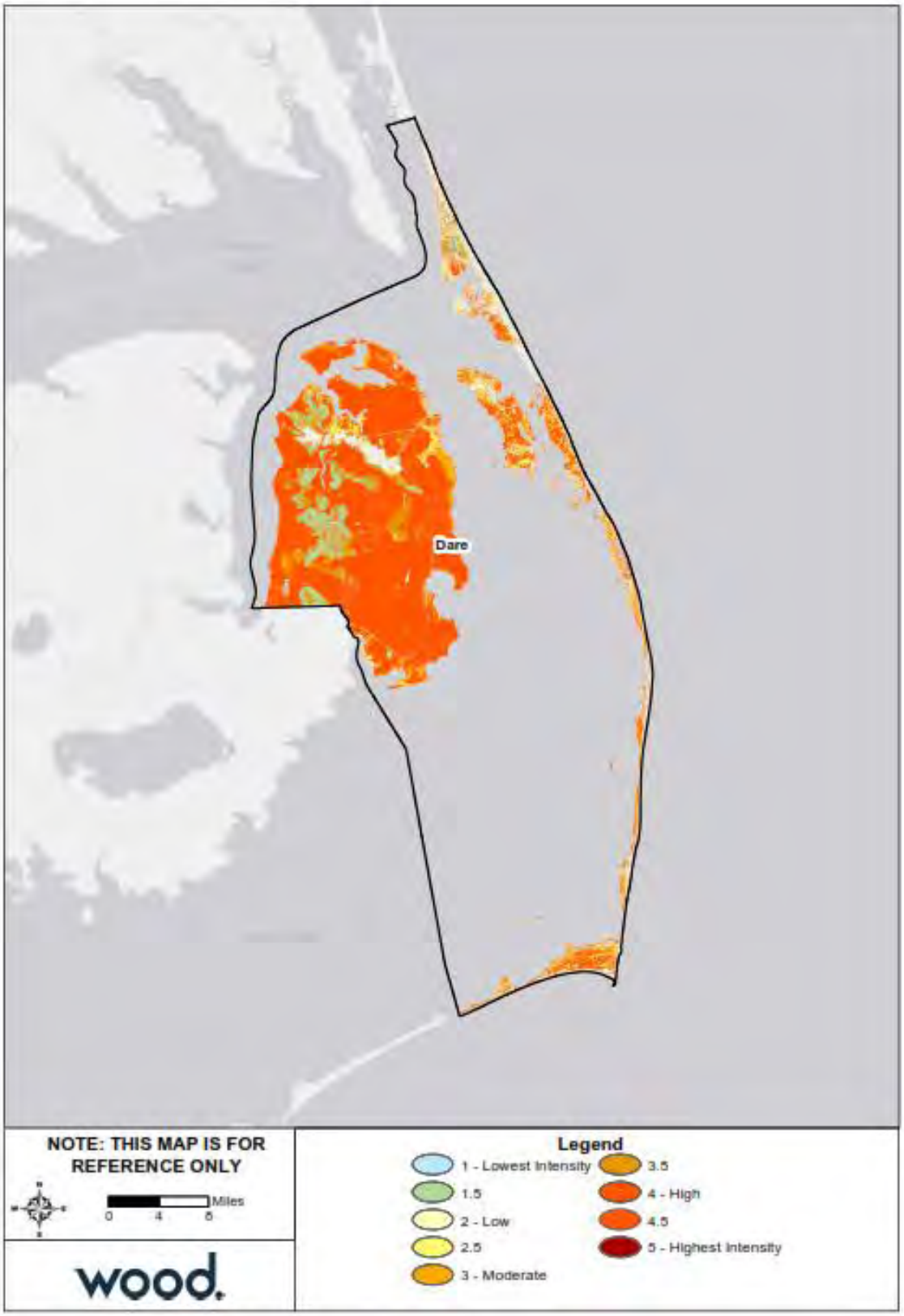
Source: NCEM Risk Management Tool

Figure B.18 – Wildland Urban Interface, Unincorporated Dare County



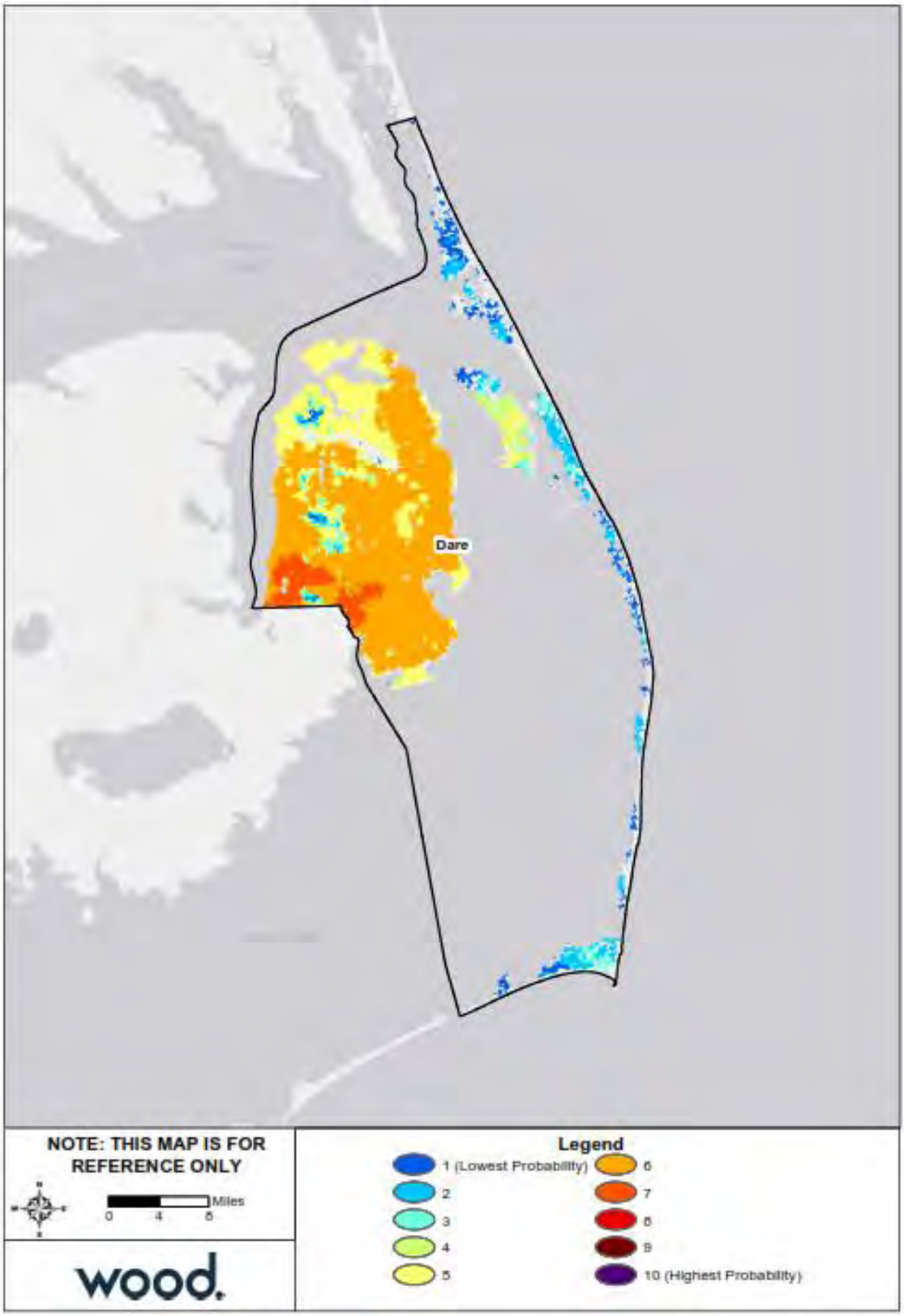
Source: Southern Wildfire Risk Assessment

Figure B.19 – Fire Intensity Scale, Unincorporated Dare County



Source: Southern Wildfire Risk Assessment

Figure B.20 – Burn Probability, Unincorporated Dare County



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 Dare 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, Dare County has an overall capability rating of Moderate. The County's Self-Assessment of key capability areas is summarized in Table B.20 below.

Table B.20 – Capability Self-Assessment, Unincorporated Dare County

Capability Area	Rating
Plans, Ordinances, Codes and Programs	High
Administrative and Technical Capability	High
Fiscal Capability	High
Education and Outreach Capability	High
Mitigation Capability	High
Political Capability	High
Overall Capability	High

B.4.2 Floodplain Management

Dare County joined the NFIP emergency program in 1971 and has been a regular participant in the NFIP since October 1978. The following tables reflect NFIP policy and claims data for the County categorized by structure type, flood zone, Pre-FIRM and Post-FIRM.

Table B.21 – 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	7,393	$4,693,844	$1,877,385,300	5,972	$82,347,519.32
2-4 Family	123	$85,259	$27,052,000	192	$4,967,396.88
All Other Residential	570	$178,514	$85,229,100	133	$5,630,022.38
Non-Residential	485	$917,716	$168,608,200	1,219	$35,224,122.18
Total	**8,571**	**$5,875,333**	**$2,158,274,600**	**7,516**	**$128,169,060.76**

Source: FEMA Community Information System, accessed December 2019

Table B.22 – NFIP Policy and Claims Data by Flood Zone

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	7,614	$4,785,038	$1,935,698,600	6,012	$107,888,383.09
A Zones	49	$57,511	$11,510,600	441	$5,420,802.15
AO Zones	88	$67,894	$28,144,200	26	$307,917.32
V01-30 & VE Zones	116	$393,718	$24,599,700	229	$3,484,451.01
V Zones	1	$1,732	$277,600	320	$4,064,339.37
B, C & X Zone					
Standard	508	$478,188	$100,568,200	403	$6,121,791.14
Preferred	172	$77,452	$56,673,000	56	$745,122.28
Total	**8,548**	**$5,861,533**	**$2,157,471,900**	**7,487**	**$128,032,806.36**

Source: FEMA Community Information System, accessed December 2019

Table B.23 – 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	971	$1,186,450	$197,477,400	1,995	$50,345,634.49
A Zones	11	$24,816	$2,460,700	288	$3,748,951.21
AO Zones	1	$956	$250,000	2	$11,219.15
V01-30 & VE Zones	36	$110,701	$5,248,100	131	$1,747,868.29
V Zones	0	$0	$0	302	$3,961,221.28
B, C & X Zone	59	$66,134	$16,919,800	235	$3,850,472.04
Standard	31	$53,741	$8,851,800	231	$3,822,228.34
Preferred	28	$12,393	$8,068,000	4	$28,243.70
Total	**1,078**	**$1,389,057**	**$222,356,000**	**2,953**	**$63,665,366.46**

Source: FEMA Community Information System, accessed December 2019

Table B.24 – 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	6,643	$3,598,588	$1,738,221,200	4,017	$57,542,748.60
A Zones	38	$32,695	$9,049,900	153	$1,671,850.94
AO Zones	87	$66,938	$27,894,200	24	$296,698.17
V01-30 & VE Zones	80	$283,017	$19,351,600	98	$1,736,582.72
V Zones	1	$1,732	$277,600	18	$103,118.09
B, C & X Zone	621	$489,506	$140,321,400	223	$3,016,250.38
Standard	477	$424,447	$91,716,400	171	$2,299,371.80
Preferred	144	$65,059	$48,605,000	52	$716,878.58
Total	**7,470**	**$4,472,476**	**$1,935,115,900**	**4,533**	**$64,367,248.90**

Source: FEMA Community Information System, accessed December 2019

B.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
DAR1	Identify Funding to improve stormwater drainage and land management preparation for flooding	Hurricane & Tropical Storm, Flood, Coastal Hazards	3.3	7-High	Dare County Planning	General Fund, Grant Funds	1-3 years	Carry Forward	Group saw need to expand participants to include adding Soil and Water staff to help identify funding sources.
DAR2	Expand the number of lifeguarded beaches in unincorporated Dare to bring lifeguards to all villages in addition to ocean rescue response personnel.	Coastal Hazards	3.3	3-Medium	National Park Service Dare County	General Fund, Grant Funds	2-3 years	New	N/A
DAR3	Update Dare County's 2001 comprehensive stormwater management plan.	Hurricane & Tropical Storm, Flood, Coastal Hazards, Severe Weather, Transportation Infrastructure Failure	3.1	6-High	Dare County Planning	General Fund, Grant Funds	1-3 years	New	N/A
DAR4	Grow Local Emergency Planning Committee membership by expanding industry participation while fully implementing Community Right to Know reporting requirements to enhance knowledge of hazardous material risk across the region	Radiological Emergency, Hazardous Materials Incident	3.3	5-High	Dare County Emergency Management	General Fund, Grant Funds	1-2 years	New	N/A
DAR5	Expand involvement with the North Carolina Information Sharing and Analysis Center to ensure actionable intelligence on immediate and emerging threats to the region are identified and shared with first responders, private sector, emergency management, local law enforcement and other partner agencies in a timely manner.	Terrorism, Radiological Emergency	4.2	3-Medium	Dare County Emergency Management, Dare Sheriff's office	General funds	1-3 years	New	N/A
Property Protection									
DAR6	Utilize existing post storm information and GIS mapping to identify the most vulnerable structures in the County.	Hurricane & Tropical Storm, Severe Weather, Coastal Hazards, Flood	3.3	5-High	Dare County Planning, Dare County Emergency Management	General Fund, Grant Funds	1 year	Carry Forward	Group saw the need to revisit this effort.
DAR7	Become a FIREWISE Community that is able to protect people, property, and natural resources from wildland fire.	Wildfire	3.3	7-High	Dare County Emergency Management. Fire Marshal, US Fish & Wildlife, NC Forestry	Grant funds, General Fund	1-3 years	New	N/A
DAR8	Maintain or increase the number of flood insurance policies in place across Dare County when new flood hazard maps become effective and many properties are reclassified as Shaded X and/or X zone no longer requiring flood insurance associated with a federally insured mortgage.	Hurricane & Tropical Storm, Severe Weather, Coastal Hazards, Flood	3.3	5-High	Dare County Planning. Emergency Management	General Fund	1-2 years	New	N/A
DAR9	Pursue the installation of flood gauges at all towns and villages. Have those gauges tied into the county alert and notification system allowing users to be alerted to changing conditions as they occur.	Hurricane & Tropical Storm, Severe Weather, Coastal Hazards, Flood	2.2	5-High	Dare County Emergency Management	Grant Funds, NC Emergency Mgmt.	2 years	New	N/A

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
DAR10	Complete a cybersecurity risk assessment from an external subject matter expert. Based on risk assessment outcomes develop and require all employees, volunteers and elected officials to complete cybersecurity awareness training before being given access to county information technology systems. Develop and offer cybersecurity awareness training for citizens. Develop and conduct cybersecurity exercises.	Terrorism, Cyber Attack	3.3	5-High	Dare County Emergency Management Dare County Information Technology	General Fund	2 years	New	N/A
DAR11	Work with all landowners including federal, state, and private to ensure proper maintenance and use of existing drainage systems to minimize impacts and reduce standing water on all property.	Hurricane & Tropical Storm, Flood, Coastal Hazards, Transportation Infrastructure Failure	1.1	7-High	Dare County Planning -- Soil and Water Conservation Board	Grants, tax or tax incentive program	1-3 years	New	N/A
Natural Resource Protection									
DAR12	Study and document sound side erosion rates and water level changes	Hurricane & Tropical Storm, Severe Weather, Coastal Hazards, Flood	3.2	3-Low	NC Division of Coastal Mgmt.	Grants, Volunteer	3- 5 years	New	N/A
DAR13	Encourage the use of natural barriers over hard structure to control shoreline erosion and protect built infrastructure.	Hurricane & Tropical Storm, Flood, Coastal Hazards, Transportation Infrastructure Failure	3.3	4-Medium	Dare County Planning -- Soil and Water Conservation Board	General Fund	3-5 years	New	N/A
DAR14	Protect natural floodplain function and resilient areas as open space to provide flood and coastal hazard risk reduction and potentially increase CRS 420 open space credit	Hurricane & Tropical Storm, Severe Weather, Coastal Hazards, Flood	3.2	4-Medium	Dare County Planning -- Soil and Water Conservation Board	General Fund	1-3 years	New	N/A
Structural Projects									
DAR15	Protect transportation routes and improve traffic flow along NC 12. Improve NC 12 to a two-lane road and coordinate traffic signals.	Hurricane & Tropical Storm, Flood, Coastal Hazards	2.2	7-High	Dare County Planning, Dare County Emergency Management, NCDOT	NCDOT	1 -3 years	Carry Forward	Group saw the need to revisit this effort and reshape the action for the new plan.
DAR16	Advocate the replacement of the Lindsey Warren (Alligator River) Bridge	Hurricane & Tropical Storm, Flood, Coastal Hazards	2.1	7-High	Dare Board of Commissioners, NCDOT	NCDOT	1 year	Carry Forward	Group saw the need to rename this effort and reshape the action for the new plan.
DAR17	Prioritize and Fund Critical Drainage Projects that improve stormwater drainage and land management preparation for flooding.	Hurricane & Tropical Storm, Flood, Coastal Hazards	2.1	7-High	NCDOT, Dare County Planning, Dare Soil & Water Board	Grant Fund, local stormwater assessments	1-3 years	Carry Forward	Group saw the need to refocus this effort and reshape the action for the new plan to include northern Roanoke Island flooding and expanded “pumping plan”.
DAR18	Take action on the results of the Moffit-Nicholas/ NCDOT Northern Roanoke Island drainage study.	Hurricane & Tropical Storm, Flood, Coastal Hazards, Transportation Infrastructure Failure	3.3	7-High	Dare Board of Commissioners, NCDOT	Grant Fund, local stormwater assessments	2 years	New	N/A
DAR19	Complete physical security assessment at all public facilities and large crowd (500+ people) gathering venues and events. Based on results, make physical security improvements and/or implement measures to protect lives from likely threats.	Terrorism	3.3	3-Low	Dare County Emergency Management. Dare Sheriff's Office	General fund	1-3 years	New	N/A
DAR20	Improve water supply and delivery systems to save water and reduce drought impacts by eliminating breaks and leaks. Encourage drought-tolerant landscape design to reduce dependence on irrigation. Encourage permeable driveways and surfaces to reduce runoff and promote groundwater recharge.	Drought, Flood	2.1	7-High	Dare County Water Department	Water enterprise fund	3-5 years	New	N/A

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Emergency Services									
DAR21	Establish secondary water supplies/points for fire protection efforts.	Hurricane & Tropical Storm, Flood, Wildfire	2.2	4-Medium	Dare County Fire Marshal	Grant Funds	3-5 years	Carry Forward	Group saw the need to revisit this effort and reshape the action for the new plan with a focus on improving water utility infrastructure capability and resilience.
DAR22	Acquire generators or other forms of redundant power supply to ensure that critical facilities and infrastructure remain operational where normal power supply is not available	All	2.2	5-High	Dare County Fire Marshal, Public Works, Emergency Mgmt.	Grant Funds	1-2 years	Carry Forward	Group saw the need to revisit this effort and develop an actionable critical facility emergency power plan.
DAR23	Study and identify all key secondary roadways used by workforce that flood routinely and develop plans to mitigate flood hazards. These are transit corridors that support year-round resident populations like Colington Road, NC 345, and Kitty Hawk Road.	Hurricane & Tropical Storm, Flood, Coastal Hazards, Severe Winter Storm, Severe Weather, Tornado, Wildfire, Transportation Infrastructure Failure	2.2	5-High	NCDOT, Dare County Planning	General fund	2 years	New	N/A
DAR24	Complete commodity flow study to identify hazardous materials that are routinely transported across the region.	Radiological Emergency, Hazardous Materials Incident	3.3	3-Low	Dare County Emergency Management	Grant funds	3-5 years	New	N/A
Public Education & Awareness									
DAR25	Coordinate with NC Floodplain Mapping on public dissemination of updated floodplain maps	Hurricane & Tropical Storm, Flood, Coastal Hazards	4.2	4-Medium	NC Floodplain Mapping, Dare County Planning	General Fund	1 year	Carry Forward	Group saw the need to retain this effort and reshape the action for the new plan.
DAR26	Lobby State Legislators to require realtors to disclose flood zones.	Hurricane & Tropical Storm, Flood, Coastal Hazards	4.1	3-Medium	Dare County Planning	General Fund	3 years	Carry Forward	Group saw the need to retain this effort and revisit how best to move it forward in the new plan.
DAR27	Maintain or increase the number of flood insurance policies in place across Dare County when new flood hazard maps become effective and many properties are reclassified as Shaded X and/or X zone no longer requiring flood insurance associated with a federally insured mortgage.	Hurricane & Tropical Storm, Flood, Coastal Hazards	3.3	5-High	Dare County Planning. Emergency Management	General Fund	1-2 years	New	N/A
DAR28	Expand hazardous weather awareness to include tornados and winter storms by expanding NWS partnership opportunities to include SKYWARN training and community forums	Hurricane & Tropical Storm, Extreme Heat, Flood, Coastal Hazards, Severe Winter Storm, Severe Weather, Tornado, Wildfire, Drought	1.1	6-High	National Weather Service, Dare County Emergency Management	General Fund	2 years	New	N/A
DAR29	Increase the use of the NWS alert feature of the County mass notification system so that residents and visitors have direct access to all issued weather alerts.	Hurricane & Tropical Storm, Extreme Heat, Flood, Coastal Hazards, Severe Winter Storm, Severe Weather, Tornado, Wildfire, Drought	1.1	6-High	Dare County Emergency Management	General Fund	1 year	New	N/A
DAR30	Expand the “Love The Beach Respect The Ocean” beach safety campaign by expanding participation with the Chamber of Commerce, Property Managers, as well as hotel, restaurant, and beach equipment rental companies	Coastal Hazards	1.1	5-High	Dare County Emergency Management, Public Relations	General Fund	1-3 years	New	N/A
DAR31	Take actions needed to ensure equipment and personnel are readily available to implement the Dare County Emergency Pumping Plan at multiple locations simultaneously.	Hurricane & Tropical Storm, Flood, Coastal Hazards, Severe Weather, Transportation Infrastructure Failure	2.2	7-High	Dare County Planning, Emergency Management, NC Forestry	General Fund, grants	1 year	New	N/A

Annex C Town of Duck

C.1 PLANNING PROCESS

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

Table C.1 – HMPC Members

Representative	Agency/Department	Position or Title
Joe Heard	Community Development	Director
Sandy Cross	Community Development	Permit Coordinator/CAMA LPO/CZO/CFM, Department of Community Development
Matt Price	Citizen	Developer that owns Waterfront Shops with 21 tenants on the sound, also own a commercial condo unit. Has first-hand knowledge of hazards facing the town.
Jim Braithwaite	Citizen	Developer that owns Waterfront Shops with 21 tenants on the sound, also own a commercial condo unit & has an interest in the BP station. Has first-hand knowledge of hazards facing the town.

C.2 COMMUNITY PROFILE

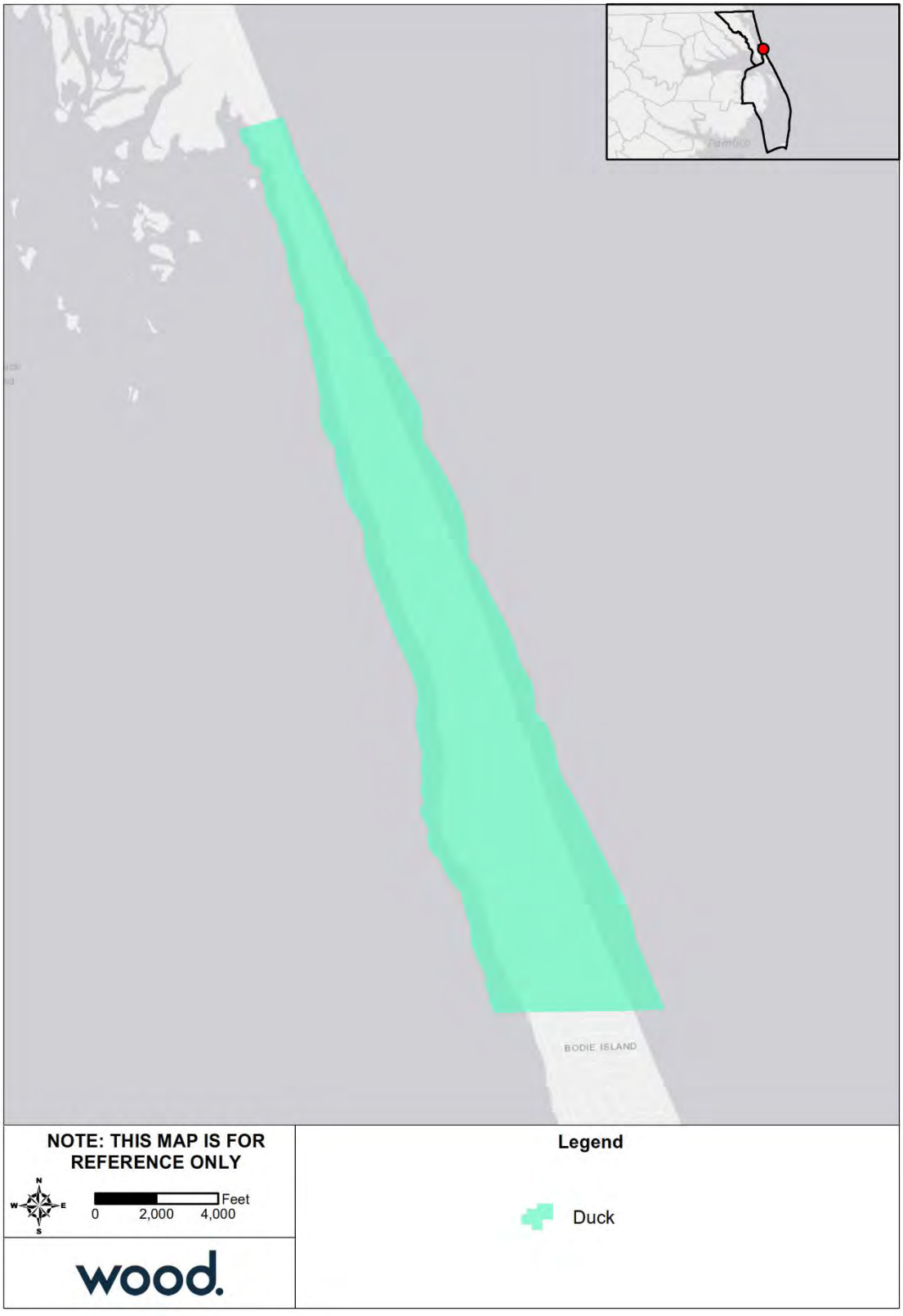
Geography

The Town of Duck is a barrier island community located in the northernmost portion of Dare County. The town is bordered by Currituck County to the north and Southern Shores to the south. Duck comprises a total land area of 2.42 square miles.

According to data from the U.S. Fish and Wildlife Service's National Wetlands Inventory, there are approximately 16 acres of wetlands in Duck, primarily estuarine and marine.

Figure C.1 shows a base map of the location of the Town of Duck.

Figure C.1 – Location Map, Town of Duck



Source: U.S. Census Bureau

Population and Demographics

Table C.2 provides population counts and growth estimates for the Town of Duck as compared to the Region overall. Table C.3 provides demographic information for Duck as compared to the Region. the arrival of tourists and vacationers.

Table C.2 – Population Counts, Duck, 2010-2017

Jurisdiction	2000 Census Population	2010 Census Population	2017 ACS Population Estimate	Total Change 2010-2017	% Change 2010-2017
Region Total	**48,157**	**57,467**	**60,659**	**3,192**	**5.55%**
Town of Duck	--	369	531	162	43.90%

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010 American Community Survey 2013-2017 5-Year Estimates

Table C.3 – Racial Demographics, Duck, 2017

Jurisdiction	White, %	Black, %	Asian, %	Other Race, %	Two or More Races, %	Persons of Hispanic or Latino Origin*, %
Region Total	**91.0**	**3.5**	**0.5**	**2.2**	**2.7**	**5.7**
Town of Duck	98.1	0.9	0.8	0.0	0.2	1.3

Source: US Census Bureau, American Community Survey 2013-2017 5-Year Estimates
*Persons of Hispanic origin may be of any race, so also are included in applicable race categories

Asset Inventory

The following tables summarize the Critical Infrastructure and Key Resources (CIKR) and high potential loss facilities identified in IRISK for the Town of Duck. Critical facilities, which include a subset of identified assets form the CIKR dataset as well as facilities identified by the HMPC, are shown in Figure C.2 on the following page and summarized in Table C.6. The County provided information is not included in IRISK vulnerability assessments. Note that the IRISK counts are by building; where a critical facility identified by IRISK comprises a cluster of buildings, each building is counted and displayed.

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

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	EM	Healthcare	Government Facilities	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Town of Duck	1	4	0	66	1	4	0	2	0	0	0	5	0	2	1	**86**

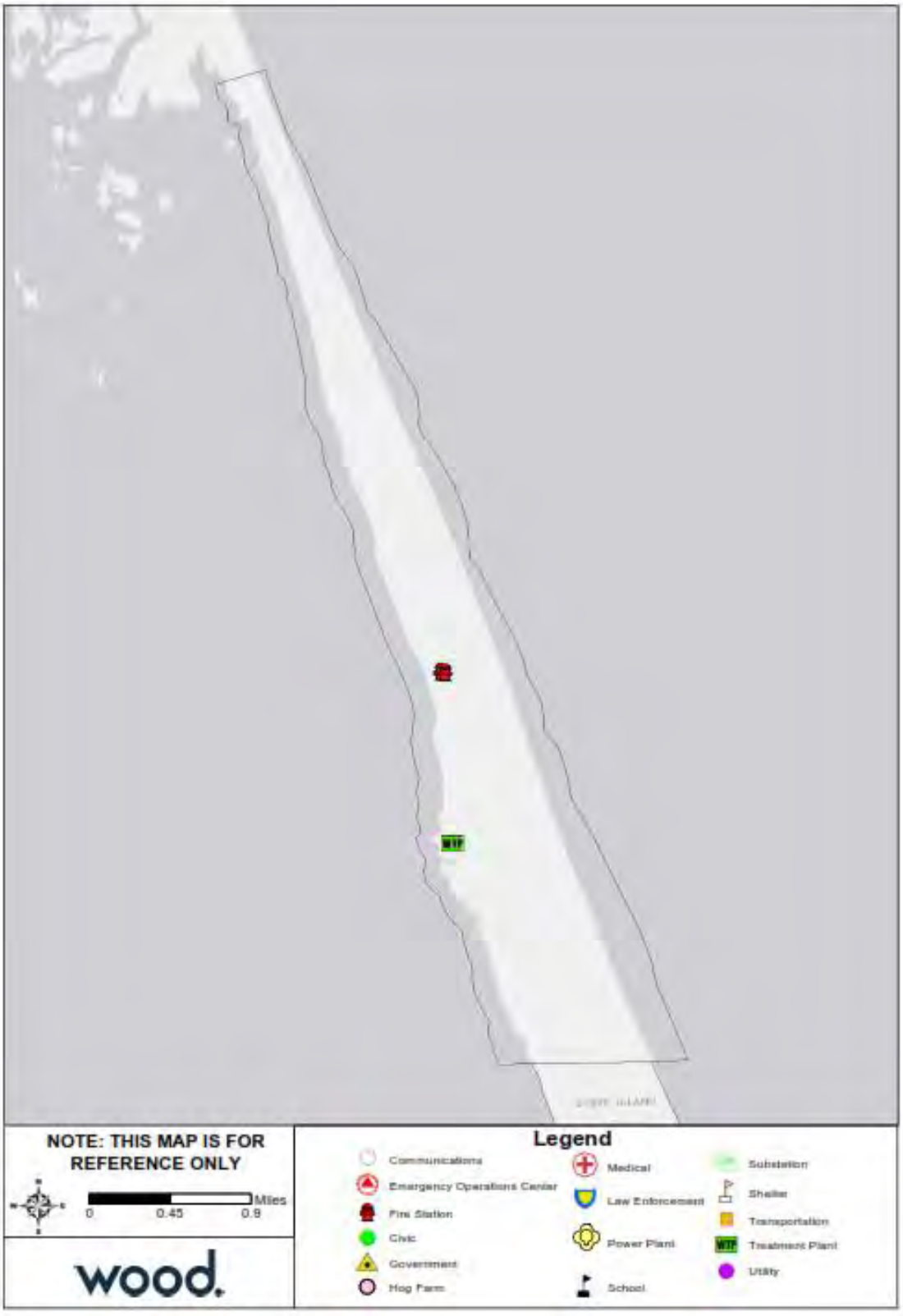
Source: NCEM Risk Management Tool

Table C.5 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Town of Duck	27	5	0	0	0	1	0	**33**

Source: NCEM Risk Management Tool

Figure C.2 – Critical Facilities, Town of Duck



Source: NCEM IRISK Database, HMPC input, GIS Analysis

Table C.6 – Critical Facilities, Town of Duck

Facility Type	Count
Fire Station	2
Treatment Plant	1
Total	**3**

Source: NCEM IRISK Database, HMPC input, GIS Analysis

To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Town of Duck, current parcel data was evaluated to identify recent development not included in NCEM's IRISK database. Based on this assessment, Duck has experienced a 3 percent increase in building count and building value exposure since IRISK estimates were compiled.

Table C.7 – Recent Development Not Included in IRISK, Town of Duck

Recent Improved Parcels		IRISK Buildings		Percent Change	
Count	Value	Count	Value	Building Count	Building Value
78	$24,632,900	2,400	$736,869,444	3.3%	3.3%

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

Note: This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

There is one listing on the National Register of Historic Places for the Town of Duck, listed below.

Table C.8 – Historic Properties

Ref#	Property Name	Status Date	Category	City
78001942	Caffeys Inlet Lifesaving Station	1/30/1978	Building	Duck

Source: National Parks Service, National Register of Historic Places, October 2018

Housing

The table below details key housing statistics for Duck as compared to the Region overall. Median home value is over 90 percent higher in Duck than across the Region overall. Duck has also experienced more growth as a percent change compared to the Region overall. These differences indicate a significant increase in asset exposure in Duck from 2010 to 2017.

Table C.9 – Housing Statistics, Duck, 2010-2017

Jurisdiction	Housing Units (2010)	Housing Units (2017)	Housing Units Percent Change (2010-2017)	Owner-Occupied, % (2017)	Vacant Units, % (2017)	Median Home Value (2017)
Region Total	**47,945**	**49,616**	**3.5%**	**74.5**	**49.6**	**$285,000**
Town of Duck	2,722	2,906	6.8%	81.0	90.6	$542,300

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2013-2017 5-Year Estimates
Note: Owner-Occupied and vacant-unit measures are reported as a percent of the total number of housing units.

Economy

The following tables present key economic statistics for Duck as compared to the Region overall.

Table C.10 – Employment Statistics, Duck, 2017

Jurisdiction	Population in Labor Force	Percent Employed* (%)	Percent Unemployed* (%)	Percent Not in Labor Force* (%)	Unemployment Rate (%)
Region Total	**32,463**	**61.7**	**3.3**	**34.4**	**5.0**
Duck	209	39.6	2.6	57.8	6.2

Source: U.S. Census Bureau, American Community Survey 2013-2017 5-Year Estimates
Note: This table reports only the civilian labor force. The labor force in armed services accounted for 0.6% of the population 16 and over across the region. *Population employed, population unemployed, and Population not in labor force are reported as a percent of the total population aged 16 years and older.

Table C.11 – Percent of Employed Population by Occupation, Duck, 2017

Occupation	Management, business, science and arts (%)	Service (%)	Sales and Office (%)	Natural Resources, Construction, and Maintenance (%)	Production, transportation, and material moving (%)
Region Total	**30.6**	**18.7**	**27.8**	**14.0**	**8.9**
Duck	38.3	26.0	28.6	7.1	0.0

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

Land Use and Future Development

The Town of Duck is currently updating their Comprehensive Land Use plan as of January 2020 and it has not yet been made available to the public. The Community Development Department is in charge of this update. Current and future land use and development information came from the 2005 CAMA CORE Land Use Plan.

Current Land Use

Since the Town has island geography and narrow strips of land, much of the development is located around the main transportation corridors. Land use is split into five categories (not including rights-of-way and easements) since there is no agricultural, forestry, confined animal feeding, or industrially zoned properties in Duck. The current categories are shown below with their total acreage in Table C.12. Acreages have been rounded to the nearest whole number as have percentages.

Table C.12 – Land Use, Town of Duck

Land Use	Total Acres	Percent of Town (%)
Single Family Residential	767	51
Multi-Family Residential	57	4
Commercial	88	6
Institutional	159	10
Total Developed	*1,071*	*71*
Undeveloped	242	16
Rights-of-way and easements	197	13
Total	**1,510**	**100**

Source: Town of Duck 2005 CAMA CORE Land Use Plan

Most of the Town is developed (71%) with 51 percent of the Town land classified as single family residential. Only 16 percent of the county is currently undeveloped.

Future Development

Current development trends are expected to continue into the coming years. The Town anticipates that there will be some re-development of properties and that no one area will see more concentrated

development than another. The population is expected to grow in the coming years for both permanent and seasonal populations. Duck will have enough housing to accommodate for this increase if some seasonal housing is converted to permanent occupancy and through development of currently vacant land. Additionally, the amount of commercially zoned land is suitable to account for this population increase.

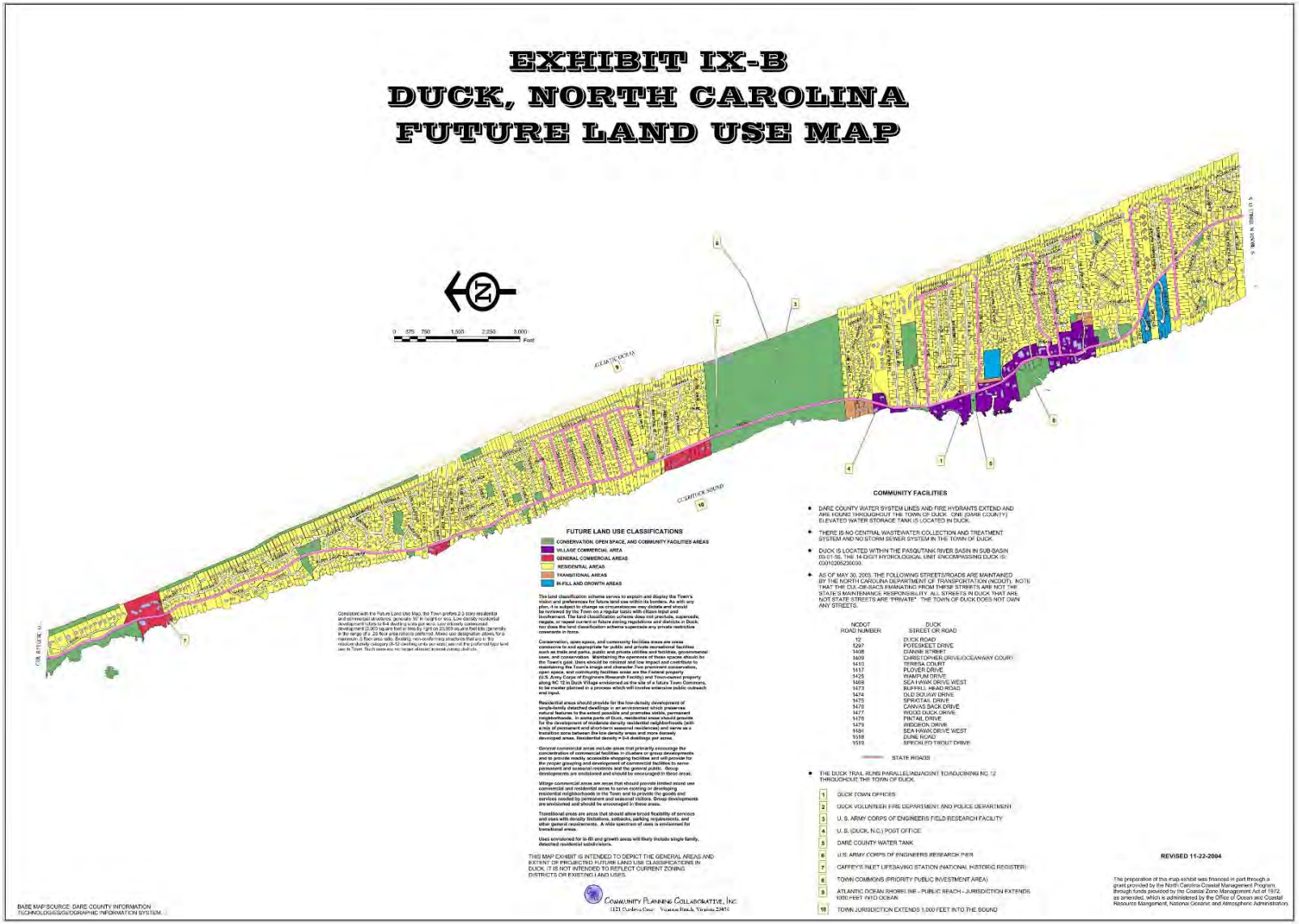
The Town has decided to create six new land classifications for their future land use and development. These classifications are:

- Conservation, open space, and community facilities areas
- Residential areas
- General commercial areas
- Village commercial areas
- Transitional areas
- In-fill and growth areas

Transitional areas are areas that allow very broad flexibility of services and uses. Some uses that are envisioned for transitional areas include single family and residential subdivisions.

Figure C.3 on the following page shows the future land use of the Town of Duck as envisioned in the 2005 CAMA CORE Land Use Plan. The transitional areas shown in orange and in-fill and growth areas shown in blue indicate the parts of the Town that will densify and change the most in the coming years.

Figure C.3 – Town of Duck Future Land Use Map



Source: Town of Duck 2005 CAMA CORE Land Use Plan

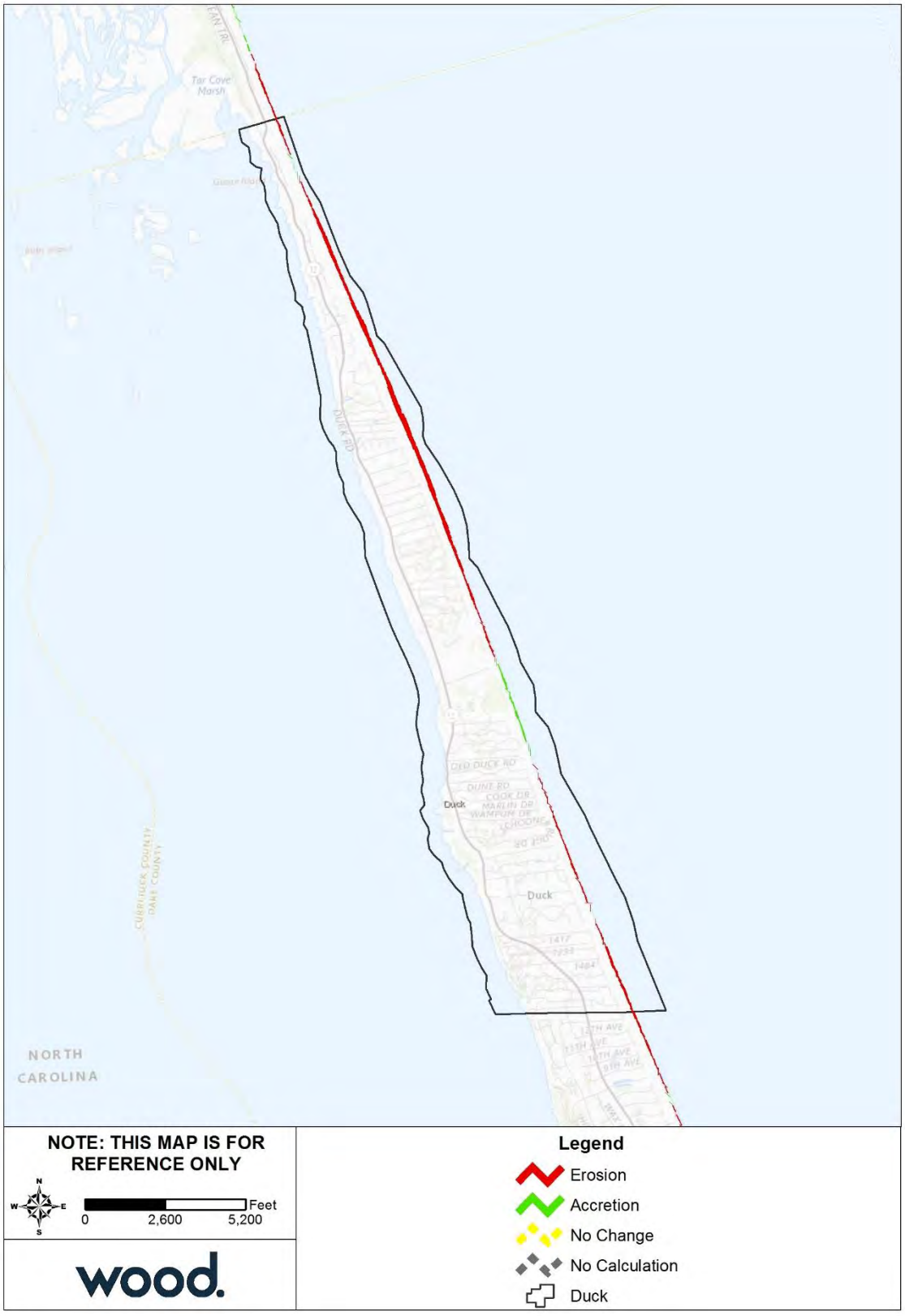
C.3 RISK ASSESSMENT

This section contains a hazard profile and vulnerability assessment for those hazards that were rated with a higher priority for the Town of Duck than for the Region as a whole. Risk and vulnerability findings are also presented here 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: Coastal Hazards, Flood, and Wildfire.

C.3.1 Coastal Hazards

Figure C.4 on the following page shows coastal erosion rates along the Town of Duck oceanfront coastline according to data from the DCM 2019 Long-Term Average Annual Erosion Rate Update Study. Long-term erosion rates are greater in the northern portions of Duck.

Figure C.4 – Erosion Rates, Town of Duck



Source: North Carolina Division of Coastal Management

C.3.2 Flood

Table C.13 details the acreage of the Town of Duck's total area by flood zone on the effective DFIRM. Per this assessment, over 60 percent of the Town falls within the mapped 1 percent annual chance floodplains and the rest is within the 0.2 percent annual chance floodplain.

Table C.13 – Flood Zone Acreage in the Town of Duck

Flood Zone	Acreage	Percent of Total (%)
Zone AE	905.48	48.1%
Zone VE	253.23	13.4%
Zone X (500-year)	724.93	38.5%
Total	**1,883.64**	--

Source: FEMA 2006 DFIRM

Figure C.5 reflects the effective mapped flood hazard zones for the Town of Duck, and Figure C.6 displays the depth of flooding estimated to occur in these areas during the 1 percent-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the Town of Duck, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. According to this assessment, over 37 percent of recent development in the Town of Duck is located in or near the SFHA.

Table C.14 – Recent Development at Risk to Flood, Town of Duck

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
29	$10,632,000	37.2%	43.2%

Source: Parcel data retrieved November 2019; FEMA 2006 DFIRM

This assessment does not evaluate flood impacts or provide damage estimates. However, this summary of recent development in or near the floodplain provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

Table C.15 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector and flood event in the Town of Duck. Table C.16 provides counts and estimated damages for High Potential Loss Properties in the Town of Duck.

Table C.15 – Critical Facilities Exposed to Flooding, Town of Duck

Sector	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	22	$1,262,679
Critical Manufacturing	1	$86,464
Transportation Systems	1	$1,688
All Categories	**24**	**$1,350,831**

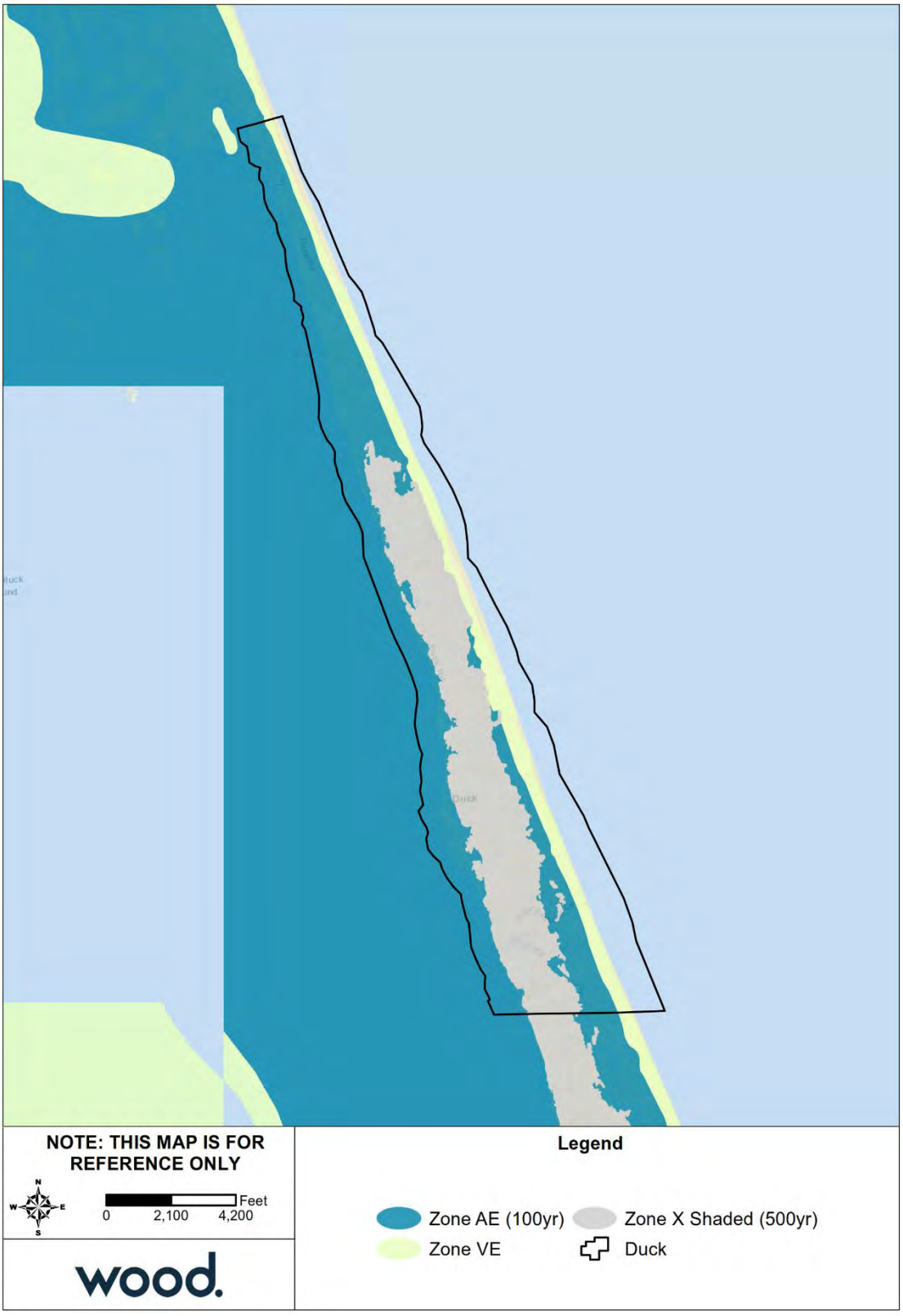
Source: NCEM Risk Management Tool

Table C.16 – High Potential Loss Properties Exposed to Flooding, Town of Duck

Category	Number of Buildings at Risk	Estimated Damages
Commercial	1	$135,780
Residential	10	$2,275,582
All Categories	**11**	**$2,411,362**

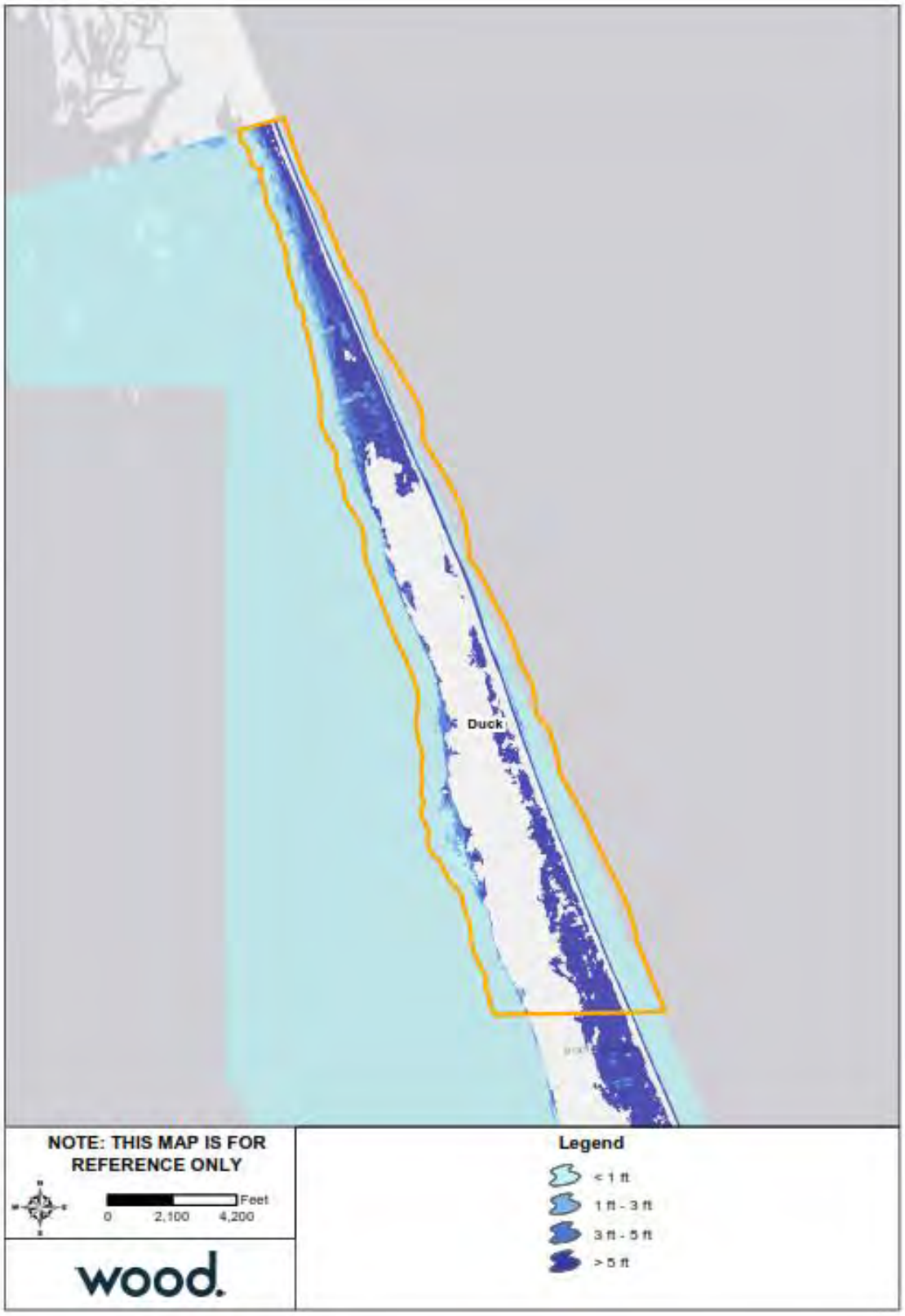
Source: NCEM Risk Management Tool

Figure C.5 – FEMA Flood Hazard Areas, Town of Duck



Source: FEMA 2006 DFIRM

Figure C.6 – Flood Depth, 1%-Annual Chance Floodplain, Town of Duck



Source: FEMA 2006 DFIRM

C.3.3 Wildfire

Table C.17 summarizes the acreage in the Town of Duck 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 66 percent of the Town of Duck is not included in the WUI.

Table C.17 – Wildland Urban Interface Acreage, Town of Duck

	Housing Density	Total Acreage	Percent of Total Acreage
	Not in WUI	*1,579.9*	*66.4%*
	LT 1hs/40ac	25.1	1.1%
	1hs/40ac to 1hs/20ac	29.6	1.2%
	1hs/20ac to 1hs/10ac	112.5	4.7%
	1hs/10ac to 1hs/5ac	361.2	15.2%
	1hs/5ac to 1hs/2ac	217.7	9.2%
	1hs/2ac to 3hs/1ac	53.4	2.2%
	GT 3hs/1ac	0.0	0.0%
	Total	**2,379.5**	

Source: Southern Wildfire Risk Assessment

Figure C.7 depicts the WUI for the Town of Duck. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure C.8 depicts the Fire Intensity Scale, which indicates the potential severity of fire based on fuel loads, topography, and other factors. Figure C.9 depicts Burn Probability based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Data is not available on past acreage burned at the jurisdictional level.

There are two small clusters of moderate to high potential fire intensity in Duck, and both coincide with areas in the WUI. However, most of the Town is not burnable and the few areas that are have a low burn probability. Therefore, there is no area of significant wildfire risk in the Town.

Table C.18 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table C.19 summarizes the High Potential Loss Properties exposed to wildfire in the Town of Duck.

Table C.18 – Critical Facilities Exposed to Wildfire, Town of Duck

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	1	$394,507
Commercial Facilities	24	$14,529,486
Communications	1	$737,800
Critical Manufacturing	1	$450,700
Food and Agriculture	1	$188,557
Transportation Systems	2	$1,309,144
All Categories	**30**	**$17,610,194**

Source: NCEM Risk Management Tool

Table C.19 – High Potential Loss Properties Exposed to Wildfire, Town of Duck

Category	Number of Buildings at Risk	Estimated Damages
Commercial	3	$3,879,200
Religious	1	$2,259,555
Residential	7	$10,202,884
All Categories	**11**	**$16,341,639**

Source: NCEM Risk Management Tool

Figure C.7 – Wildland Urban Interface, Town of Duck



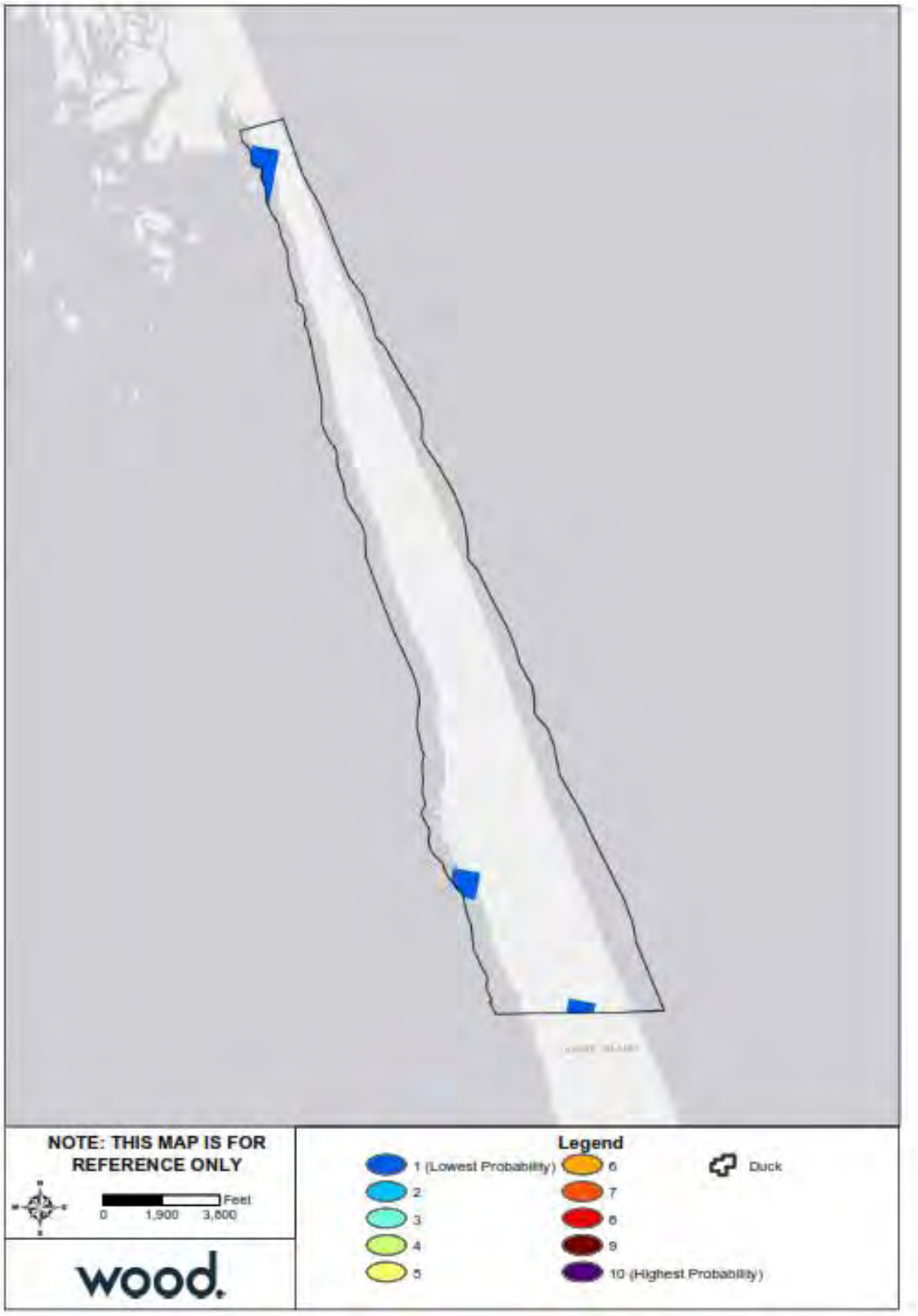
Source: Southern Wildfire Risk Assessment

Figure C.8 – Fire Intensity Scale, Town of Duck



Source: Southern Wildfire Risk Assessment

Figure C.9 – Burn Probability, Town of Duck



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 Duck were provided by the Town's HMPC representatives and are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Duck has an overall capability rating of Moderate. The Town's Self-Assessment of key capability areas is summarized in Table C.20 below.

Table C.20 – Capability Self-Assessment, Duck

Capability Area	Rating
Plans, Ordinances, Codes and Programs	High
Administrative and Technical Capability	Moderate
Fiscal Capability	Moderate
Education and Outreach Capability	High
Mitigation Capability	Limited
Political Capability	Moderate
Overall Capability	Moderate

C.4.2 Floodplain Management

The Town of Duck joined the NFIP as a regular participant in November 2003. The following tables reflect NFIP policy and claims data for the Town categorized by structure type, flood zone, Pre-FIRM and Post-FIRM.

Table C.21 – NFIP Policy and Claims Data by Structure Type

Structure Type	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
Single Family	1,059	$945,825	$329,564,500	52	$663,673.62
2-4 Family	21	$26,043	$6,017,500	0	$0.00
All Other Residential	18	$9,347	$3,573,900	0	$0.00
Non-Residential	59	$85,143	$28,493,500	6	$141,964.16
Total	**1,157**	**$1,066,358**	**$367,649,400**	**58**	**$805,637.78**

Source: FEMA Community Information System, accessed December 2019

Table C.22 – 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	550	$334,611	$167,881,900	40	$312,433.02
AO Zones	62	$49,389	$21,678,300	1	$654.91
V01-30 & VE Zones	60	$315,153	$17,268,700	1	$31,949.87
B, C & X Zone					
Standard	120	$205,021	$35,157,500	6	$195,728.17
Preferred	365	$162,184	$125,663,000	10	$264,871.81
Total	**1,157**	**$1,066,358**	**$367,649,400**	**58**	**$805,637.78**

Source: FEMA Community Information System, accessed August 2019

Table C.23 – 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	33	$35,167	$9,238,900	3	$63,574.70
AO Zones	2	$2,840	$689,900	0	$0.00
V01-30 & VE Zones	12	$68,924	$3,074,700	0	$0.00
B, C & X Zone	20	$16,172	$7,018,300	1	$30,041.52
Standard	5	$8,353	$1,608,300	0	$0.00
Preferred	15	$7,819	$5,410,000	1	$30,041.52
Total	**67**	**$123,103**	**$20,021,800**	**4**	**$93,616.22**

Source: FEMA Community Information System, accessed December 2019

Table C.24 – 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	517	$299,444	$158,643,000	37	$248,858.32
AO Zones	60	$46,549	$20,988,400	1	$654.91
V01-30 & VE Zones	48	$246,229	$14,194,000	1	$31,949.87
B, C & X Zone	465	$351,033	$153,802,200	15	$430,558.46
Standard	115	$196,668	$33,549,200	6	$195,728.17
Preferred	350	$154,365	$120,253,000	9	$234,830.29
Total	**1,090**	**$943,255**	**$347,627,600**	**54**	**$712,021.56**

Source: FEMA Community Information System, accessed December 2019

C.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
DCK1	Continue to fund enforcement of current hazard mitigation regulations.	All	3.1	High	Town Staff, Town Council	General Fund	Annual, Ongoing	Carry Forward	Town Council continues to annually fund a Code Enforcement Position and Certified Floodplain Manager as well as continuing education training.
DCK2	Adopt and apply development policies that balance protection of natural resources and fragile areas with residential and economic development	Hurricane & Tropical Storm, Coastal Hazards, Flood, Severe Weather, Wildfire	1.2	High	Town Staff, Town Council	General Fund	6 Month, Annual	Carry Forward	Town Staff is working with OBX CRS Users Group on the development of a new floodplain ordinance with higher regulatory standards for areas within the Special Flood Hazard Area (SFHA) as well as areas that are not located within the SFHA to address known flood risks. These standards are being prepared in expectation of the adoption of new Flood Insurance Rate Maps from FEMA in 2020. Town Council adopted a Resolution establishing a policy related to the Emergency Pumping of Floodwaters September, 2018. The Town had an emergency floodwater management discharge plan approved by the NC Division of Water Quality in May, 2019.
DCK3	Develop policies that minimize threats to life, property, and natural resources resulting from development located in or adjacent to hazard areas, such as those subject to erosion, high winds, storm surge, flooding, or sea level rise.	Hurricane & Tropical Storm, Coastal Hazards, Flood, Severe Weather, Wildfire	1.2	High	Town Staff, Town Council	General Fund	6 Month, Annual	Carry Forward	Adoption of revised Flood Insurance Rate Maps and Flood Damage Prevention Ordinance, local participation in CAMA LPO program, Participation in the FEMA Community Rating System, enforcement of NC State Building Code Revisions and amendments including wind-borne debris provisions. The Town has also revised policies related to oceanfront development including additional setbacks for accessory structures, new dune walkway standards, and remedies for structures encroaching on the ocean beach. Annual beach profile surveys initiated in 2017 continue to assess changing shoreline patterns.
DCK4	Develop location, density, and intensity criteria for new, existing development and redevelopment including public facilities and infrastructure so that they can better avoid or withstand natural hazards.	Hurricane & Tropical Storm, Coastal Hazards, Flood, Severe Weather, Wildfire	3.1	High	Town Staff, Town Council	General Fund	Annual Review	Carry Forward	Town Code revisions including lot coverage regulations, limitations on residential dwelling size, increased setbacks for accessory structures, additional elevation requirements for V-Zone structures and incentives for use of permeable and semi-permeable materials for driveways and parking have been adopted. Town Council adopted additional limitations on the scale of development through house size limitations and increased setback requirements January, 2019
DCK5	As a FEMA CRS commuity, we will take advantage of the various mitigation strategies promoted by this program	Hurricane & Tropical Storm, Coastal Hazards, Flood	3.3	High	Town Staff, Town Council	General Fund	Annual	Carry Forward	The Town continues to develop actions and strategies that will lower its CRS rating and therefore provide lower flood insurance premiums to property owners within the Town. See also DCK3.
DCK6	Support programs and initiatives to annually assess shoreline changes (erosion and accretion)	Hurricane & Tropical Storm, Coastal Hazards, Flood	3.2	High	Town Council	General Fund	Annual, As Needed	Carry Forward	The Town has been monitoring high oceanfront erosion areas by documenting storm damage and taking photos/Go Pro and aerial drone video. A beach erosion study has been completed for the Town by the USACOE and Coastal Planning and Engineering which documents erosion patterns and existing conditions. The Town enacted an additional tax to support beach management activities, and annual beach profile surveys were initiated in 2017 to assess changing patterns. These surveys are expected to soon be supplemented with aerial drone technology providing 3D imaging analysis that will further enhance the Town's ability to track shoreline change. These techniques may likely be carried over to assess soundside shoreline changes as well.
DCK7	Stay informed, involved and supportive relative to Federal, State, and/or regional studies, initiatives and efforts concerning beach re-nourishment and maintenance	Hurricane & Tropical Storm, Coastal Hazards, Flood	3.2	High	Town Staff, Town Council	General Fund	Annual	Carry Forward	The Town participates in the annual program established by the Dare County Shoreline Commission to provide funds for beach maintenance. The Town started discussions in 3/2019 regarding beach re-nourishment in conjunction with Dare County and the Towns of Kill Devil Hills, Kitty Hawk and Southern Shores.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
DCK8	Develop a Fire Ordinance consistent with State regulations and unique to the Town.	All	3.1	Medium	Public Safety, Town Staff, Town Council	General Fund	6 Month	New	Public Safety and Town staff are currently working on the development of a Fire Prevention Ordinance that will address fire inspections, mutual aid, allowable and prohibited fires, life safety provisions.
DCK9	Update CAMA Land Use Plan	All	3.3	High	Town Staff, Planning Consultant, NC Division of Coastal Management	General Fund	9 Month	New	The Town of Duck is currently working on updating its Comprehensive CAMA Land Use Plan. When completed, the plan will contain existing and emerging background information, assessments of issues and opportunities, and development of future goals and objectives. Key topics include natural resources, community resiliency, economic development, stormwater management, and multi-modal transportation.
Property Protection									
DCK10	Identify areas most at risk and investigate strategies to reduce risk from wild land/urban interface fires	Wildfire	1.2	High	Fire Department, Town Staff	General Fund	1-2 Years	Carry Forward	Fire department staff will be utilizing resources to include utilizing new GIS mapping tools to identify areas that may be vulnerable in order to determine effective risk reduction strategies.
Natural Resource Protection									
DCK11	Increase the amount of open space throughout the town by seeking land donations or making land purchases. Develop an open space plan to further enhance these areas.	Hurricane & Tropical Storm, Coastal Hazards, Flood	3.3	Medium	Town Council	General Fund	Annual Review	Carry Forward	The Town owns an 11-acre park in the center of the Village Commercial area which is partially maintained as open space. As the Town is 90 percent developed, there are few areas available to purchase and maintain as open space. Additionally, Town funds for property acquisitions are limited. Future activities in this area will largely depend on the success of the Town in acquiring property with available grants.
DCK12	Protect the oceanfront recreation area through active beach maintenance, nourishment, and public engagement	Hurricane & Tropical Storm, Coastal Hazards, Flood, Severe Weather	3.2	High	Town Council, Town Staff	General Fund, Dare County Occupancy Tax, Municipal Service Districts, Bonds	Annual Maintenance, 5 Year Renourishment	New	The Town has begun discussions related to renourishment of 1.7 miles of oceanfront beach. During these discussions, surveys and data for the entire oceanfront will be considered to determine whether other areas are subject to vulnerability and in need of nourishment as well. In the interim, during the planning process for renourishment, the Town continues to fund annual beach planting, limited sand fencing and supports a volunteer planting program to engage residents, owners and visitors in the protection of the ocean shoreline.
DCK13	Continue to work with State and Federal Agencies to promote living shoreline opportunities along the soundfront	Hurricane & Tropical Storm, Coastal Hazards, Flood, Severe Weather	3.3	High	Town Council, Town Staff	General Fund, Grants	2-3 Years	New	The Town is working with an engineering consultant on the design and permitting of a living shoreline project in a vulnerable area along Currituck Sound. The Town is seeking grant assistance to fund a portion of the project costs.
DCK14	Increase coastal resiliency through research and progressive planning	Hurricane & Tropical Storm, Coastal Hazards, Flood, Severe Weather	3.3	High	Town Council, Town Staff, NCDOT	General Fund, Grants	Present to 5 Years, Annual Review	New	The Town has been working with Woods Hole Oceanographic Institution to improve flooding predictions. With the help and engagement of citizen scientists, flood events data is being collected and used to help evaluate and improve models for flooding from ocean and sound storms as well as rainfall. If successful, these models will help guide the Town's flood management policies in the future. The Town is also partnering on a grant-funded vulnerability assessment with researchers at the Program for the Study of Developed Shorelines at Western Carolina University.
Structural Projects									
DCK15	Improve stormwater drainage in vulnerable areas	Hurricane & Tropical Storm, Coastal Hazards, Flood	3.3	High	Town Staff, Town Council	General Fund	Annual	Carry Forward	Town Staff continues to identify and resolve localized roadway flooding issues as funding and resources become available. The Town has identified low lying areas through GIS mapping and associated flood risks to those areas resulting from rain events. The Town has submitted an emergency floodwater management plan that was reviewed and approved by NCDWR to address stormwater flooding in these areas. The Town also continues to implement stormwater management projects along NC12 to mitigate flooding and standing water. Drainage Projects along NC12 at Duck Ridge Village Court, Station Bay Marina and along the Duck Trail are being considered funding in the budget for fiscal year 2019-20.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
DCK16	Lobby the NC Board of Transportation and the NC Department of Transportation and NC Turnpike Authority for the construction of the Mid-County Bridge.	Hurricane & Tropical Storm, Coastal Hazards, Flood	3.3	High	Town Council, NCDOT	NCDOT	Annual	Carry Forward	The Town Council has issued several resolutions to support the construction of the Mid-Currituck Bridge and to identify the Town's preferred design alternative for the project. The Town has sent letters to NCDOT and NC Turnpike Authority Staff providing comments on the project studies that have been underway for several years. The Town frequently discusses the project at regular Town Council meetings and is kept informed of the status of the project by Town staff and residents who serve on a local committee to support construction of the bridge.
DCK17	Address drainage issues on NC 12 as applicable and provide funding for necessary stormwater improvements.	Hurricane & Tropical Storm, Coastal Hazards, Flood, Severe Weather	3.3	High	Town Staff, Town Council	General Fund, NCDOT	Annual	Carry Forward	Engineering is ongoing to rectify localized drainage problems on parts of NC 12 and funding is being provided in the CIP annually. Completed projects include pedestrian improvements along the west side of NC12 in the Village which include a sidewalk with both landscaping and stormwater features, and Duck Trail improvements north of Waxwing Lane and Station Bay Drive. FY 2019-2020 budget includes funding for improvements along the east side of NC12 from Duck Deli to the north end of the Village, the east and west side of NC12 at Wee Winks, south of Four Seasons Lane and at NC12 and Station Bay Marina. Collaboration with NCDOT continues as needed.
Emergency Services									
DCK18	Participate in the Dare/Currituck County Local Emergency Preparedness Committee (LEPC)	All	4.1	High	Public Safety	General Fund	Quarterly	New	Dare and Currituck County Emergency Management initiated meetings in 2017 for consideration of forming a joint LEPC. The Outer Banks Regional LEPC was established in order to improve capabilities to meet all threats and hazards not just HAZMAT. Public safety personnel is and will continue to participate in meetings and joint trainings to improve multi-jurisdictional emergency response to all hazards.
DCK19	Annual Review of Emergency Operations Plan	All	2.2	High	Public Safety, Town Staff	General Fund	Annual	New	Continue to review the Town's Emergency Operations Plan annually in order to address any lessons learned, priorities, procedures, or additions to ensure effective implementation of the plan.
DCK20	Develop Standard Operating procedure for Crisis Track	Hurricane & Tropical Storm, Coastal Hazards, Flood	3.3	Medium	Public Safety, Town Staff	General Fund	6-12 Months, Annual	New	Public Safety and Town Staff will develop a standard operating procedure for instructional purposes on the process and use of the County Hurricane Assessment software, Crisis Track, to include annual staff and volunteer training.
Public Education & Awareness									
DCK21	Collaborate with Duck Fire and Town Staff to educate the homeowners, developers and landscapers on designing fire safe communities.	Wildfire	1.1	High	Fire Department, Town Staff	General Fund	6 Month-2 Years	Carry Forward	Fire department staff is initiating a phased approach with Phase I implementation focusing on education and awareness. Future phases will look at regulatory implementation and a formalized plan.
DCK22	Continue education efforts to promote dune maintenance.	Hurricane & Tropical Storm, Coastal Hazards, Flood	1.1	High	Town Staff, Division of Coastal Management	General Fund, Grant Fund	Annual	Carry Forward	Town distributes information and promotes the proper installation of sand fence and encourages the planting of native vegetation. The Town implemented volunteer based beach planting program November, 2017 with funding expected to be continued. The program has garnered support from residents, non-residents and local volunteer groups.
DCK23	Keep effective construction techniques for coastal communities available online	Hurricane & Tropical Storm, Coastal Hazards, Flood	1.1	High	Town Staff	General Fund	Annual	Carry Forward	Town of Duck Floodplain webpage reworked 9/18 to include FEMA/NC Department of Insurance publications on Coastal Construction Techniques.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
DCK24	Mitigate ocean overwash and sound erosion by identifying vulnerable areas, developing public outreach information and disseminating this information to the public.	Hurricane & Tropical Storm, Coastal Hazards, Flood	1.1	High	Town Staff	General Fund	6 Months-Annual	Carry Forward	The Town has been monitoring high oceanfront erosion areas by documenting storm damage and taking photos/go pro and aerial drone video. A beach erosion study has been completed for the Town by the USACOE and Coastal Planning and Engineering which documents erosion patterns and existing conditions. As a result of these findings, annual beach profile surveys were initiated in 2017 to assess changing patterns and will continue annually. These surveys are being supplemented with aerial drone technology to develop 3D imaging analysis. The Town still needs to develop a method to track sound side erosion. Information regarding these findings are disseminated through social media, the Town website and direct email correspondence to oceanfront owners and to soundfront owners once that database is completed.
DCK25	Provide residents information and links to technical assistance concerning beach nourishment, re-nourishment and maintenance activities, including options such as sand fencing	Hurricane & Tropical Storm, Coastal Hazards, Flood	1.1	High	Town Staff, Town Council	General Fund	Annual	Carry Forward	The Town website, social media and direct email communication is utilized to disseminate information. The Town provides information and issues CAMA permits to oceanfront property owners seeking to maintain their primary and frontal dunes.
DCK26	Continue to provide effective public information and education materials to disseminate data on hazards, and educate beachgoers on beach safety (rip currents, beach holes, beach fires, etc.)	All	1.1	High	Town Council, Town Manager, Public Information Officer, Ocean Rescue	General Fund	Annual	Carry Forward	Continue collaboration through the County's Joint Information Center (JIC) and Emergency Management tools to include methods such as regroup and other joint marketing techniques designed for large scale public dissemination. Continue annual and in-season evaluations and reviews regarding public safety staffing, life-guard stand locations, and effective means to communicate threats (ocean conditions, storms hazardous conditions); i.e. social media, life guard advisories, use of flag notification systems and signage at beach access locations.
DCK27	Continue development and improvement related to the dissemination of public information to stakeholders	All	1.1	High	Town Staff, Town Council	General Fund	Biannual	Carry Forward	The Town effectively utilizes its website, social media, and direct email and telephone communications to communicate threats to and from its stakeholders (i.e.; property owners, residents, business owners, and vacationers), however continual research and development of new and effective means of communication are constantly pursued. Collaboration with the County's Joint Information Center (JIC) and Emergency Management has helped with the development of new techniques and technology to disseminate information. Ongoing collaboration with Duck Merchant's Association is maintained through quarterly and monthly meetings. Databases for the purpose of direct email communications with oceanfront and soundfront owners are maintained and updated regularly. The direct email database is slated for expansion to include the all residents and owners within the Town.
DCK28	Develop Annual Outreach Event regarding Fire Safety	All	1.1	High	Public Safety, Town Staff	General Fund	Biannual	New	Public Safety and Town Staff are currently working on the development of an annual outreach program to educate and inform business owners on proper and safe fire prevention in connection with and addition to annual and multi-year inspections.

Annex D Town of Kill Devil Hills

D.1 PLANNING PROCESS

The table below lists the HMPC members who represented the Town of Kill Devil Hills.

Table D.1 – HMPC Members

Representative	Agency/Department	Position or Title
Meredith Guns	Planning & Inspections	Planning Director
Cameron Ray	Planning & Inspections	Senior Planner
Doug Styons	Citizen	Business owner, Citizen, licensed land surveyor, stakeholder on KDH PPI Committee & Damage Assessment Team member
Mike O'Steen	Citizen	Local business owner, Professional Engineer, stakeholder for KDHPPI Committee
Skip Jones	Citizen	Local business owner, Licensed Contractor, former President Homebuilders Association, stakeholder for KDH PPI Committee

D.2 COMMUNITY PROFILE

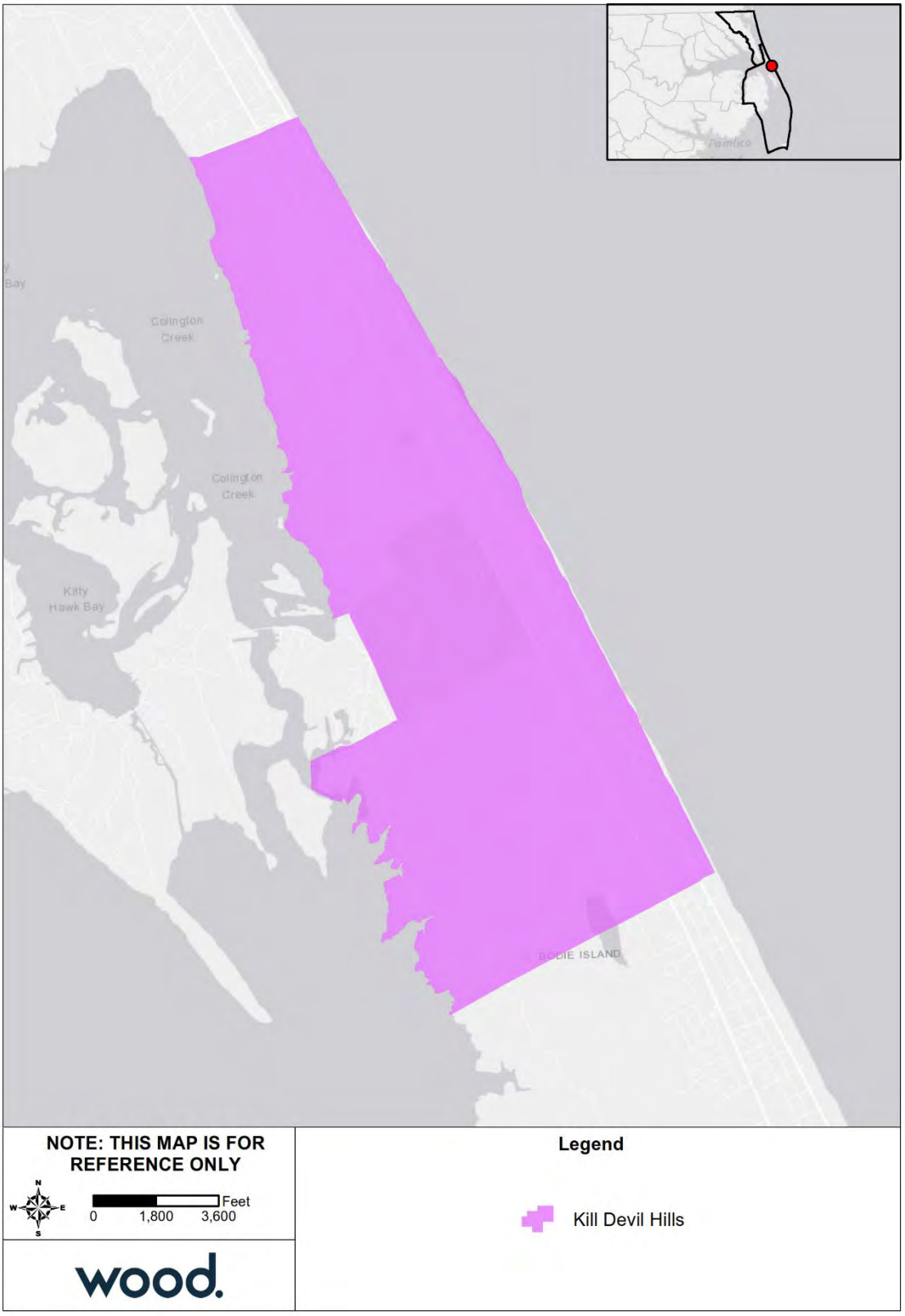
Geography

The Town of Kill Devil Hills is a barrier island community in Dare County. It is neighbored by Kitty Hawk to the north and Nags Head to the south. To the west of Kill Devil Hills is Colington Creek and the unincorporated community of Colington. Kill Devil Hills comprises a total land area of 5.62 square miles.

According to data from the U.S. Fish and Wildlife Service's National Wetlands Inventory, there are approximately 69 acres of wetlands in Kill Devil Hills, primarily forested/shrub wetland.

Figure D.1 shows a base map of the Town of Kill Devil Hills.

Figure D.1 – Location Map, Town of Kill Devil Hills



Source: U.S. Census Bureau

Population and Demographics

Table D.2 provides population counts and growth estimates for the Town of Kill Devil Hills as compared to the Region overall. Table D.3 provides demographic information for Kill Devil Hills as compared to the Region.

Table D.2 – Population Counts, Kill Devil Hills, 2010-2017

Jurisdiction	2000 Census Population	2010 Census Population	2017 ACS Population Estimate	Total Change 2010-2017	% Change 2010-2017
Region Total	**48,157**	**57,467**	**60,659**	**3,192**	**5.55%**
Town of Kill Devil Hills	5,897	6,683	6,978	295	4.41%

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2013-2017 5-Year Estimates

Table D.3 – Racial Demographics, Kill Devil Hills, 2017

Jurisdiction	White, %	Black, %	Asian, %	Other Race, %	Two or More Races, %	Persons of Hispanic or Latino Origin*, %
Region Total	**91.0**	**3.5**	**0.5**	**2.2**	**2.7**	**5.7**
Town of Kill Devil Hills	90.4	1.8	0.7	5.0	2.1	12.2

Source: US Census Bureau, American Community Survey 2013-2017 5-Year Estimates
*Persons of Hispanic origin may be of any race, so also are included in applicable race categories

Asset Inventory

The following tables summarize the Critical Infrastructure and Key Resources (CIKR) and high potential loss facilities identified in IRISK for the Town of Kill Devil Hills. Critical facilities, which include a subset of identified assets form the CIKR dataset as well as facilities identified by the HMPC, are shown in Figure D.2 on the following page and summarized in Table D.6. The County provided information is not included in IRISK vulnerability assessments. Note that the IRISK counts are by building; where a critical facility identified by IRISK comprises a cluster of buildings, each building is counted and displayed.

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

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	EM	Healthcare	Government Facilities	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Town of Kill Devil Hills	1	11	0	249	4	45	0	12	10	1	0	29	4	1	5	**372**

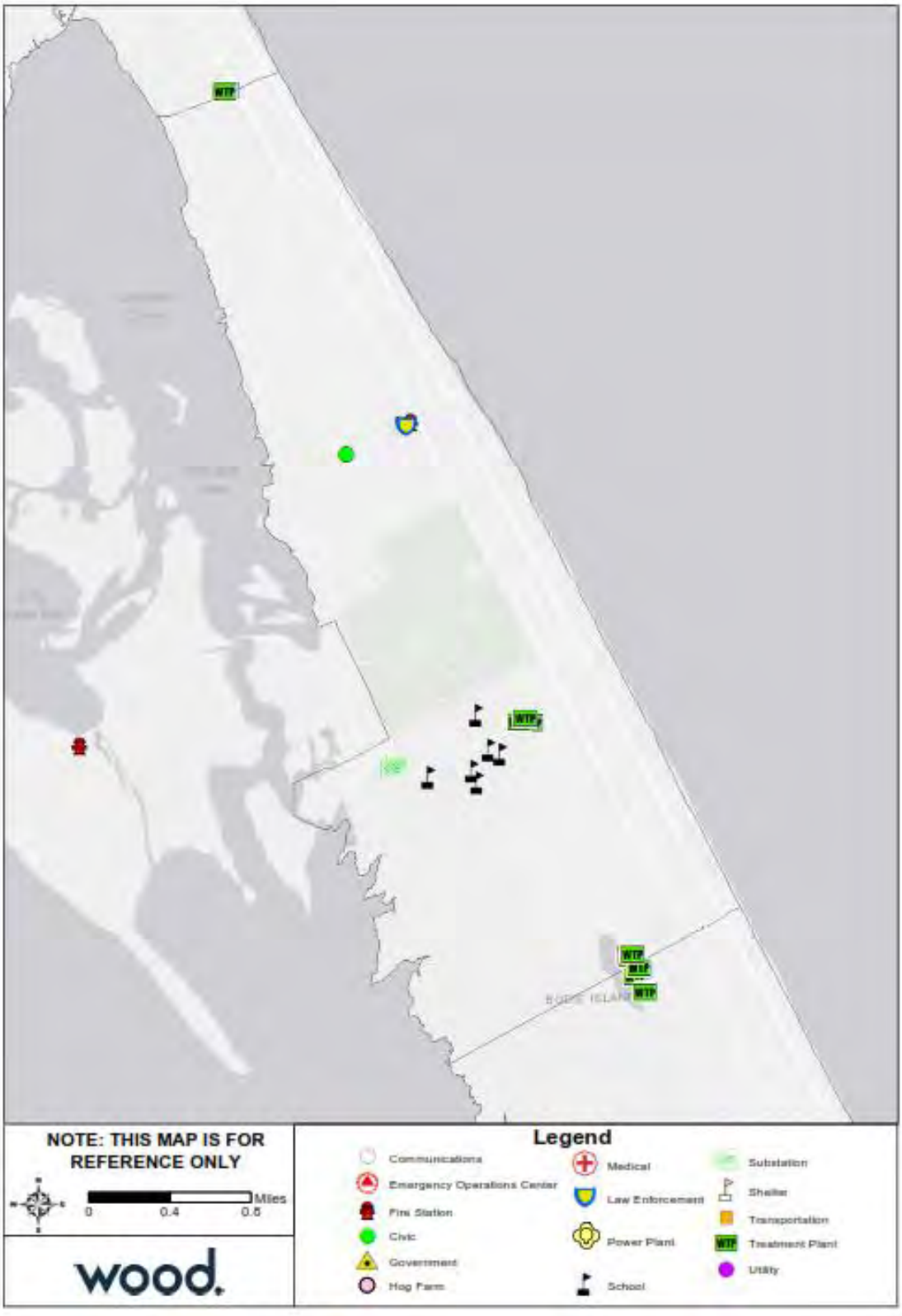
Source: NCEM Risk Management Tool

Table D.5 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Town of Kill Devil Hills	40	28	0	3	0	0	2	**73**

Source: NCEM Risk Management Tool

Figure D.2 – Critical Facilities, Town of Kill Devil Hills



Source: NCEM IRISK Database, HMPC input, GIS Analysis

Table D.6 – Critical Facilities List, Town of Kill Devil Hills

Facility Type	Count
Fire Station	1
Police Station	1
School	6
Substation	2
Treatment Plant	6
Total	**16**

Source: NCEM IRISK Database, HMPC input, GIS Analysis

To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Town of Kill Devil Hills, current parcel data was evaluated to identify recent development not included in NCEM's IRISK database. Per this assessment, since IRISK data was compiled the Town of Kill Devil Hills' building value exposure has increased by 9.6 percent.

Recent Improved Parcels		IRISK Buildings		Percent Change	
Count	Value	Count	Value	Building Count	Building Value
416	$93,552,200	5,972	$974,106,060	7.0%	9.6%

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

Note: This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

There are two listings on the National Register of Historic Places for the Town of Kill Devil Hills. These sites are listed in the table below.

Table D.7 – Historic Properties

Ref#	Property Name	Status Date	Category	City
66000071	Wright Brothers National Memorial	10/15/1966	District	Kill Devil Hills
99000062	Sam's Diner	1/27/1999	Building	Kill Devil Hills

Source: National Parks Service, National Register of Historic Places, October 2018

Housing

The table below details key housing statistics for Kill Devil Hills as compared to the Region overall.

Table D.8 – Housing Statistics, Kill Devil Hills, 2010-2017

Jurisdiction	Housing Units (2010)	Housing Units (2017)	Housing Units Percent Change (2010-2017)	Owner-Occupied, % (2017)	Vacant Units, % (2017)	Median Home Value (2017)
Region Total	**47,945**	**49,616**	**3.5%**	**74.5**	**49.6**	**$285,000**
Town of Kill Devil Hills	6,617	6,433	-2.8%	58.5	54.3	$240,200

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2013-2017 5-Year Estimates
Note: Owner-Occupied and vacant-unit measures are reported as a percent of the total number of housing units.

Economy

The following tables present key economic statistics for Kill Devil Hills as compared to the Region overall.

Table D.9 – Employment Statistics, Kill Devil Hills, 2017

Jurisdiction	Population in Labor Force	Percent Employed* (%)	Percent Unemployed* (%)	Percent Not in Labor Force* (%)	Unemployment Rate (%)
Region Total	**47,945**	**49,616**	**3.5%**	**74.5**	**49.6**
Kill Devil Hills	4,288	70.7	5.3	24.1	7.0

Source: U.S. Census Bureau, American Community Survey 2013-2017 5-Year Estimates
Note: This table reports only the civilian labor force. The labor force in armed services accounted for 0.6% of the population 16 and over across the region. *Population employed, population unemployed, and Population not in labor force are reported as a percent of the total population aged 16 years and older.

Table D.10 – Percent of Employed Population by Occupation, Kill Devil Hills, 2017

Occupation	Management, business, science and arts (%)	Service (%)	Sales and Office (%)	Natural Resources, Construction, and Maintenance (%)	Production, transportation, and material moving (%)
Region Total	**30.6**	**18.7**	**27.8**	**14.0**	**8.9**
Kill Devil Hills	28.3	26.4	25.1	12.5	7.7

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

Land Use and Future Development

The Town of Kill Devil Hills Planning and Inspections Department is responsible for land-use planning for the Town. The Town is currently reviewing the new 2019 CAMA Land Use Plan Update as of January 2020. The draft of this plan is available and information from it was used for this assessment of future development.

Current Land Use

Since the County has island geography and narrow strips of land, much of the development is located around the main transportation corridors, US 158 and NC 12. The Town classifies their land into eight different categories. These categories are shown below with their total acreage in Table D.11. Acreages have been rounded to the nearest whole number as have percentages.

Table D.11 – Land Use, Town of Kill Devil Hills

Land Use	Total Acres	Percent of Town (%)
Commercial	199	6
Industrial	33	1
Office and Institutional	596	19
Mixed Use	6	1
Multi-Family Residential	97	3
Single Family Residential	1,154	37
Recreational	87	3
Total Developed	*2,172*	*70*
Vacant/ Unimproved	941	30
Total	**3,113**	**100**

Source: Town of Kill Devil Hills 2019 CAMA Land Use Plan Update

Recreational parcels include public parks, open space, and public beach access. Undeveloped land falls under the vacant/unimproved category. Most of the Town is developed (70%) with 37 percent of land classified as single family residential.

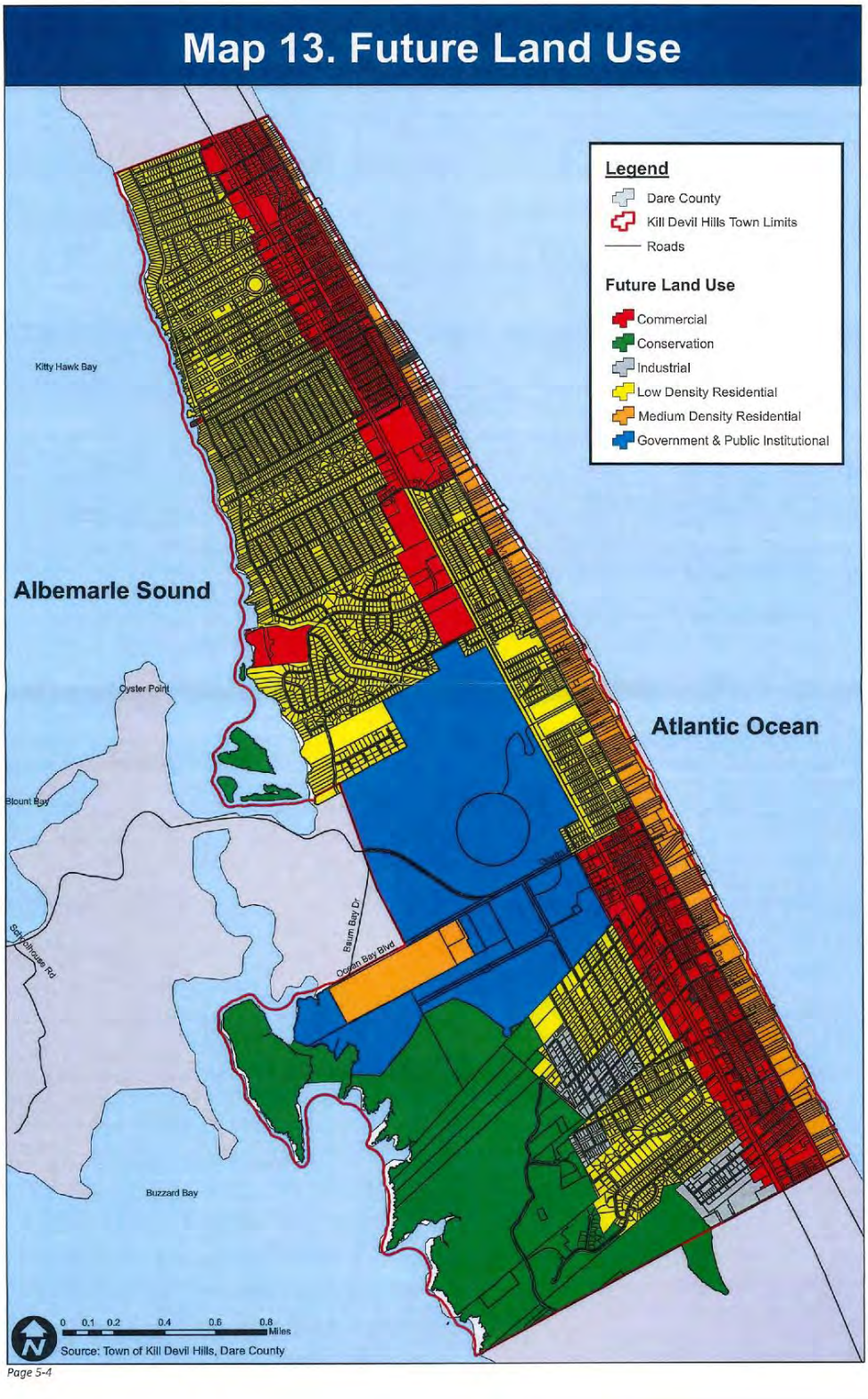
Future Development

Even though 30 percent of land in the Town is deemed vacant/unimproved, there is not much vacant land available for development. However, re-development of some lots is an option when considering future development. Development will most likely continue to locate around the transportation corridors and will continue at a consistent pace. Future development within the Town will use a new classification system with five classes. These classes are

- Commercial
- Residential
- Conservation
- Industrial
- Government and Public Institutional

Figure D.3 shows the future land use of the Town of Kill Devil Hills as envisioned in the 2019 CAMA Land Use Plan Update.

Figure D.3 – Town of Kill Devil Hills Future Land Use Map



Source: Town of Kill Devil Hills 2019 CAMA Land Use Plan Update

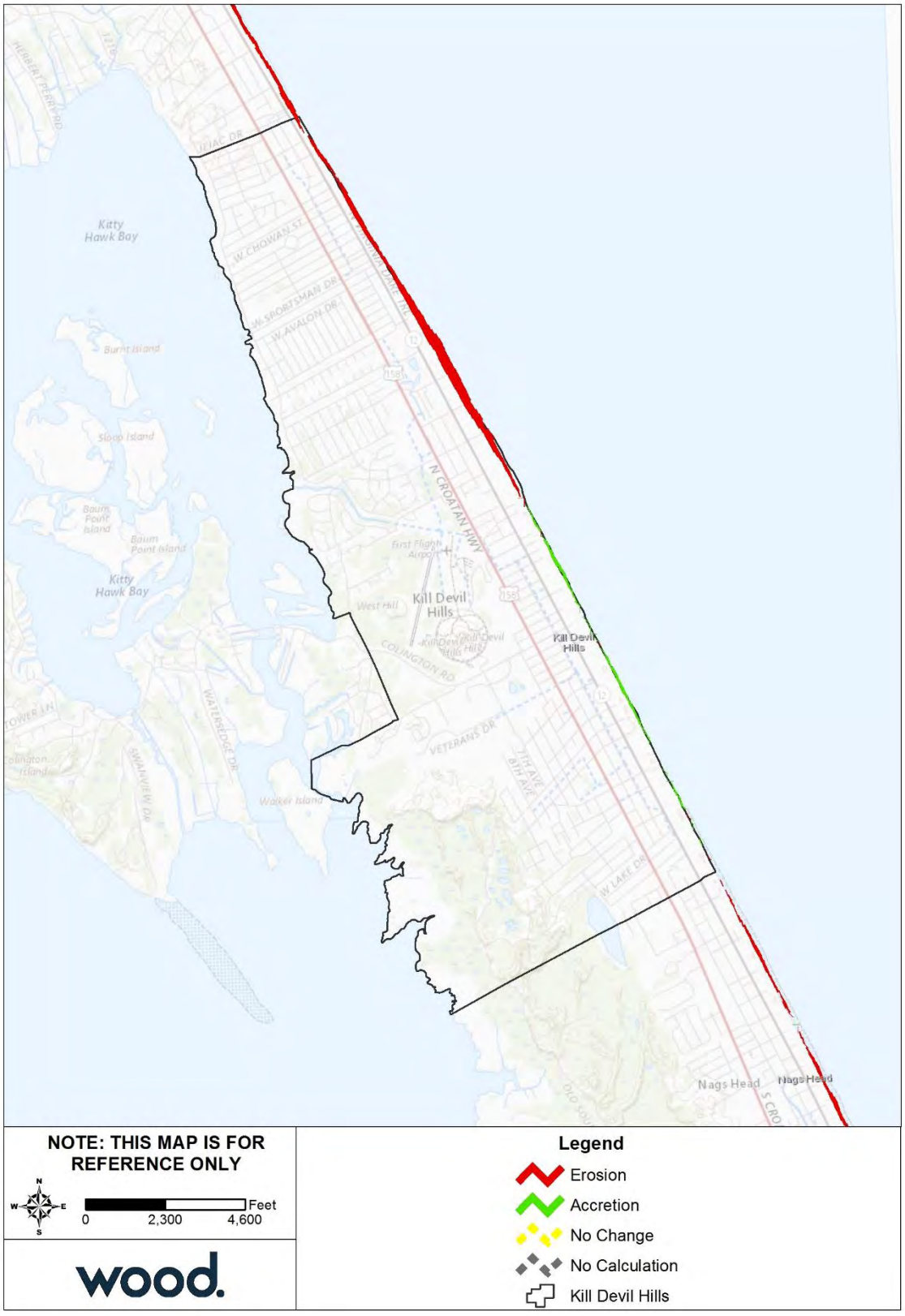
D.3 RISK ASSESSMENT

This section contains a hazard profile and vulnerability assessment for those hazards that were rated with a higher priority for the Town of Kill Devil Hills than for the Region as a whole. Risk and vulnerability findings are also presented here 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: Coastal Hazards, Flood, and Wildfire.

D.3.1 Coastal Hazards

Figure D.4 on the following page shows coastal erosion rates along the Town of Kill Devil Hills oceanfront coastline according to data from the DCM 2019 Long-Term Average Annual Erosion Rate Update Study. Long-term erosion rates are greater in the northern portions of Kill Devil Hills.

Figure D.4 – Erosion Rates, Town of Kill Devil Hills



Source: North Carolina Division of Coastal Management

D.3.2 Flood

Table D.12 details the acreage of the Town of Kill Devil Hills total area by flood zone on the effective DFIRM. Per this assessment, nearly 65 percent of the Town falls within the mapped 1%-annual-chance floodplains and the remainder is within the 0.2 percent annual chance floodplain.

Table D.12– Flood Zone Acreage in the Town of Kill Devil Hills

Flood Zone	Acreage	Percent of Total (%)
Zone A	13.36	0.4%
Zone AE	2,090.81	57.7%
Zone VE	260.48	7.2%
Zone X (500-year)	1,255.87	34.7%
Total	**3,620.52**	--

Source: FEMA Effective DFIRM

Figure D.5 reflects the effective mapped flood hazard zones for the Town of Kill Devil Hills, and Figure D.6 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the Town of Kill Devil Hills, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. According to this assessment, over 13 percent of recent development in the Town of Kill Devil Hills is located in or near the SFHA.

Table D.13 – Recent Development at Risk to Flood, Town of Kill Devil Hills

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
55	$20,722,600	13.2%	22.2%

Source: Parcel data retrieved November 2019; FEMA 2006 DFIRM

This assessment does not evaluate flood impacts or provide damage estimates. However, this summary of recent development in or near the floodplain provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

Table D.14 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector and flood event in the Town of Kill Devil Hills. Table D.15 provides counts and estimated damages for High Potential Loss Properties in the Town of Kill Devil Hills.

Table D.14 – Critical Facilities Exposed to Flooding, Town of Kill Devil Hills

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	2	$20,256
Commercial Facilities	62	$1,584,322
Communications	1	$629
Critical Manufacturing	10	$215,316
Healthcare and Public Health	1	$1,363
Transportation Systems	7	$41,453
All Categories	**83**	**$1,863,339**

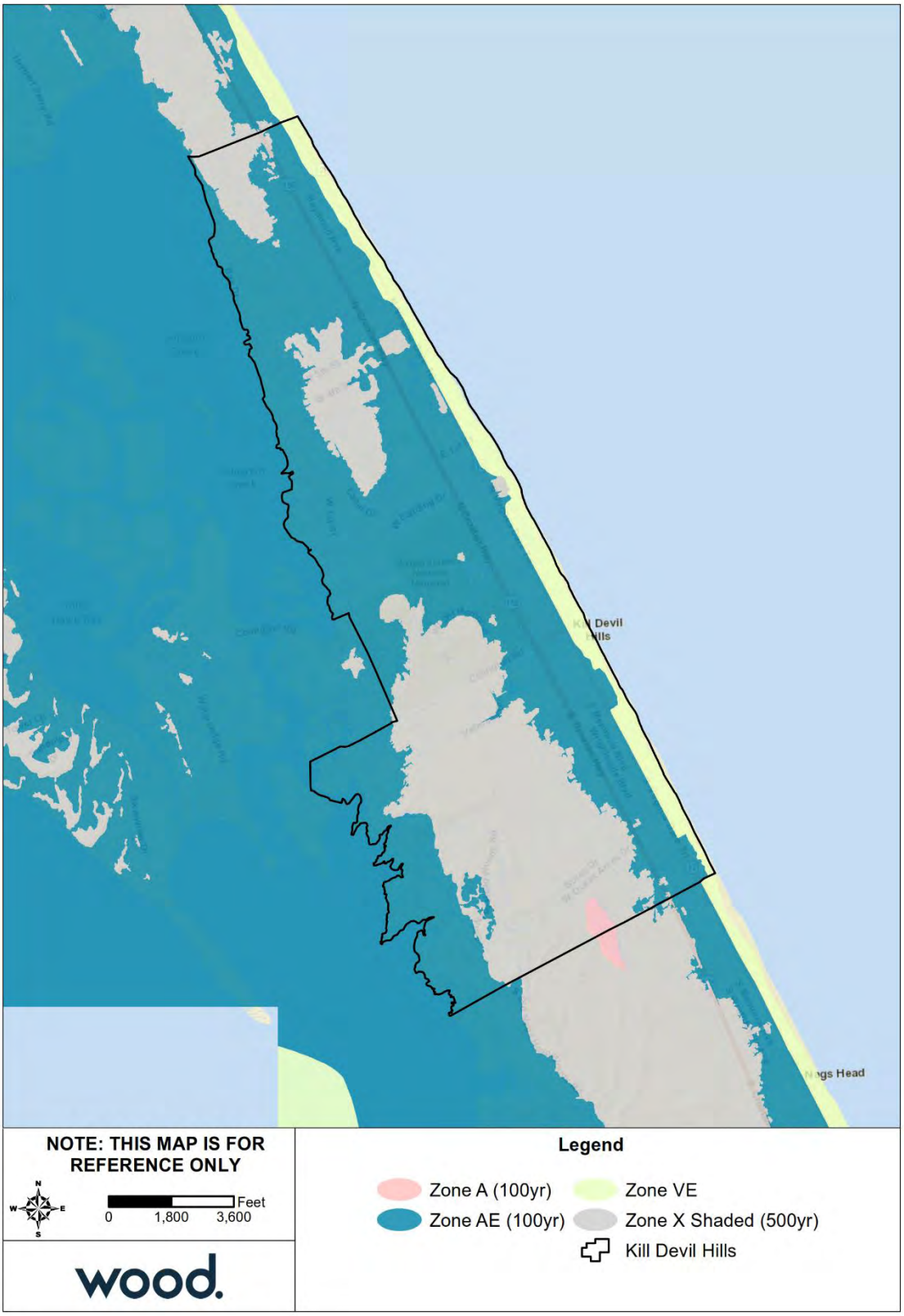
Source: NCEM Risk Management Tool

Table D.15 – High Potential Loss Properties Exposed to Flooding, Town of Kill Devil Hills

Category	Number of Buildings at Risk	Estimated Damages
Commercial	1	$315,960
Residential	31	$4,305,887
All Categories	**32**	**$4,621,847**

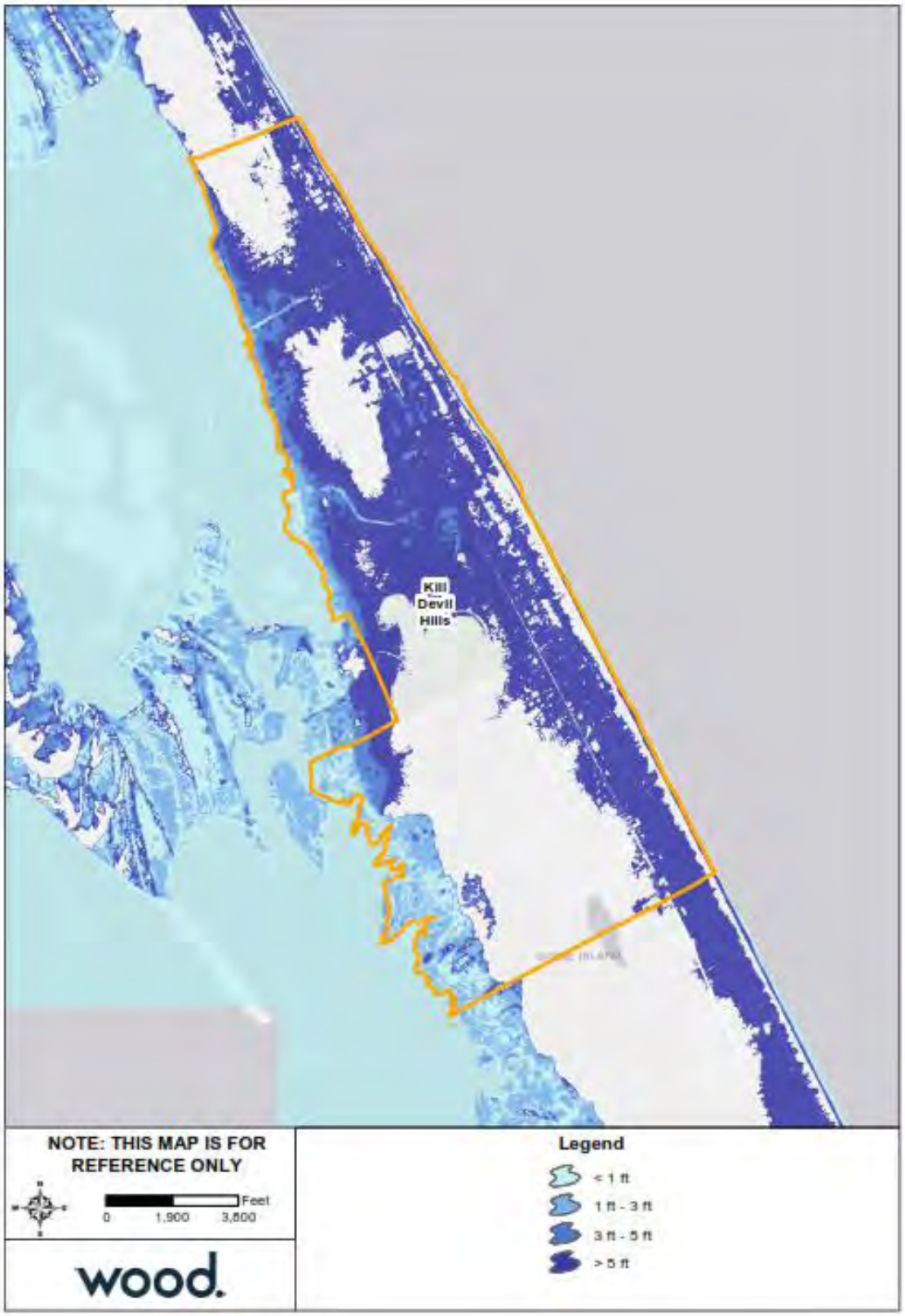
Source: NCEM Risk Management Tool

Figure D.5 – FEMA Flood Hazard Areas, Town of Kill Devil Hills



Source: FEMA Effective DFIRM

Figure D.6 – Flood Depth, 1%-Annual-Chance Floodplain, Town of Kill Devil Hills



Source: FEMA Effective DFIRM

D.3.3 Wildfire

Table D.16 summarizes the acreage in the Town of Kill Devil Hills 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 44 percent of the Town of Kill Devil Hills is not included in the WUI.

Table D.16 – Wildland Urban Interface Acreage, Town of Kill Devil Hills

	Housing Density	Total Acreage	Percent of Total Acreage
	Not in WUI	*1,610.5*	*44.4%*
	LT 1hs/40ac	12.0	0.3%
	1hs/40ac to 1hs/20ac	25.1	0.7%
	1hs/20ac to 1hs/10ac	37.0	1.0%
	1hs/10ac to 1hs/5ac	46.1	1.3%
	1hs/5ac to 1hs/2ac	230.6	6.4%
	1hs/2ac to 3hs/1ac	945.1	26.0%
	GT 3hs/1ac	724.5	20.0%
	Total	**3,630.9**	

Source: Southern Wildfire Risk Assessment

Figure D.7 depicts the WUI for the Town of Kill Devil Hills. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure A.10 depicts the Fire Intensity Scale, which indicates the potential severity of fire based on fuel loads, topography, and other factors. Figure D.9 depicts Burn Probability based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Data is not available on past acreage burned at the jurisdictional level.

Potential fire intensity is highest in the southwestern part of the Town of Kill Devil Hills. Much of this area falls outside the WUI; however, the eastern and northern fringes of this area contain the highest areas of risk in the Town, where housing, moderate to high fire intensity, and burn probability overlap.

Table D.17 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard.

Table D.18 summarizes the High Potential Loss Properties exposed to wildfire in the Town of Kill Devil Hills.

Table D.17 – Critical Facilities Exposed to Wildfire, Town of Kill Devil Hills

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	2	$1,468,711
Commercial Facilities	45	$32,245,983
Communications	1	$155,900
Critical Manufacturing	18	$6,392,358
Emergency Services	1	$849,456
Energy	1	$6,629,744
Food and Agriculture	1	$393,798

Sector	Number of Buildings at Risk	Estimated Damages
Government Facilities	7	$37,339,799
Healthcare and Public Health	4	$8,902,119
Transportation Systems	10	$4,818,293
Water	2	$1,423,735
All Categories	**92**	**$100,619,896**

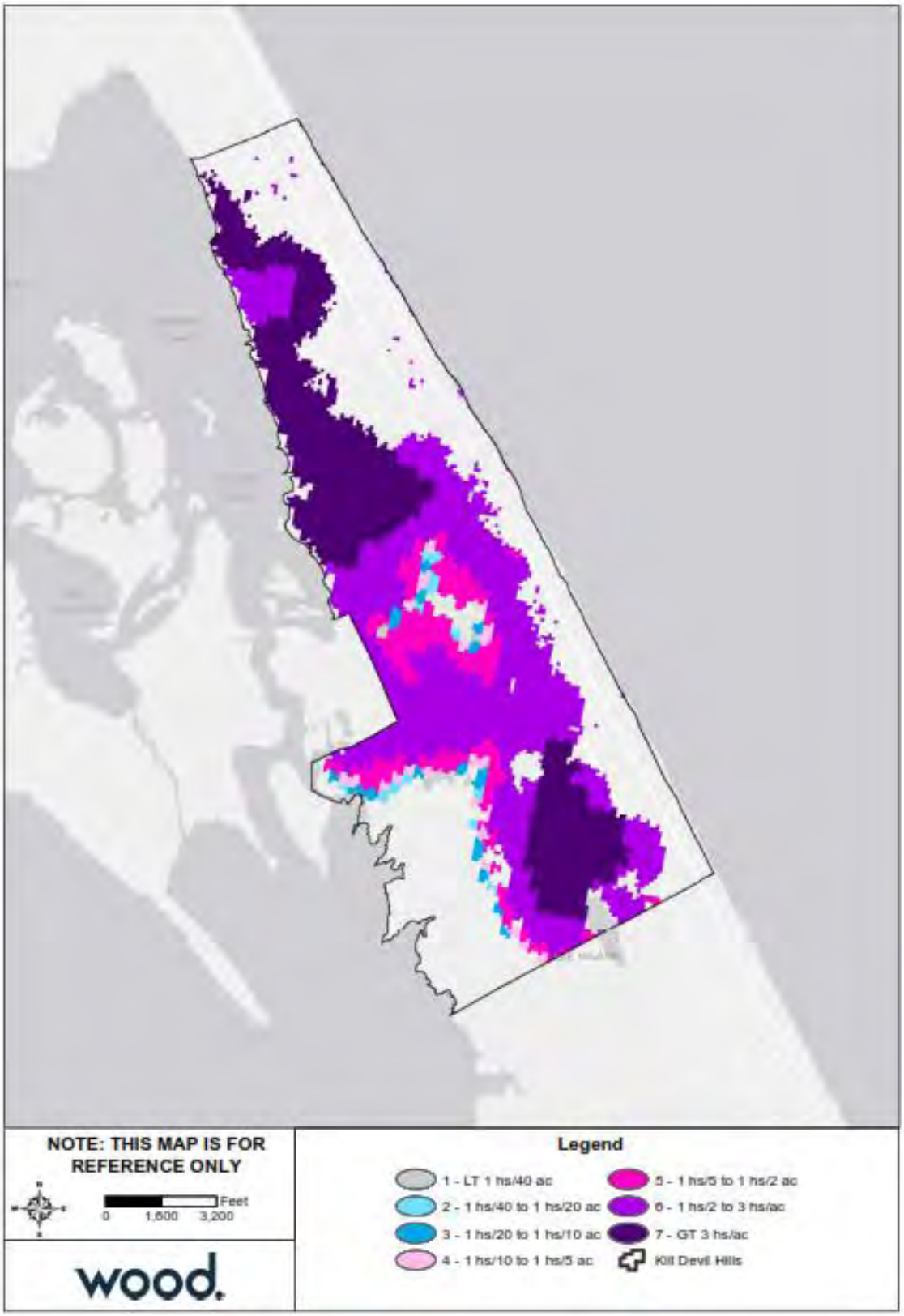
Source: NCEM Risk Management Tool

Table D.18 – High Potential Loss Properties Exposed to Wildfire, Town of Kill Devil Hills

Category	Number of Buildings at Risk	Estimated Damages
Commercial	6	$19,631,741
Government	2	$35,173,607
Residential	11	$3,736,456
Utilities	1	$6,629,744
All Categories	**20**	**$65,171,548**

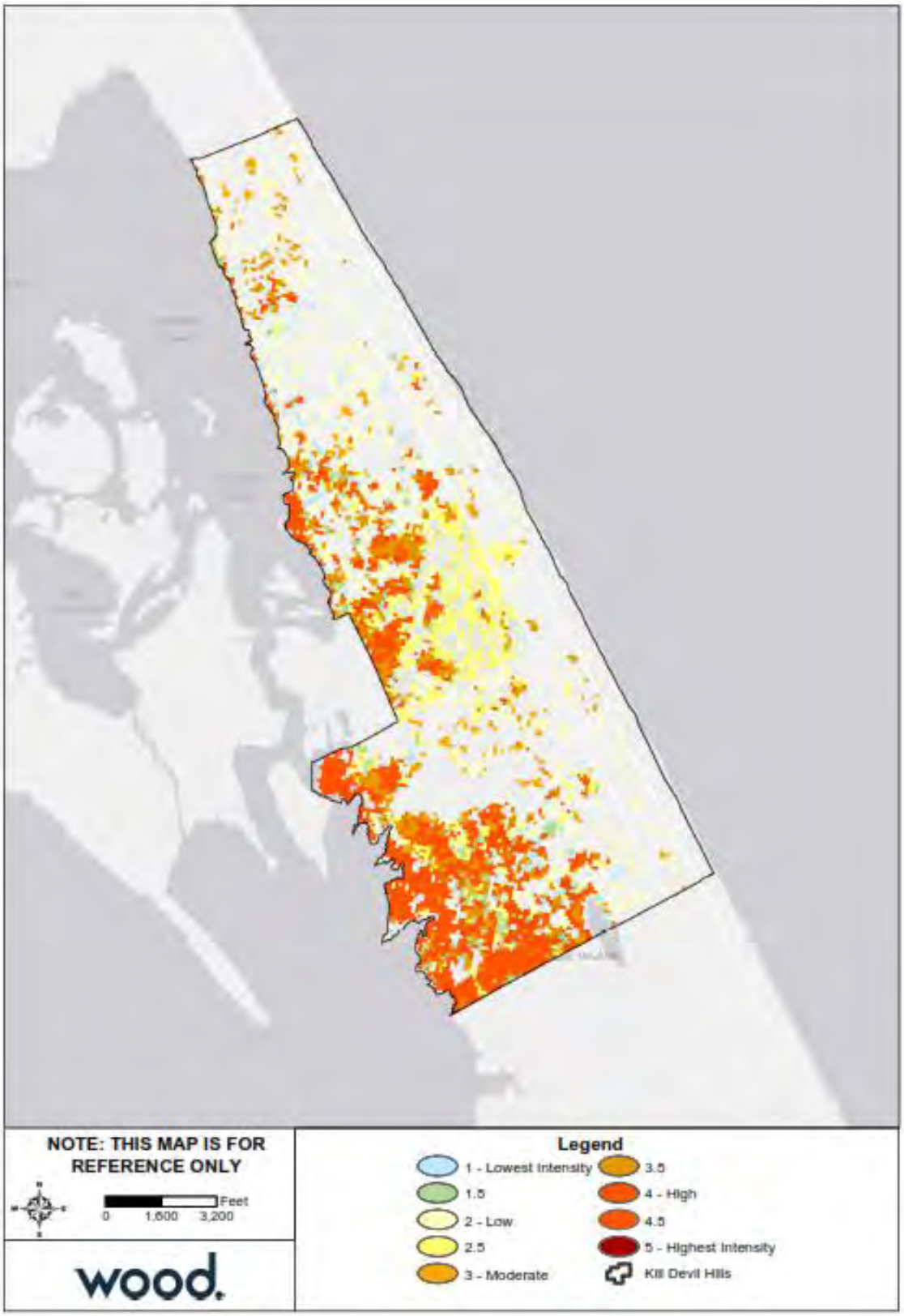
Source: NCEM Risk Management Tool

Figure D.7 – Wildland Urban Interface, Town of Kill Devil Hills



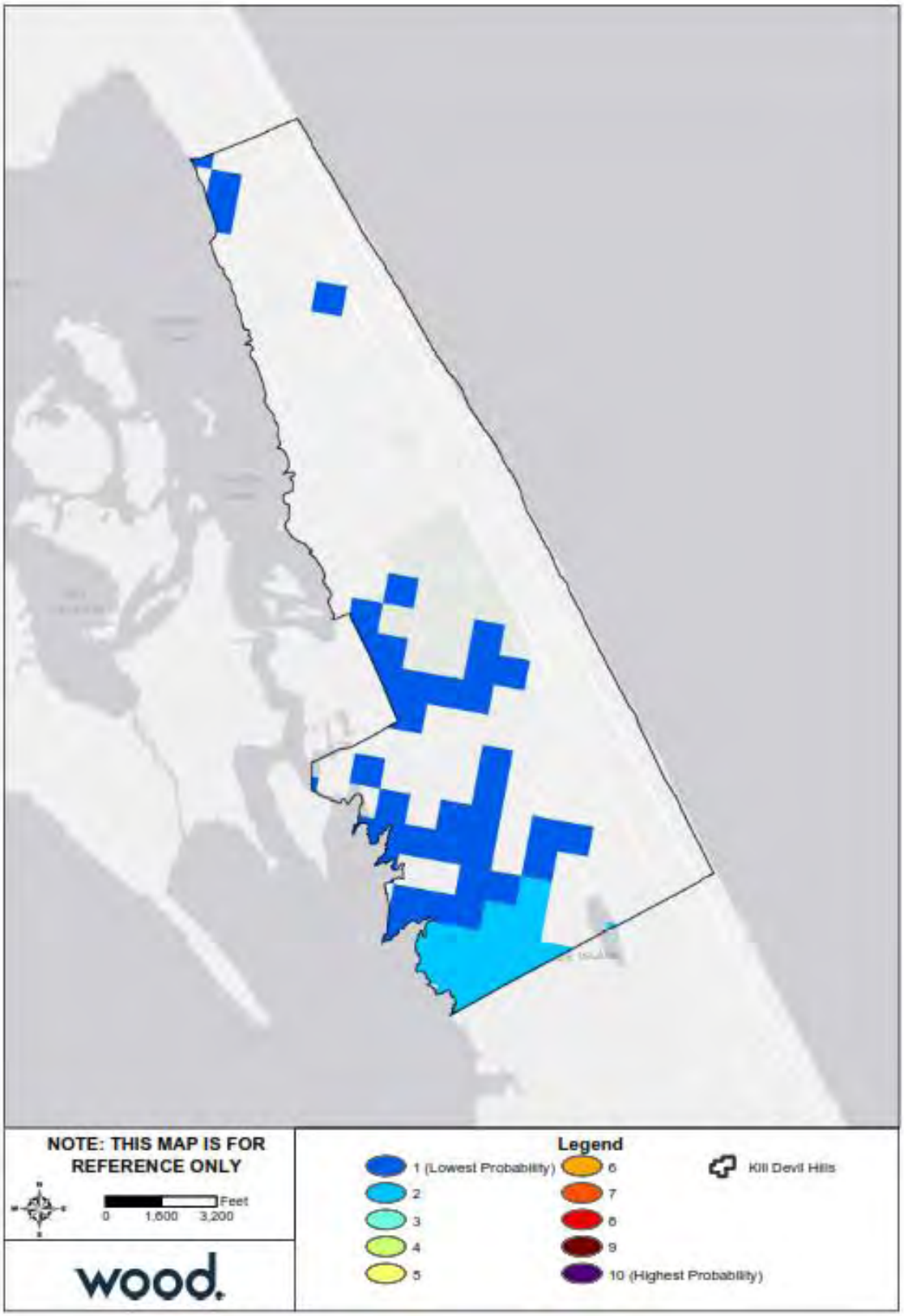
Source: Southern Wildfire Risk Assessment

Figure D.8 – Fire Intensity Scale, Town of Kill Devil Hills



Source: Southern Wildfire Risk Assessment

Figure D.9 – Burn Probability, Town of Kill Devil Hills



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 Town of Kill Devil Hills were provided by the Town's HMPC representatives and are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Kill Devil Hills has an overall capability rating of Moderate. The Town's Self-Assessment of key capability areas is summarized in Table D.19 below.

Table D.19 – Capability Self-Assessment, Kill Devil Hills

Capability Area	Rating
Plans, Ordinances, Codes and Programs	High
Administrative and Technical Capability	High
Fiscal Capability	Moderate
Education and Outreach Capability	High
Mitigation Capability	Limited
Political Capability	Moderate
Overall Capability	Moderate

D.4.2 Floodplain Management

The Town of Kill Devil Hills joined the NFIP as a regular participant in May 1973. 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.20 – NFIP Policy and Claims Data by Structure Type

Structure Type	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
Single Family	3,140	$2,091,007	$760,149,000	1,070	$9,576,424.18
2-4 Family	117	$57,539	$23,242,100	79	$867,378.65
All Other Residential	805	$269,993	$140,290,500	81	$3,838,609.45
Non-Residential	202	$427,137	$102,113,500	106	$3,976,238.39
Total	**4,264**	**$2,845,676**	**$1,025,795,100**	**1,336**	**$18,258,650.67**

Source: FEMA Community Information System, accessed December 2019

Table D.21 – 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	3,423	$1,956,447	$814,882,400	752	$8,680,332.85
A Zones	0	$0	$0	9	$32,705.03
V01-30 & VE Zones	80	$335,716	$20,841,600	130	$835,996.23
B, C & X Zone					
Standard	526	$437,635	$115,276,400	394	$7,887,110.09
Preferred	232	$114,078	$74,690,000	51	$822,506.47
Total	**4,261**	**$2,843,876**	**$1,025,690,400**	**1,336**	**$18,258,650.67**

Source: FEMA Community Information System, accessed December 2019

Table D.22 – 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	422	$539,560	$88,932,800	355	$5,894,728.34
A Zones	0	$0	$0	7	$28,278.33
V01-30 & VE Zones	24	$89,955	$5,364,200	101	$622,515.63
B, C & X Zone	97	$121,974	$26,300,900	209	$3,461,887.59
Standard	75	$111,413	$18,795,900	201	$3,369,452.76
Preferred	22	$10,561	$7,505,000	8	$92,434.83
Total	**543**	**$751,489**	**$120,597,900**	**672**	**$10,007,409.89**

Source: FEMA Community Information System, accessed December 2019

Table D.23 – 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	3,001	$1,416,887	$725,949,600	393	$2,777,768.79
A Zones	0	$0	$0	1	$3,212.24
V01-30 & VE Zones	56	$245,761	$15,477,400	21	$195,561.92
B, C & X Zone	661	$429,739	$163,665,500	236	$5,247,728.97
Standard	451	$326,222	$96,480,500	193	$4,517,657.33
Preferred	210	$103,517	$67,185,000	43	$730,071.64
Total	**3,718**	**$2,092,387**	**$905,092,500**	**651**	**$8,224,271.92**

Source: FEMA Community Information System, accessed December 2019

D.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
KDH1	Drainage System Maintenance - Continue mowing draiange ditches and conduct normal maintenance and storm event driven maintenance	Flood, Hurricane & Tropical Storm, Coastal Hazards	2.2	High	Public Services, NCDOT	General Fund	Annually	Carry Forward	Continue to maintain ditches and other storm water systems to reduce/eliminate standing water. This is constantly updated and prioritized quarterly.
KDH2	Erosion and Sediment Control - Continue to enforce local and state regulations	Flood, Coastal Hazards	3.2	High	Planning Department	General Fund	Annually	Carry Forward	Review and Enforcement of State Sedimentation regulations and staff serving as S&E inspector
KDH3	Maritime Forest Environmental Zoning District - Continue to enforce the Maritime Forest Environmental Zoning District	Wildfire	3.2	High	Planning Department	General Fund	Annually	Carry Forward	Action modified. Participate in control burn of the marsh and other portion of Maritime forest to prevent forest fires.
KDH4	Flood Response - Coordinate efforts to expedite reconstruction and rebuilding efforts in coopoeration with Dare County Emergency Management staff.	Flood, Hurricane & Tropical Storm, Coastal Hazards, Winter Storm	3.1	High	Planning Department	General Fund	1-3 years	Carry Forward	In state of Emergency, offer no cost permits for damage repair and work with Dare County to coordinate mitigation grants.
KDH5	Fire Protection - Implement Water Systems Master Plan	Wildfire	3.3	High	Public Services, Water Department	Water Fund	1-5 years	Carry Forward	Continue replacing waterlines in accordance with the Water Master Plan. Require flow test for new development sites.
KDH6	Storm water Management - Continue to implement the storm water management plan. Local Planning and Regulations.	Flood, Coastal Hazards	3.3	High	Public Services	General Fund	6 months	Carry Forward	Development of regulatory requirements for maintenance. Develop regulations for onsite storm water management at large single family dwelling. Maintain and use staff BMP inspection certificates.
KDH7	Map Information - Maintain updated flood map information for citizens and customers. Map Erosion areas annually to help inform the public of high erosion areas.	Flood, Hurricane & Tropical Storm, Coastal Hazards	1.1	High	NC Division of Emergency Management, Planning Department	NC Division of Emergency Management	1 year	Carry Forward	Maintain current and historic flood maps. Provide education information to citizens annually. Map erosion prone areas to better regulate development.
KDH8	Continue to participate in CRS	Flood, Hurricane & Tropical Storm, Coastal Hazards	3.3	High	Planning Department	General Fund	Annually	Carry Forward	Work to increase score in CRS program specifically for public outreach and education
KDH9	Add freeboard to the Flood Damage Prevention Ordinance for development in and outside the SFHA	Flood, Hurricane & Tropical Storm, Coastal Hazards	3.1	High	Planning Department	General Fund	1 year	New	Update the Flood Damage Prevention Ordinance in conjunction with updated flood maps.
Property Protection									
KDH10	Relocation - Expedite permitting for the relocation of repetitive loss situations	Flood, Hurricane & Tropical Storm, Coastal Hazards	1.2	Medium	Planning Department	General Fund	3-5 years	Carry Forward	Incomplete
KDH11	Acquisition - Encourage repetitive loss properties to consider acquisition as a possible solution	Flood, Hurricane & Tropical Storm, Coastal Hazards	1.2	Low	Planning Director, Board of Commissioners	NC Division of Emergency Management, FEMA	5+ years	Carry Forward	Incomplete by lack of funding
KDH12	Critical Facilities Protection - Take appropriate actions to prevent and/or minimize damages to critical facilities. Use generators or other forms of redundant power to ensure that critical facilities and infrastructure remain operational.	All	2.1/2.2	High	Police, Fire & Rescue, Public Works, NC Dominion Power	General Fund	1-3 years	Carry Forward	Utilize shutters on windows in municipal buildings. Test and fuel alternative power sources and install alternative energy sources on all Town buildings.
Natural Resource Protection									

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
KDH13	Open Space Preservation - Support efforts to preserve natural areas	Flood, Hurricane & Tropical Storm, Coastal Hazards, Severe Weather	3.3	High	Planning Department	General Fund	3-5 years	Carry Forward	Incomplete due to lack of funding
KDH14	Wetlands Protection - Continue to utilize the zoning ordinance and the Land Use Plan to protect wetlands, implement and enforce CAMA AEC regulations and refer applicants to US Army Corps of Engineers for Section 404 wetlands.	Flood, Hurricane & Tropical Storm, Coastal Hazards	3.2	High	USACE, Planning Department, NCDEQ	General Fund	Annually	Carry Forward	Protect wetlands and look into living shorelines in public esturarine areas.
KDH15	Reservoirs - 1. Continue protection efforts concerning the Fresh Pond. 2. Maintain liaison with NC Division of Coastal Management concerning the development of the Kill Devil Hills Land Use Plan	Flood, Hurricane & Tropical Storm, Coastal Hazards, Winter Storm	3.1	High	Planning Department, CAMA	General Fund	1 year	Carry Forward	Updating CAMA Land Use Plan and Maintain AEC at Fresh Pond
KDH16	Surface Water Quality - Preserve surface water quality and enhance water quality through storm water management and zoning.	Flood, Hurricane & Tropical Storm, Coastal Hazards	3.2	High	Planning Department, Public Services	General Fund	3-5 years	Carry Forward	Continue to maintain storm water system and improve run off. Follow Town Storm water Master Plan to reduce dependency on NCDOT Ocean Outfalls for drainage.
Structural Projects									
KDH17	Dune and Beach Maintenance - Continue ongoing beach nourishment efforts	Flood, Hurricane & Tropical Storm, Coastal Hazards	3.2	High	Planning Director, Board of Commissioners	General Fund	Monitor Annually, nourish every 5 years	Carry Forward	Initial Beach Nourishment Project completed in 2016. Ongoing stabilization and re-nourishment in accordance with the adopted Shore Protection Project Maintenance Plan.
Emergency Services									
KDH18	Hazard Warning - Facilitate evacuation	All	1.1	High	Dare County Control Group	General Fund	Annually	Carry Forward	Utilize the Regroup Emergency Alert System to the fullest potential for all hazards and emergency information.
KDH19	Health and Safety Maintenance - Develop ongoing protocols to assure the maintenance of critical public services	All	2.1	High	Police, Fire & Rescue, Public Works, Dare County Emergency Management	General Fund	Annually	Carry Forward	Conduct annual training session with all emergency response departments. Develop a plan for action. Develop a multi-jurisdictional response plan.
KDH20	Emergency Services - Hurricane Exercises	Hurricane & Tropical Storm	2.1	High	Planning Department	General Fund	1 year	New	Continue to participate in countywide emergency operation hurricane exercises. Update local plan accordingly.
Public Education & Awareness									
KDH21	Hazard Recovery - Coordinate efforts to expedite recovery.	All	1.1	High	Planning Department, Board of Commissioners	General Fund	1 year	Carry Forward	Work with Dare County Emergency Management on information dissemination after an event and develop a website for post hazard information
KDH22	Insurance - Maintain outreach efforts and continue making flood insurance available to the Town's residents	Flood, Hurricane & Tropical Storm, Coastal Hazards	1.1	High	Planning Department, Town Clerk	General Fund	1 year	Carry Forward	Update materials and distribute to property owners and residents and specialty groups
KDH23	Compile and maintain current information in the Kill Devil Hills Floodplain Management Library	Flood, Hurricane & Tropical Storm, Coastal Hazards	1.1	High	CRS Coordinator	General Fund	Annually	Carry Forward	Scan current and past flood maps; scan elevation certificates for future reference and future property owners; scan building permits
KDH24	Outreach Projects - Initiate outreach projects to inform the public on Town and County initiatives that will reduce hazard related losses of property and life	All	1.1	High	Planning Department, Dare County Emergency Management	General Fund	1 year or Annually	Carry Forward	Provide printed educational materials for citizens regarding hazards. Create videos for hazard awareness and safety. Post education and prevention techniques on website.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
KDH25	Circulate brochure specifically on NFIP	Flood, Hurricane & Tropical Storm, Coastal Hazards	1.1	High	Planning Department	General Fund	Annually	Carry Forward	Work to increase score in CRS program specifically for public outreach and education
KDH26	Conduct contractors meeting	All	3.1	High	Planning Department	General Fund	1 year	Carry Forward	Work to increase score in CRS program specifically for public outreach and education
KDH27	Outreach Projects - Hold annual outreach meeting for citizens to discuss hazards and how to protect themselves. Hold annual outreach to engineer and developers on how to construct to a higher standard to prevent damage.	All	1.1	High	Planning Department	General Fund	1 year	New	Schedule annual meeting to discuss hazards and prevention
KDH28	Create educational brochure on the dangers of extreme heat and cold and steps the public can take to protect themselves	Extreme Heat, Winter Storm	1.1	Medium	Planning Department	General Fund	1-2 years	New	Develop education program
KDH29	Mitigation education	All	1.1	Medium	Planning Department	General Fund	2-3 years	New	Develop mitigation possibilities and present to governing board annually

Annex E Town of Kitty Hawk

E.1 PLANNING PROCESS

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

Table E.1 – HMPC Members

Representative	Agency/Department	Position or Title
Rob Testerman	Planning Department	Director of Planning and Inspections
Mike Talley	Fire Department	Fire Chief
Mark Bissel	Citizen	Concerned citizen and local engineer who owns Bissell Professional Group in Kitty Hawk

E.2 COMMUNITY PROFILE

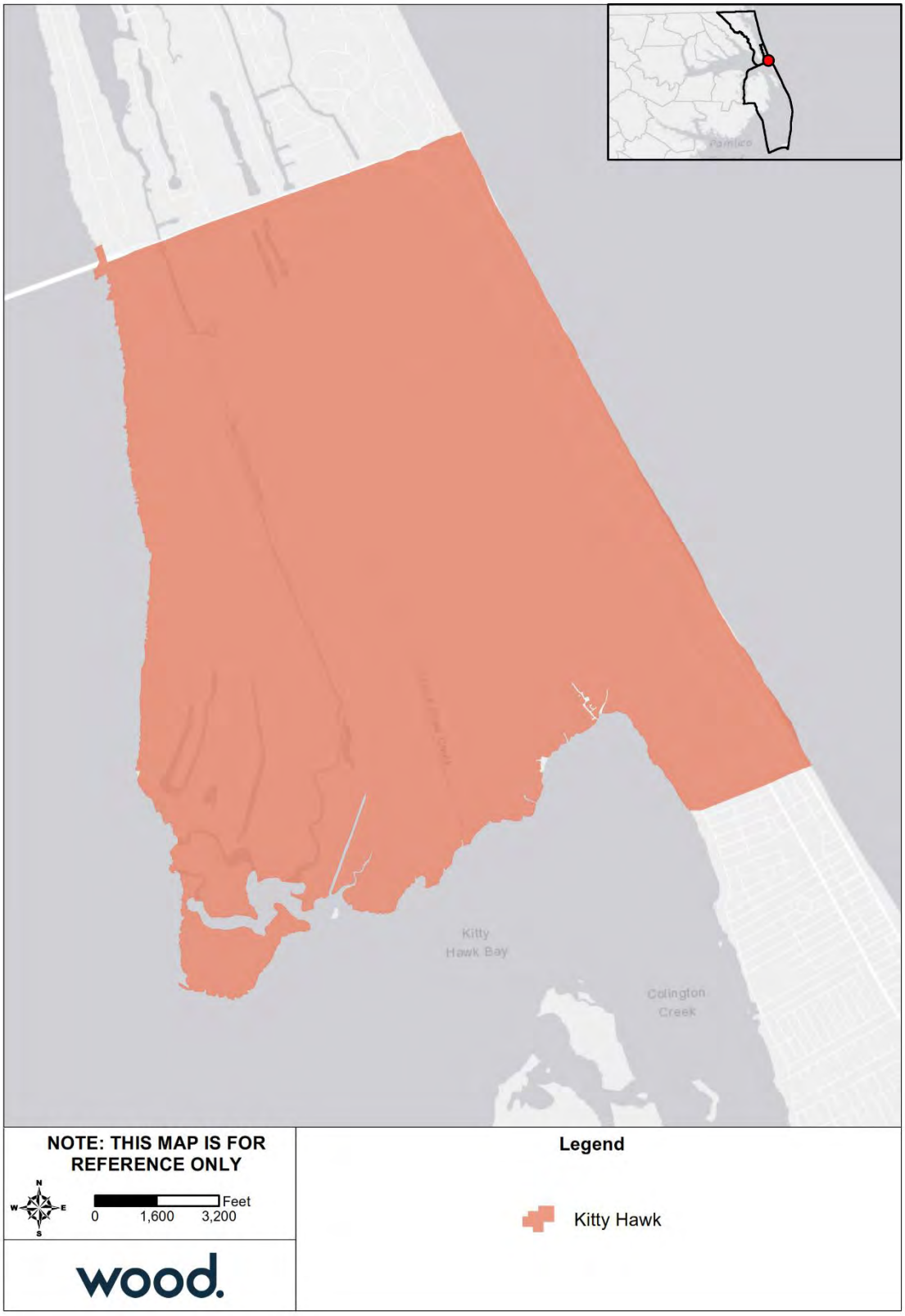
Geography

The Town of Kitty Hawk is a barrier island community located in northern Dare County. It is neighbored by Southern Shores to the north and Kill Devil Hills to the south. Kitty Hawk comprises a total land area of 8.11 square miles.

According to data from the U.S. Fish and Wildlife Service's National Wetlands Inventory, there are approximately 199 acres of wetlands in Kitty Hawk, primarily forested/shrub wetland.

Figure E.1 shows a base map of the Town of Kitty Hawk.

Figure E.1 – Location Map, Town of Kitty Hawk



Source: U.S. Census Bureau

Population and Demographics

Table E.2 provides population counts and growth estimates for the Town of Kitty Hawk as compared to the Region overall. Table E.3 provides demographic information for Kitty Hawk as compared to the Region.

Table E.2 – Population Counts, Kitty Hawk, 2010-2017

Jurisdiction	2000 Census Population	2010 Census Population	2017 ACS Population Estimate	Total Change 2010-2017	% Change 2010-2017
Region Total	**48,157**	**57,467**	**60,659**	**3,192**	**5.55%**
Town of Kitty Hawk	2,991	3,272	3,422	150	4.58%

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2013-2017 5-Year Estimates

Table E.3 – Racial Demographics, Kitty Hawk, 2017

Jurisdiction	White, %	Black, %	Asian, %	Other Race, %	Two or More Races, %	Persons of Hispanic or Latino Origin*, %
Region Total	**91.0**	**3.5**	**0.5**	**2.2**	**2.7**	**5.7**
Town of Kitty Hawk	97.8	0.9	0.5	0.0	0.8	1.3

Source: US Census Bureau, American Community Survey 2013-2017 5-Year Estimates
*Persons of Hispanic origin may be of any race, so also are included in applicable race categories

Asset Inventory

The following tables summarize the Critical Infrastructure and Key Resources (CIKR) and high potential loss facilities identified in IRISK for the Town of Kitty Hawk. Critical facilities, which include a subset of identified assets form the CIKR dataset as well as facilities identified by the HMPC, are shown in Figure E.2 on the following page and summarized in Table E.6. The County provided information is not included in IRISK vulnerability assessments. Note that the IRISK counts are by building; where a critical facility identified by IRISK comprises a cluster of buildings, each building is counted and displayed.

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

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	EM	Healthcare	Government Facilities	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Town of Kitty Hawk	9	39	0	405	0	105	0	12	9	0	0	57	12	9	9	**666**

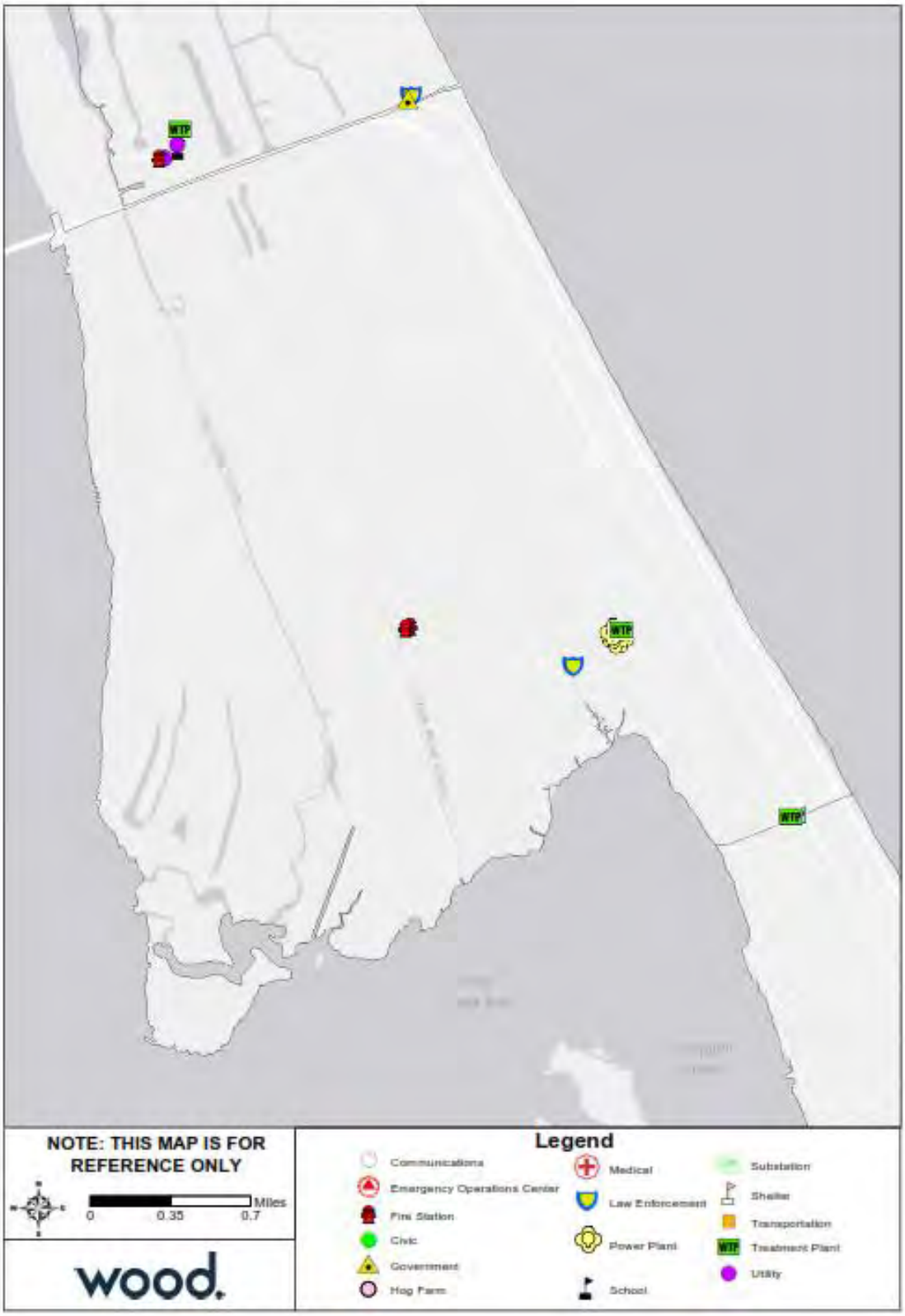
Source: NCEM Risk Management Tool

Table E.5 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Town of Kitty Hawk	3	54	0	3	0	3	12	**75**

Source: NCEM Risk Management Tool

Figure E.2 – Critical Facilities, Town of Kitty Hawk



Source: NCEM IRISK Database, HMPC input, GIS Analysis

Table E.6 – Critical Facilities List, Town of Kitty Hawk

Facility Type	Count
Fire Station	2
Police Station	1
Power Plant	4
Treatment Plant	3
Total	**10**

Source: NCEM IRISK Database, HMPC input, GIS Analysis

To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Town of Kitty Hawk, current parcel data was evaluated to identify recent development not included in NCEM's IRISK database. Based on this assessment, building exposure in Kitty Hawk has increased by nearly 8 percent since IRISK data was compiled.

Table E.7 – Recent Development Not Included in IRISK, Kitty Hawk

Recent Improved Parcels		IRISK Buildings		Percent Change	
Count	Value	Count	Value	Building Count	Building Value
221	$50,065,300	2,803	$637,910,353	7.9%	7.8%

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

Note: This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

There is one listing on the National Register of Historic Places for the Town of Kitty Hawk, listed below.

Table E.8 – Historic Properties

Ref#	Property Name	Status Date	Category	City
84000073	Kitty Hawk Life-Saving Station	10/11/1984	Building	Kitty Hawk

Source: National Parks Service, National Register of Historic Places, October 2018

Housing

The table below details key housing statistics for Kitty Hawk as compared to the Region overall.

Table E.9 – Housing Statistics, Kitty Hawk, 2010-2017

Jurisdiction	Housing Units (2010)	Housing Units (2017)	Housing Units Percent Change (2010-2017)	Owner-Occupied, % (2017)	Vacant Units, % (2017)	Median Home Value (2017)
Region Total	**47,945**	**49,616**	**3.5%**	**74.5**	**49.6**	**$285,000**
Town of Kitty Hawk	3,196	3,227	1.0%	76.7	52.5	$321,300

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2013-2017 5-Year Estimates
Note: Owner-Occupied and vacant-unit measures are reported as a percent of the total number of housing units.

Economy

The following tables present key economic statistics for Kitty Hawk as compared to the Region overall.

Table E.10 – Employment Statistics, Kitty Hawk, 2017

Jurisdiction	Population in Labor Force	Percent Employed* (%)	Percent Unemployed* (%)	Percent Not in Labor Force* (%)	Unemployment Rate (%)
Region Total	**32,463**	**61.7**	**3.3**	**34.4**	**5.0**
Kitty Hawk	2,167	68.7	4.5	25.6	6.1

Source: U.S. Census Bureau, American Community Survey 2013-2017 5-Year Estimates
Note: This table reports only the civilian labor force. The labor force in armed services accounted for 0.6% of the population 16 and over across the region. Kitty Hawk had slightly higher population in the armed forces at 1.3%. *Population employed, population unemployed, and Population not in labor force are reported as a percent of the total population aged 16 years and older.

Table E.11 – Percent of Employed Population by Occupation, Kitty Hawk, 2017

Occupation	Management, business, science and arts (%)	Service (%)	Sales and Office (%)	Natural Resources, Construction, and Maintenance (%)	Production, transportation, and material moving (%)
Region Total	**30.6**	**18.7**	**27.8**	**14.0**	**8.9**
Kitty Hawk	34.4	15.0	29.0	12.4	9.3

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

Land Use and Future Development

The Town of Kitty Hawk Planning and Inspections Department is responsible for land-use planning for the Town. The 2004 CAMA CORE Land Use Plan Update was used to evaluate future development potential.

Current Land Use

Since the Town has island geography and narrow strips of land, much of the development is located around the main transportation corridors. The Town is currently divided into ten land use categories. These categories are shown below with their total acreage in Table E.12. Percentages have been rounded to the nearest whole number.

Table E.12 – Land Use, Town of Kitty Hawk

Land Use	Total Acres	Percent of County (%)
Residential – Single Family Detached	1,052	20
Residential – Duplexes	17	1
Residential – Multi-Family	102	2
Commercial	221	3
Public/Semi-Public/ Institutional/ Community Facilities	76	1
Trailer Park	17	1
Church/Cemetery	27	1
Total Developed	*1,512*	*29*
Conservation	1,900	36
Undeveloped/Vacant	1,836	35
Beach Access	*N/A*	*N/A*
Total	**5,248**	**100**

Source: Town of Kitty Hawk 2004 CAMA CORE Land Use Plan Update

The trailer park classification includes travel trailer campgrounds, popular for tourists. Beach access is defined as Town owned public beach access. Most of the Town is undeveloped (71%) with about half of

the undeveloped land falling under the conservation category (36%), and the other half falling under the undeveloped/vacant category (35%).

Future Development

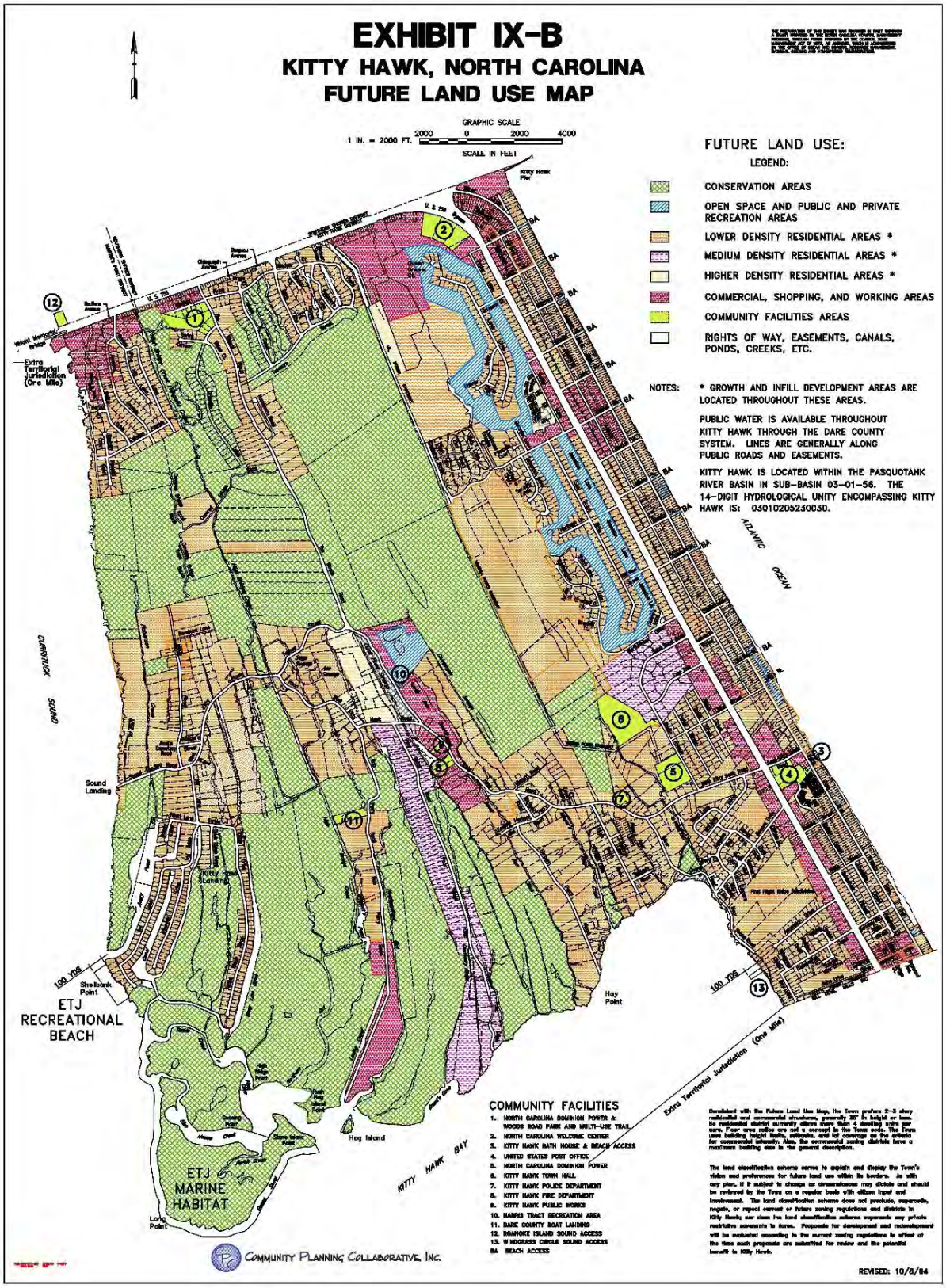
Development will continue at the current rate for the coming years. It is expected that many parcels will be re-developed. There is not one area that will see the majority of development. Future development within the Town will use a new classification system with six classes. These classes are:

- Conservation
- Open space and public and private recreation areas
- Residential areas
- Commercial, shopping, and working areas
- Community facility areas
- Growth and in-fill development areas

Areas intended for future growth will likely include single family, detached residential, and some commercial growth.

Figure E.3 below shows the future land use of the Town of Kitty Hawk as envisioned in the 2004 CAMA CORE Land Use Plan Update.

Figure E.3 – Town of Kitty Hawk Future Land Use Map



Source: Town of Kitty Hawk 2004 CAMA CORE Land Use Plan Update

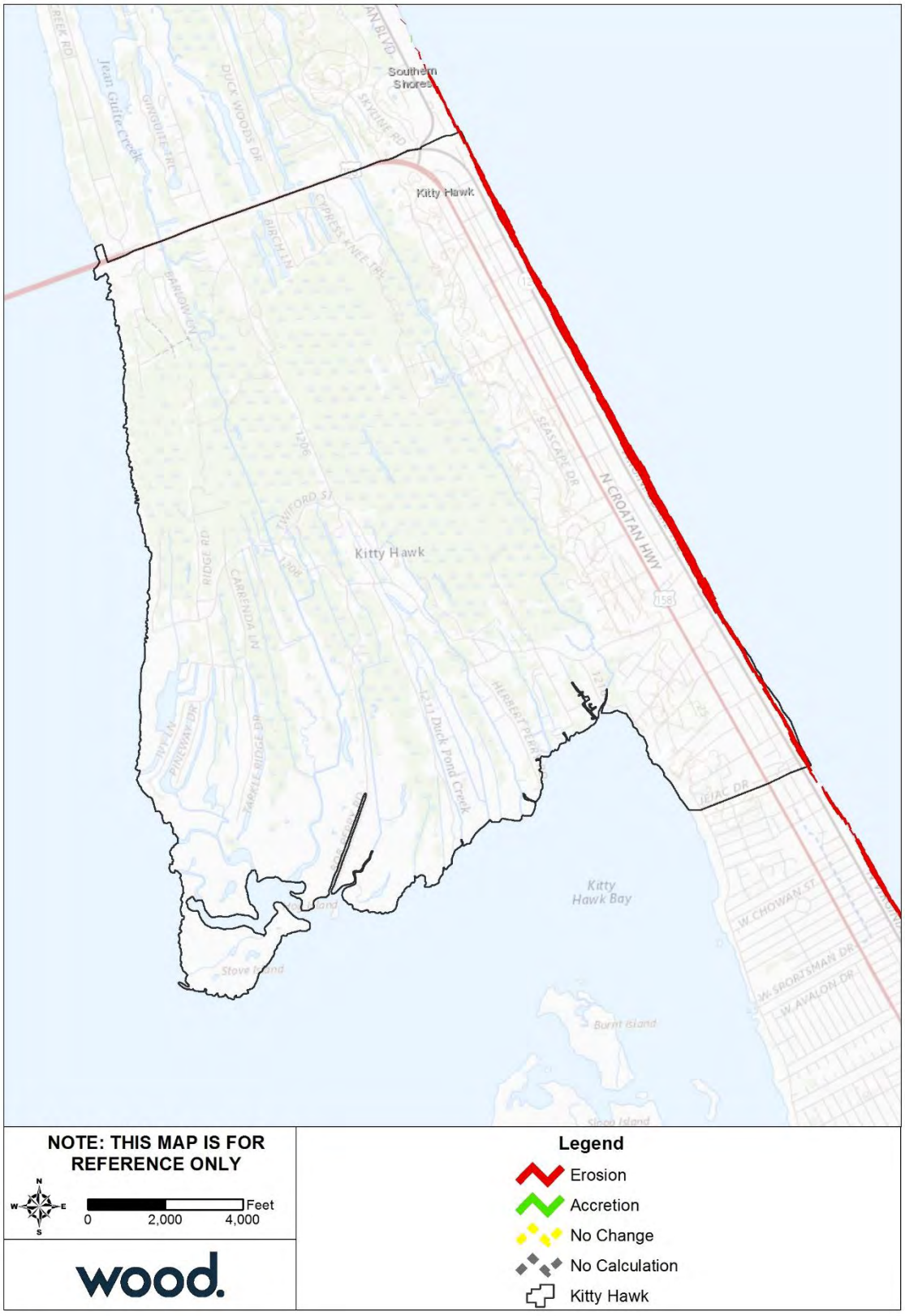
E.3 RISK ASSESSMENT

This section contains a hazard profile and vulnerability assessment for those hazards that were rated with a higher priority for the Town of Kitty Hawk than for the Region as a whole. Risk and vulnerability findings are also presented here 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: Coastal Hazards, Flood, and Wildfire.

E.3.1 Coastal Hazards

Figure E.4 on the following page shows coastal erosion rates along the Town of Kitty Hawk oceanfront coastline according to data from the DCM 2019 Long-Term Average Annual Erosion Rate Update Study. The entire Kitty Hawk oceanfront coastline is experiencing erosion.

Figure E.4 – Erosion Rates, Town of Kitty Hawk



Source: North Carolina Division of Coastal Management

E.3.2 Flood

Table E.13 details the acreage of the Town of Kitty Hawk total area by flood zone on the effective DFIRM. Per this assessment, over 80 percent of the Town falls within the mapped 1 percent annual chance floodplains and the remainder falls within the 0.2 percent annual chance floodplain.

Table E.13 – Flood Zone Acreage in the Town of Kitty Hawk

Flood Zone	Acreage	Percent of Total (%)
Zone AE	4,070.14	77.3%
Zone VE	163.88	3.1%
Zone X (500-year)	1,029.36	19.6%
Total	**5,263.38**	--

Source: FEMA 2006 DFIRM

Figure E.5 reflects the effective mapped flood hazard zones for the Town of Kitty Hawk, and Figure E.6 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the Town of Kitty Hawk, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. According to this assessment, over 13 percent of recent development in the Town of Kitty Hawk is located in or near the SFHA.

Table E.14 – Recent Development at Risk to Flood, Town of Kitty Hawk

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
110	$18,652,800	49.8%	37.3%

Source: Parcel data retrieved November 2019; FEMA 2006 DFIRM

This assessment does not evaluate flood impacts or provide damage estimates. However, this summary of recent development in or near the floodplain provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

Table E.15 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector and flood event in the Town of Kitty Hawk. Table E.16 provides counts and estimated damages for High Potential Loss Properties in the Town of Kitty Hawk.

Table E.15 – Critical Facilities Exposed to Flooding, Town of Kitty Hawk

Sector	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	38	$1,160,813
Critical Manufacturing	15	$278,234
Emergency Services	3	$162,207
Food and Agriculture	2	$2,666
Government Facilities	2	$248,997
Transportation Systems	4	$108,759
All Categories	**64**	**$1,961,676**

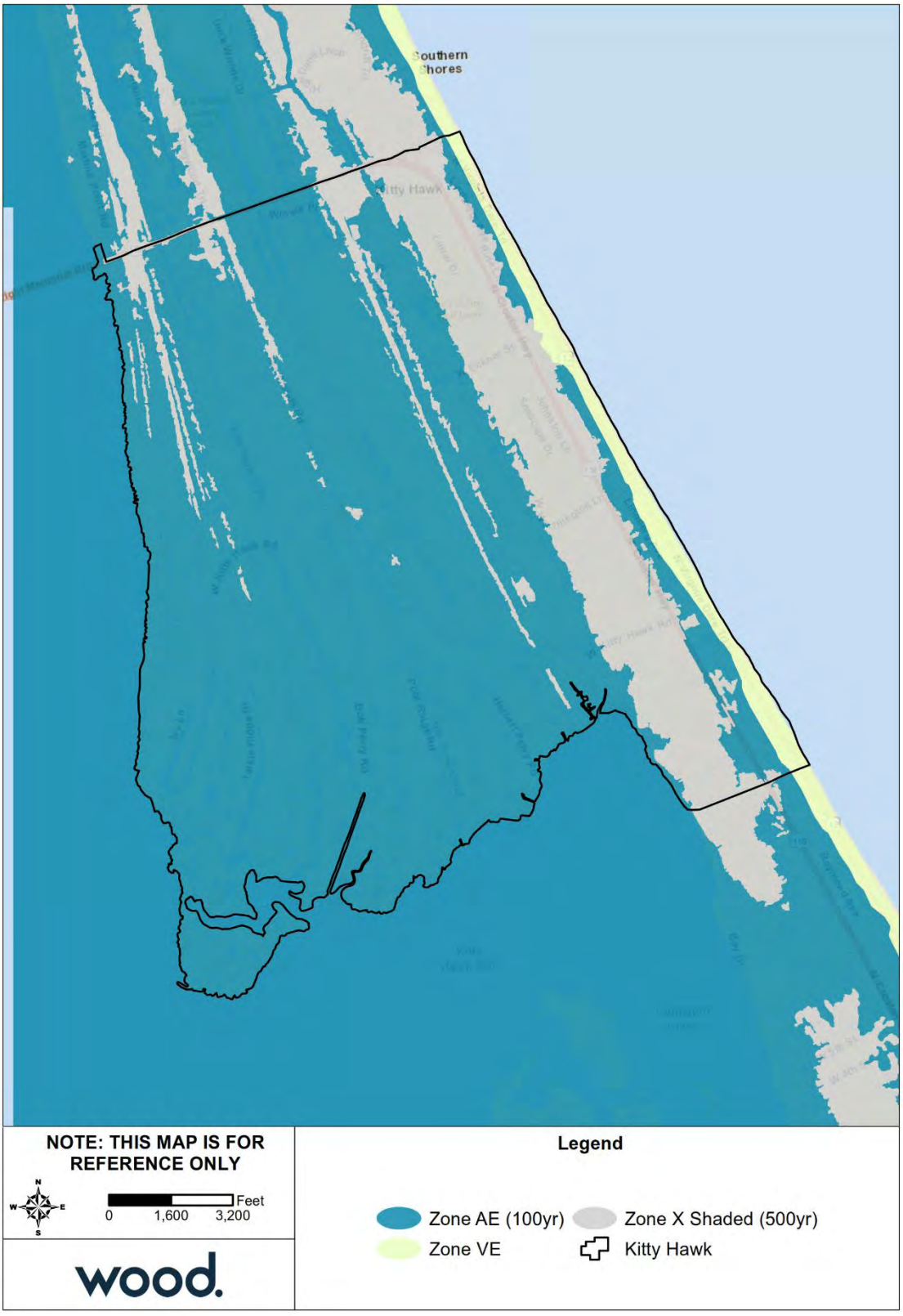
Source: NCEM Risk Management Tool

Table E.16 – High Potential Loss Properties Exposed to Flooding, Town of Kitty Hawk

Category	Number of Buildings at Risk	Estimated Damages
Commercial	1	$141,448
Residential	1	$94,224
All Categories	**2**	**$235,672**

Source: NCEM Risk Management Tool

Figure E.5 – FEMA Flood Hazard Areas, Town of Kitty Hawk



Source: FEMA Effective DFIRM

Figure E.6 – Flood Depth, 1%-Annual-Chance Floodplain, Town of Kitty Hawk



Source: FEMA Effective DFIRM

E.3.3 Wildfire

Table E.17 summarizes the acreage in the Town of Kitty Hawk 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 36 percent the Town of Kitty Hawk is not included in the WUI.

Table E.17 – Wildland Urban Interface Acreage, Town of Kitty Hawk

	Housing Density	Total Acreage	Percent of Total Acreage
	Not in WUI	*1,944.8*	*36.7%*
	LT 1hs/40ac	411.0	7.8%
	1hs/40ac to 1hs/20ac	225.7	4.3%
	1hs/20ac to 1hs/10ac	201.0	3.8%
	1hs/10ac to 1hs/5ac	277.8	5.2%
	1hs/5ac to 1hs/2ac	667.3	12.6%
	1hs/2ac to 3hs/1ac	1,426.8	26.9%
	GT 3hs/1ac	143.6	2.7%
	Total	**5,297.9**	

Source: Southern Wildfire Risk Assessment

Figure E.7 depicts the WUI for the Town of Kitty Hawk. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure E.8 depicts the Fire Intensity Scale, which indicates the potential severity of fire based on fuel loads, topography, and other factors. Figure E.9 depicts Burn Probability based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Data is not available on past acreage burned at the jurisdictional level.

There are areas of moderate and high potential fire intensity throughout much of Kitty Hawk, which coincide with low burn probability. Because these areas fall within the WUI, there is development at risk to wildfire.

Table E.18 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table E.19 summarizes the High Potential Loss Properties exposed to wildfire in the Town of Kitty Hawk.

Table E.18 – Critical Facilities Exposed to Wildfire, Town of Kitty Hawk

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	2	$1,468,711
Commercial Facilities	45	$32,245,983
Communications	1	$155,900
Critical Manufacturing	18	$6,392,358
Emergency Services	1	$849,456
Energy	1	$6,629,744
Food and Agriculture	1	$393,798
Government Facilities	7	$37,339,799
Healthcare and Public Health	4	$8,902,119
Transportation Systems	10	$4,818,293
Water	2	$1,423,735
All Categories	**92**	**$100,619,896**

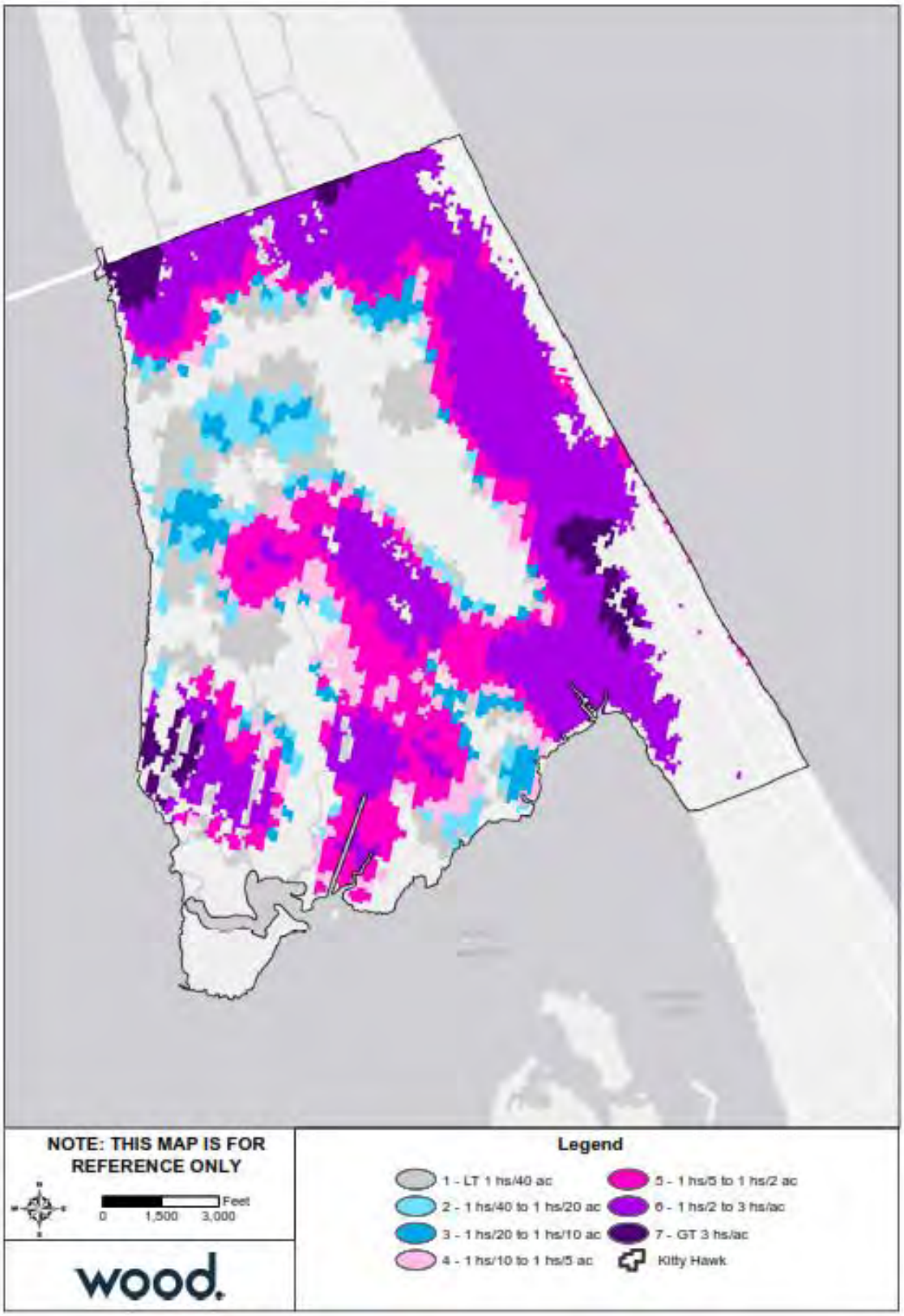
Source: NCEM Risk Management Tool

Table E.19 – High Potential Loss Properties Exposed to Wildfire, Town of Kitty Hawk

Category	Number of Buildings at Risk	Estimated Damages
Commercial	5	$22,246,566
Residential	1	$1,206,890
All Categories	**6**	**$23,453,456**

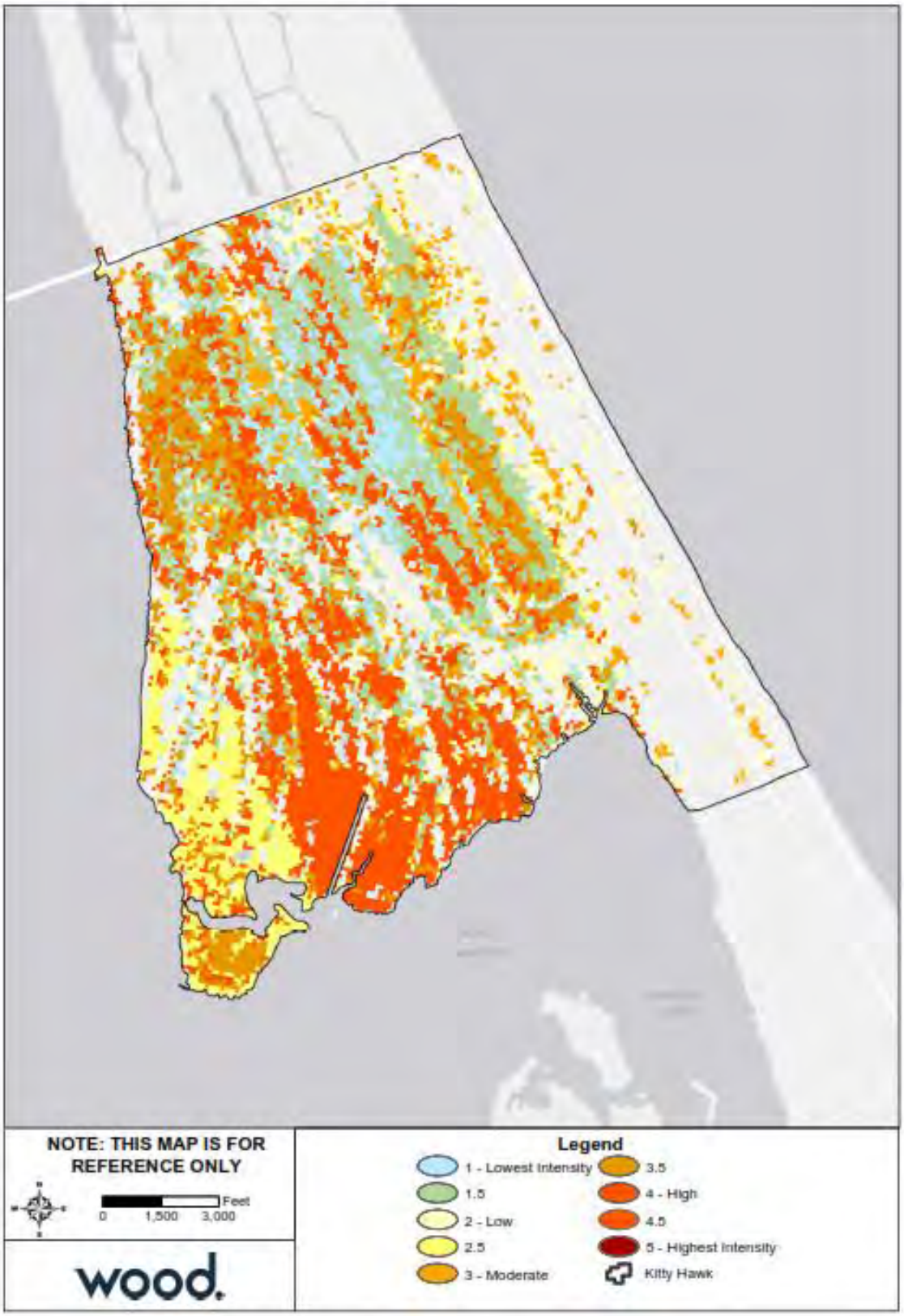
Source: NCEM Risk Management Tool

Figure E.7 – Wildland Urban Interface, Town of Kitty Hawk



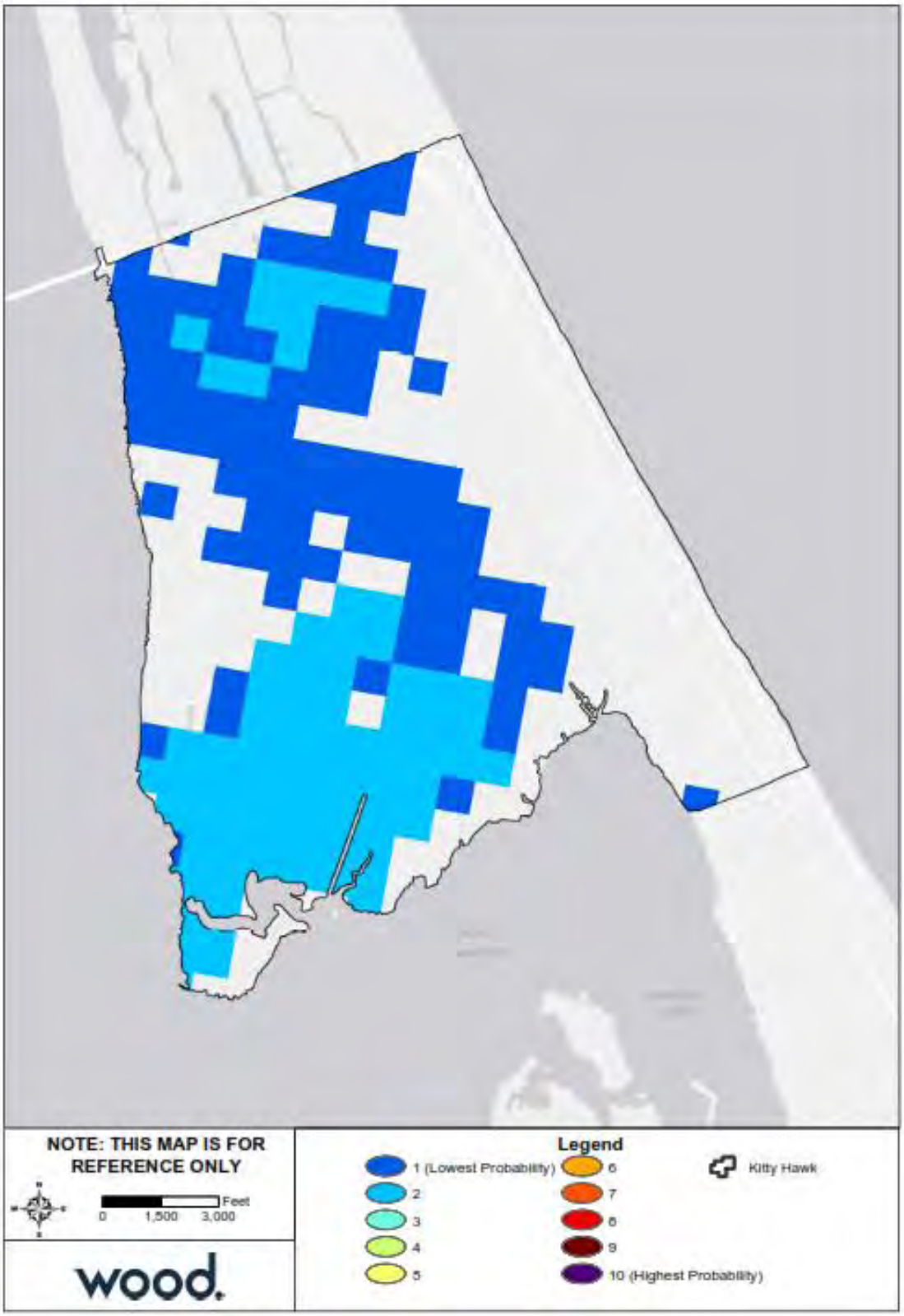
Source: Southern Wildfire Risk Assessment

Figure E.8 – Fire Intensity Scale, Town of Kitty Hawk



Source: Southern Wildfire Risk Assessment

Figure E.9 – Burn Probability, Town of Kitty Hawk



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 Kitty Hawk were provided by the Town's HMPC representatives and are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Kitty Hawk has an overall capability rating of High. The Town's Self-Assessment of key capability areas is summarized in Table E.20 below.

Table E.20 – Capability Self-Assessment, Kitty Hawk

Capability Area	Rating
Plans, Ordinances, Codes and Programs	Moderate
Administrative and Technical Capability	Limited
Fiscal Capability	Moderate
Education and Outreach Capability	Limited
Mitigation Capability	Moderate
Political Capability	Moderate
Overall Capability	Moderate

E.4.2 Floodplain Management

The Town of Kitty Hawk joined the NFIP as a regular participant in October 1978. The following tables reflect NFIP policy and claims data for the Town categorized by structure type, flood zone, Pre-FIRM and Post-FIRM.

Table E.21 – NFIP Policy and Claims Data by Structure Type

Structure Type	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
Single Family	1,321	$1,172,656	$341,394,100	1,355	$14,641,990.40
2-4 Family	73	$34,019	$13,496,100	21	$335,595.10
All Other Residential	11	$7,719	$3,442,000	25	$445,671.80
Non-Residential	121	$278,918	$51,163,900	78	$3,047,792.37
Total	**1,526**	**$1,493,312**	**$409,496,100**	**1,479**	**$18,471,049.67**

Source: FEMA Community Information System, accessed December 2019

Table E.22 – 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	873	$566,182	$222,522,000	309	$3,592,265.66
A Zones	16	$25,715	$3,612,900	18	$308,063.56
AO Zones	205	$169,240	$56,359,000	306	$3,615,575.35
V01-30 & VE Zones	69	$267,563	$15,538,300	72	$1,105,800.58
B, C & X Zone					
Standard	222	$373,035	$59,360,900	745	$9,575,961.27
Preferred	141	$91,577	$52,103,000	29	$273,383.25
Total	**1,526**	**$1,493,312**	**$409,496,100**	**1,479**	**$18,471,049.67**

Source: FEMA Community Information System, accessed December 2019

Table E.23 – 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	110	$139,737	$21,956,600	113	$2,319,469.09
A Zones	5	$14,503	$823,000	6	$203,362.05
AO Zones	38	$32,685	$9,350,200	81	$1,207,545.35
V01-30 & VE Zones	41	$170,398	$8,230,600	40	$910,347.09
B, C & X Zone	94	$132,262	$25,276,800	315	$4,557,478.71
Standard	78	$121,993	$19,366,800	308	$4,485,759.14
Preferred	16	$10,269	$5,910,000	7	$71,719.57
Total	**288**	**$489,585**	**$65,637,200**	**555**	**$9,198,202.29**

Source: FEMA Community Information System, accessed December 2019

Table E.24 – 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	763	$426,445	$200,565,400	196	$1,272,796.57
A Zones	11	$11,212	$2,789,900	12	$104,701.51
AO Zones	167	$136,555	$47,008,800	225	$2,408,030.00
V01-30 & VE Zones	28	$97,165	$7,307,700	32	$195,453.49
B, C & X Zone	269	$332,350	$86,187,100	459	$5,291,865.81
Standard	144	$251,042	$39,994,100	437	$5,090,202.13
Preferred	125	$81,308	$46,193,000	22	$201,663.68
Total	**1,238**	**$1,003,727**	**$343,858,900**	**924**	**$9,272,847.38**

Source: FEMA Community Information System, accessed December 2019

E.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
KH1	Establish town plans for mitigation and recovery through information on disaster planning recovery and reconstruction.	All	3.1	High	Town Manager	1 year	Carry forward	Carry forward	Should establish a separate mitigation plan, or add on to Emergency Preparedness, Response and Recovery Plan.
KH2	Revise Town's Flood Damage Prevention Ordinance in conjunction with new maps to increase the required freeboard in AE zones and regulate elevation requirements in Shaded X zones	Hurricanes, Nor'easters, Floods, Thunderstorm	3.1	Med	Planning & Inspections/Town Council	3 months	New	New	
Property Protection									
KH3	Clean out culverts, ditches, and waterways to relieve standing water and facilitate the stormwater drainage	Hurricanes, Nor'easters, Floods, Thunderstorm	2.1	High	Public Works	Ongoing	Carry Forward	Carry Forward	Partially complete. Waterways cleaned out, ditches and culverts still need to be addressed
KH4	Establish long-term plan for funding and implementation of beach renourishment	Hurricanes, Nor'easters, Floods, Thunderstorm, Erosion	3.2	Med	Town Council/Town Manager	1 year	New	New	
KH5	Expedite permitting for the relocation of repetitive loss situations	Hurricanes, Nor'easters, Floods, Thunderstorm, Erosion	1.2	Low	Planning & Inspections	Ongoing	New	New	
Natural Resource Protection									
KH6	Construct and maintain living shoreline projects in most vulnerable soundside areas	Hurricanes, Nor'easters, Floods, Thunderstorm, Erosion	3.2	Med	Town Council/Town Manager	3 years	New	New	
KH7	Encourage open space preservation/conservation	Flood, Hurricane & Tropical Storm, Coastal Hazards, Severe Weather	3.3	Med	Planning & Inspections	Ongoing	New	New	
Structural Projects									
KH8	Implement stormwater drainage improvements per the studies/plan	Hurricanes, Nor'easters, Floods, Thunderstorm	3.3	High	Town Manager/Public Works	Ongoing	Carry Forward	Carry Forward	Partially complete
Emergency Services									
KH9	Update and improve protocols and procedures (local, county, and state) by which citizens in KH are made aware of impending storm events and expected impacts	Hurricanes, Nor'easters, Floods, Thunderstorm	1.1	High	Town Manager	1 year	Carry Forward	Carry Forward	Partially complete. Has been some discussion of a town alert, in addition to the existing county one.
KH10	Work w/ Dare Co. to improve the communication systems between all public safety departments within the towns, county, and state so that in the event of a disaster, all entities will be able to communicate with one another.	All	4.2	Med	Town Manager/Fire Department/Police Department	2 years	Carry forward	Carry forward	
KH11	Review vulnerabilities of all critical facilities as a component of annual review of Emergency Preparedness, Response and Recovery Plan	All	2.1	High	Town Manager, Fire Department/Police Department	1 year	New	New	
KH12	Maintain post-disaster debris management contract with qualified provider.	Flood, Hurricane & Tropical Storm, Coastal Hazards, Severe Weather	3.1	Med	Town Manager/Public Works	Ongoing	New	New	
Public Education & Awareness									
KH13	Increase awareness of availability of flood insurance through various methods (mailings, flyers, etc.)	Hurricanes, Nor'easters, Floods, Thunderstorm	1.1	Med	Planning & Inspections	Twice Annually	New	New	
KH14	Provide information on flood damage protection techniques to citizens and property owners.	Hurricanes, Nor'easters, Floods, Thunderstorm	1.1	Med	Planning & Inspections	Ongoing	New	New	
KH15	Initiate outreach projects to inform the public on Town and County initiatives that will reduce hazard related losses of property and life	All	1.1	Med	Planning & Inspections	2 years	New	New	

Annex F Town of Manteo

F.1 PLANNING PROCESS

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

Table F.1 – HMPC Members

Representative	Agency/Department	Position or Title
Melissa Dickerson	Planning & Zoning	Planner
Casey Howell	Finance	Finance Officer
Malcolm Fearing	Citizen	Business owner, concerned citizen and former NCDOT Board of Transportation member
Taldage Jones	Citizen	Roanoke Island Volunteer Fire Chief, concerned citizen.

F.2 COMMUNITY PROFILE

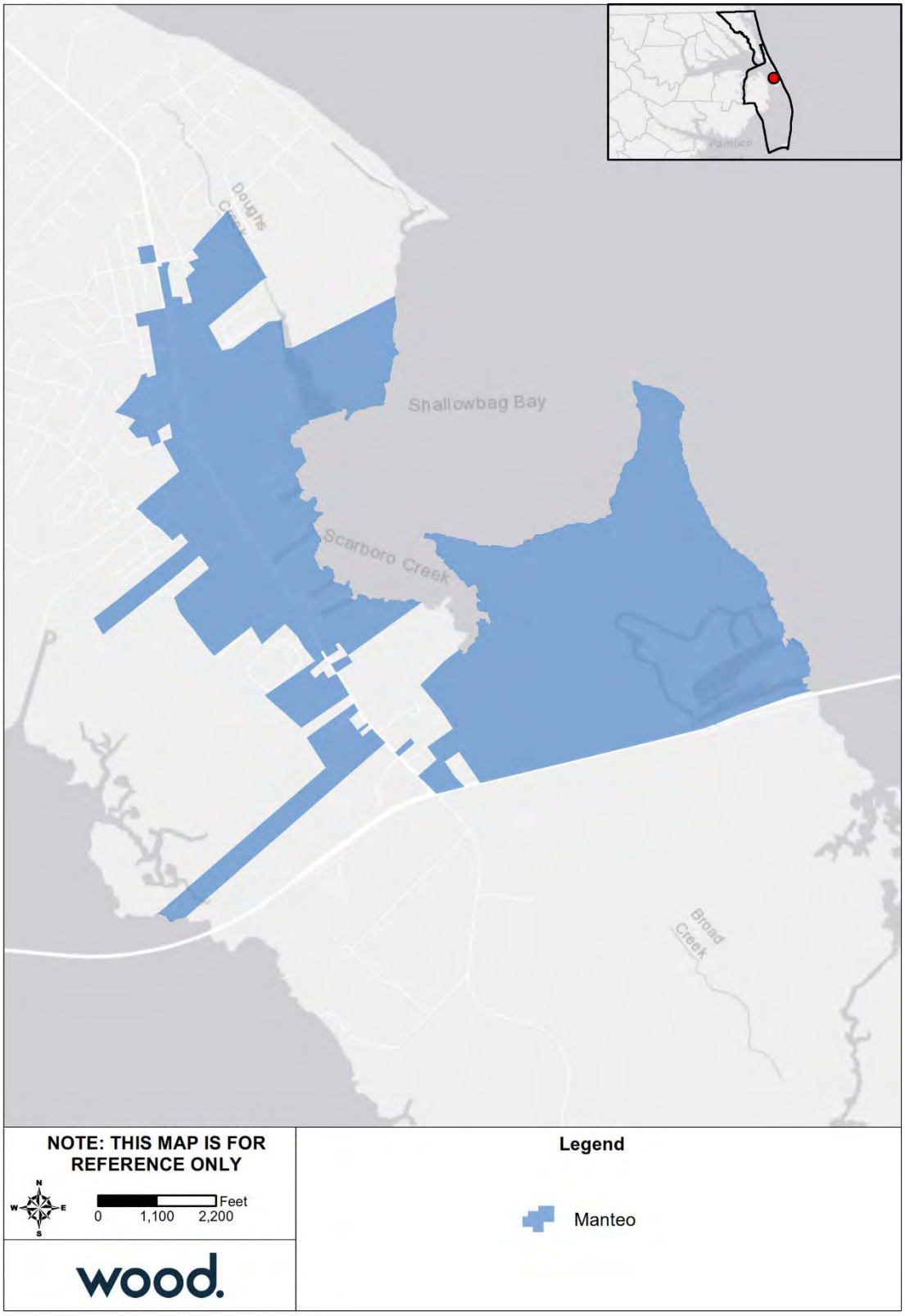
Geography

The Town of Manteo is located on the northeastern portion of Roanoke Island in Dare County. Manteo comprises a total land area of 1.90 square miles.

According to data from the U.S. Fish and Wildlife Service's National Wetlands Inventory, there are approximately 50 acres of wetlands in Manteo.

Figure F.1 shows a base map of the Town of Manteo.

Figure F.1 – Location Map – Town of Manteo



Source: U.S. Census Bureau

Population and Demographics

Table F.2 provides population counts and growth estimates for the Town of Manteo as compared to the Region overall. Table F.3 provides demographic information for Manteo as compared to the Region.

Table F.2 – Population Counts, Manteo, 2010-2017

Jurisdiction	2000 Census Population	2010 Census Population	2017 ACS Population Estimate	Total Change 2010-2017	% Change 2010-2017
Region Total	**48,157**	**57,467**	**60,659**	**3,192**	**5.55%**
Town of Manteo	1,052	1,434	1,485	51	3.56%

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2013-2017 5-Year Estimates

Table F.3 – Racial Demographics, Manteo, 2017

Jurisdiction	White, %	Black, %	Asian, %	Other Race, %	Two or More Races, %	Persons of Hispanic or Latino Origin*, %
Region Total	**91.0**	**3.5**	**0.5**	**2.2**	**2.7**	**5.7**
Town of Manteo	92.4	2.2	0.5	4.0	0.9	5.6

Source: US Census Bureau, American Community Survey 2013-2017 5-Year Estimates
*Persons of Hispanic origin may be of any race, so also are included in applicable race categories

Asset Inventory

The following tables summarize the Critical Infrastructure and Key Resources (CIKR) and high potential loss facilities identified in IRISK for the Town of Manteo. Critical facilities, which include a subset of identified assets form the CIKR dataset as well as facilities identified by the HMPC, are shown in Figure F.2 on the following page and summarized in Table F.6. The County provided information is not included in IRISK vulnerability assessments. Note that the IRISK counts are by building; where a critical facility identified by IRISK comprises a cluster of buildings, each building is counted and displayed.

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

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	EM	Healthcare	Government Facilities	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Town of Manteo	1	5	0	106	3	5	0	19	3	0	0	20	0	1	0	**163**

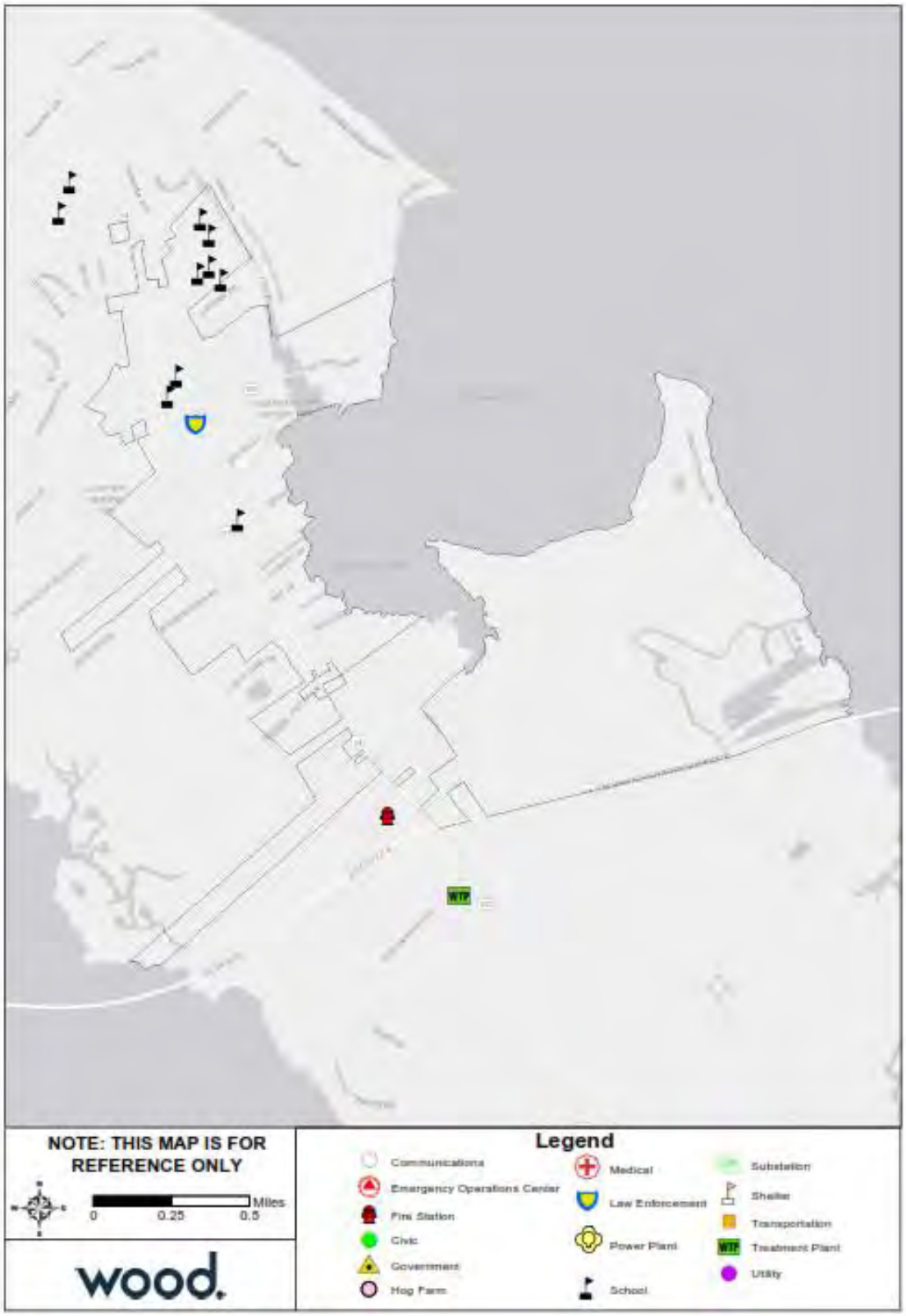
Source: NCEM Risk Management Tool

Table F.5 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Town of Manteo	11	12	0	6	0	3	0	**32**

Source: NCEM Risk Management Tool

Figure F.2 – Critical Facilities, Town of Manteo



Source: NCEM IRISK Database, HMPC input, GIS Analysis

Table F.6 – Critical Facilities List, Town of Manteo

Facility Type	Count
School	8
Police Station	1
Total	**9**

Source: NCEM IRISK Database, HMPC input, GIS Analysis

To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Town of Manteo, current parcel data was evaluated to identify recent development not included in NCEM's IRISK database. Based on this assessment, building counts have increased by 14.3 percent and values are 8.3 percent higher since IRISK data was compiled.

Recent Improved Parcels		IRISK Buildings		Percent Change	
Count	Value	Count	Value	Building Count	Building Value
131	$23,359,300	918	$282,189,726	14.3%	8.3%

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

Note: This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

There are four listings on the National Register of Historic Places for the Town of Manteo, listed below. In addition to these sites, the Town's waterfront gazebo holds significant cultural importance as a community asset and an attraction for tourists.

Table F.7 – Historic Properties

Ref#	Property Name	Status Date	Category	City
03000339	Daniels, John T., House	5/1/2003	Building	Manteo
66000102	Fort Raleigh National Historic Site	10/15/1966	Site	Manteo
82001295	Meekins, Thedore S., House	12/17/1982	Building	Manteo
82004798	Creef, George Washington, House	8/12/1982	Building	Manteo

Source: National Parks Service, National Register of Historic Places, October 2018

Housing

The table below details key housing statistics for Manteo as compared to the Region overall.

Table F.8 – Housing Statistics, Manteo, 2010-2017

Jurisdiction	Housing Units (2010)	Housing Units (2017)	Housing Units Percent Change (2010-2017)	Owner-Occupied, % (2017)	Vacant Units, % (2017)	Median Home Value (2017)
Region Total	**47,945**	**49,616**	**3.5%**	**74.5**	**49.6**	**$285,000**
Town of Manteo	1,353	1,416	4.7%	53.8	50.2	$310,800

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2013-2017 5-Year Estimates
Note: Owner-Occupied and vacant-unit measures are reported as a percent of the total number of housing units.

Economy

The following tables present key economic statistics for Manteo as compared to the Region overall.

Table F.9 – Employment Statistics, Manteo, 2017

Jurisdiction	Population in Labor Force	Percent Employed* (%)	Percent Unemployed* (%)	Percent Not in Labor Force* (%)	Unemployment Rate (%)
Region Total	32,463	61.7	3.3	34.4	5.0
Manteo	733	54.7	4.0	40.8	6.9

Source: U.S. Census Bureau, American Community Survey 2013-2017 5-Year Estimates
Note: This table reports only the civilian labor force. The labor force in armed services accounted for 0.6% of the population 16 and over across the region. *Population employed, population unemployed, and Population not in labor force are reported as a percent of the total population aged 16 years and older.

Table F.10 – Percent of Employed Population by Occupation, Manteo, 2017

Occupation	Management, business, science and arts (%)	Service (%)	Sales and Office (%)	Natural Resources, Construction, and Maintenance (%)	Production, transportation, and material moving (%)
Region Total	30.6	18.7	27.8	14.0	8.9
Manteo	27.2	19.4	26.3	13.3	13.9

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

Land Use and Future Development

The Town of Manteo Planning and Zoning Department is responsible for land-use planning. Current and future land use and development information came from the 2007 CORE CAMA Land Use Plan Update.

Current Land Use

Since the Town has island geography and narrow strips of land, much of the development is located around the main transportation corridors. Land use is split into five categories. The current categories are shown below with their total acreage in Table F.11. Acreages have been rounded to the nearest whole number as have percentages.

Table F.11 – Land Use, Town of Manteo

Land Use	Total Acres	Percent of Town (%)
Residential	272	27
Commercial	88	8
Mixed-Use	20	2
Institutional	138	13
Total Developed/ "active"	*518*	*50*
Open Space	512	50
Total	**1,030**	**100**

Source: Town of Manteo 2007 CORE CAMA Land Use Plan Update

A slight majority of the Town is developed (slightly more than 50%) with 27 percent of the Town land classified as residential. Almost half of the Town is open space.

Future Development

Current development trends are expected to continue into the coming years. The Town anticipates that there will be some re-development of properties and that no one area will see more concentrated development than another. The population is expected to grow in the coming years for both permanent and seasonal populations. Since there is little undeveloped land, and the Town wishes to protect fragile surrounding ecosystems, future development densification and re-development will shape the future land

use. A future goal of the Town is to slow growth. There is a projected need of a little more than 55 acres to accommodate for an increase in population.

The Town used five land classifications with subsections for their future land use and development. These classifications are

- Commercial
  - County services and tourist-oriented commercial
  - Downtown commercial
  - Virginia Dare corridor commercial
- Mixed-Use
- Institutional
- Open Space
- Residential
  - Single Family Detached
  - Single Family Attached
  - Multi-Family Residential

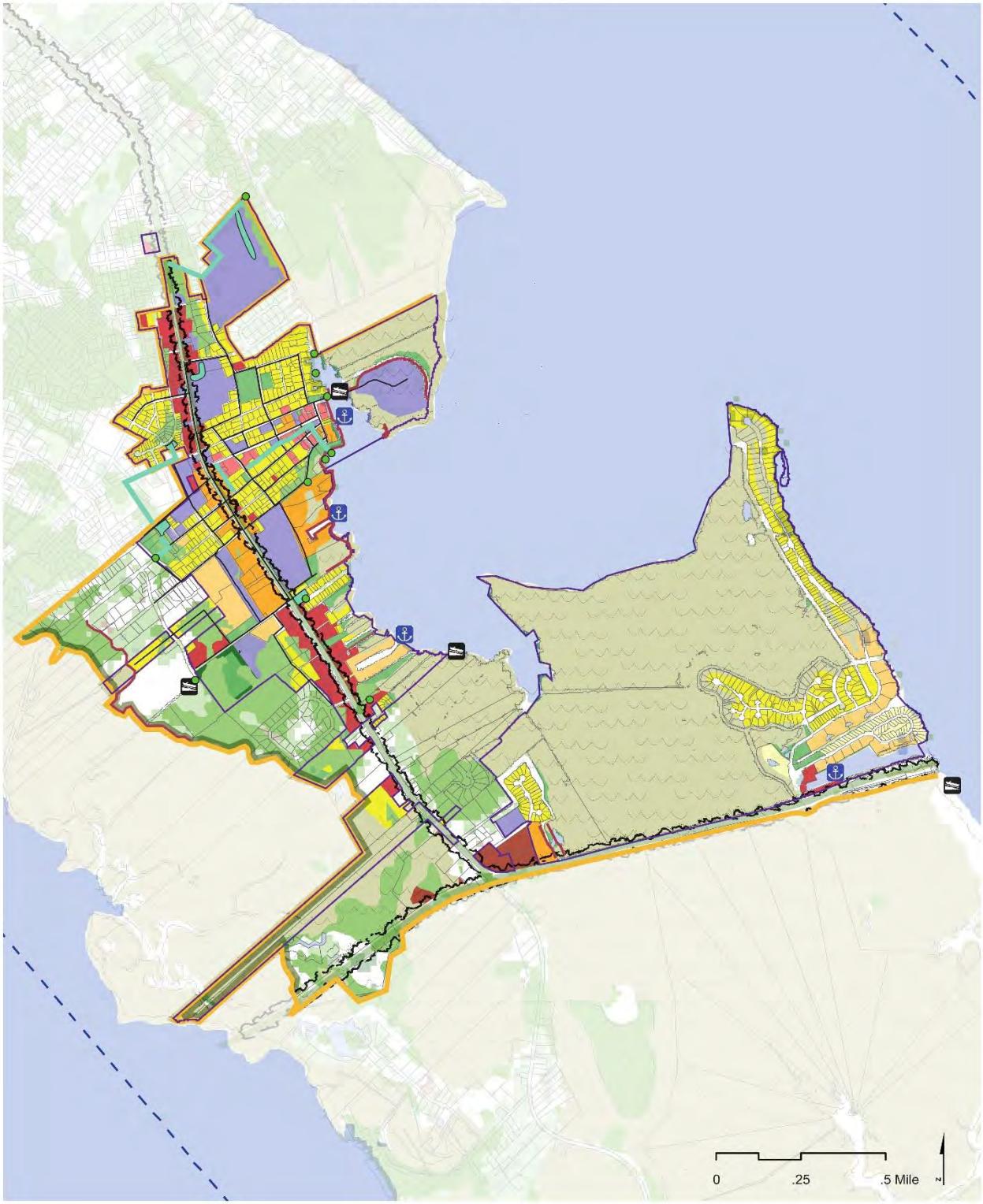
County services and tourist-oriented commercial areas are planned for future growth and development. All other land classifications can be re-developed and in-filled. There are approximately 92 developable vacant parcels within Town limits.

Figure F.3 and Figure F.4 on the following pages show the future land use of the Town of Manteo as envisioned in the 2007 CORE CAMA Land Use Plan Update. County services and tourist-oriented commercial, shown in dark red, are areas planned for future development. Other areas may experience infill or redevelopment.

Figure F.3 – Town of Manteo Future Land Use Map

The Town of Manteo CAMA Land Use Plan Update June 13, 2007

Figure 36. Town of Manteo Conceptual Future Land Use Plan Map



Source: Town of Manteo 2007 CORE CAMA Land Use Plan Update

Figure F.4 – Town of Manteo Future Land Use Map Key

The Town of Manteo CAMA Land Use Plan Update June 13, 2007

TOWN OF MANTEO CONCEPTUAL FUTURE LAND USE PLAN MAP cont'd

Areas Planned for Future Growth and Development

County Services and Tourist-oriented Commercial – This commercial area strongly encourages uses that primarily cater to tourists and offer services that support the nearby County facilities. Appropriate commercial uses include: Hotel or Inns; Drive through ATM; Restaurant(s); County services; Convenience store; Tourist and/or souvenir shop; Professional services; Mixed-use residential above commercial catering to seasonal residents, tourists, or professional services.
- Density: 6 units/acre
- Building height: 12-36'
- Lot coverage: 55%
- Square footage: 2,500-20,000

Areas in Existing Developed Areas for Infill, Preservation, and Redevelopment

Downtown Commercial – This commercial zone should foster heavy pedestrian traffic through dense and easily accessible retail development that serves both locals and tourists. Appropriate uses include but are not limited to: Boutiques; Restaurants, bars, and cafes; Inns; Beauty services; Health services; Professional services; Florists; Galleries; Museums; Movie theaters; Maritime and waterfront uses.
- Density: 8-40 units/acre
- Building height: 12-36'
- Lot coverage: 50-100%
- Square footage: 1,000-20,000

Virignia Dare Corridor Commercial – This commercial subzone strongly encourages commercial uses that will not compete with the everyday town center. Appropriate commercial uses include: Lumberyard; Contractor; Professional services; Truck and auto sales and repair; Auto parts store; Restaurant; Hotel; Motel; Title Co.; Flooring, Furniture, Paint, Interior decorating, Appliance stores; Banks; Boat manufacturing; Tanning salon; Computer/technology store; Income tax services; Gas station; Rental yard; Religious institutions; Gym; Assisted living; County buildings; Commercial nursery; Printing companies; NWR offices; Thrift store; Animal care and shelter.
- Density: 6 units/acre
- Building height: 12-36'
- Lot coverage: 55%
- Square footage: 1,000-20,000

Mixed-Use – Mixed-use development should include retail/residential buildings with commercial retail uses on the first floor and residential uses on the upper floors to promote and sustain the critical mass necessary for both economic viability and social vitality. Commercial uses may include all those listed under Downtown Commercial.
- Density: 6-40 units/acre
- Building height: 12-36'
- Lot coverage: 35-70%
- Square footage: 1,000-20,000

Institutional – Dare County schools, County services, and Town services.
- Building height: 12-36'
- Lot coverage: 25-55%
- Square footage: 1,000-20,000

Residential:

Single Family
- Density: 4-6 units/acre
- Building height: 12-24'
- Lot coverage: 30-35%
- Lot size: 7,500-15,000

Single Family Attached
- Density: 6-8 units/acre
- Building height: 24-36'
- Lot coverage: 35-55%
- Lot size: 5,000-10,000

Multi-family
- Density: 6-8 units/acre
- Building height: 24-36'
- Lot coverage: 30-35%
- Lot size: 20,000-100,000

Notes:

1. There are approximately 92 developable vacant parcels within the Town of Manteo's corporate limits.
2. No new infrastructure is required to support proposed development.

Source: Town of Manteo 2007 CORE CAMA Land Use Plan Update

F.3 RISK ASSESSMENT

This section contains a hazard profile and vulnerability assessment for those hazards that were rated with a higher priority for the Town of Manteo than for the Region as a whole. Risk and vulnerability findings are also presented here for those hazards that are spatially defined and have variations in risk that could be evaluated quantitatively on a jurisdictional level. The hazards included in this section are: Flood and Wildfire.

F.3.1 Flood

Table F.12 details the acreage of the Town of Manteo by flood zone on the effective DFIRM. Per this assessment, nearly 99 percent of the Town of Manteo falls within the mapped 1%-annual-chance floodplains and the rest falls within the 0.2 percent annual chance floodplain.

Table F.12 – Flood Zone Acreage in the Town of Manteo

Flood Zone	Acreage	Percent of Total (%)
Zone AE	1,207.76	96.6%
Zone VE	24.54	2.0%
Zone X (500YR)	18.54	1.5%
Total	**1,250.84**	--

Source: FEMA 2006 DFIRM

Figure F.5 reflects the effective mapped flood hazard zones for the Town of Manteo, and Figure F.6 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the Town of Manteo, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. According to this assessment, over 63 percent of recent development in the Town of Manteo is located in or near the SFHA.

Table F.13 – Recent Development at Risk to Flood, Town of Manteo

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
83	$16,219,400	63.4%	69.4%

Source: Parcel data retrieved November 2019; FEMA 2006 DFIRM

This assessment does not evaluate flood impacts or provide damage estimates. However, this summary of recent development in or near the floodplain provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

Table F.17 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector and flood event in the Town of Manteo. Table F.18 provides counts and estimated damages for High Potential Loss Properties in the Town of Manteo.

Table F.14 – Critical Facilities Exposed to Flooding, Town of Manteo

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	1	$12,906
Commercial Facilities	75	$5,834,819
Communications	2	$19,028
Critical Manufacturing	1	$41,510
Government Facilities	5	$82,306
Healthcare and Public Health	1	$6,660
Transportation Systems	13	$287,243
All Categories	**98**	**$6,284,472**

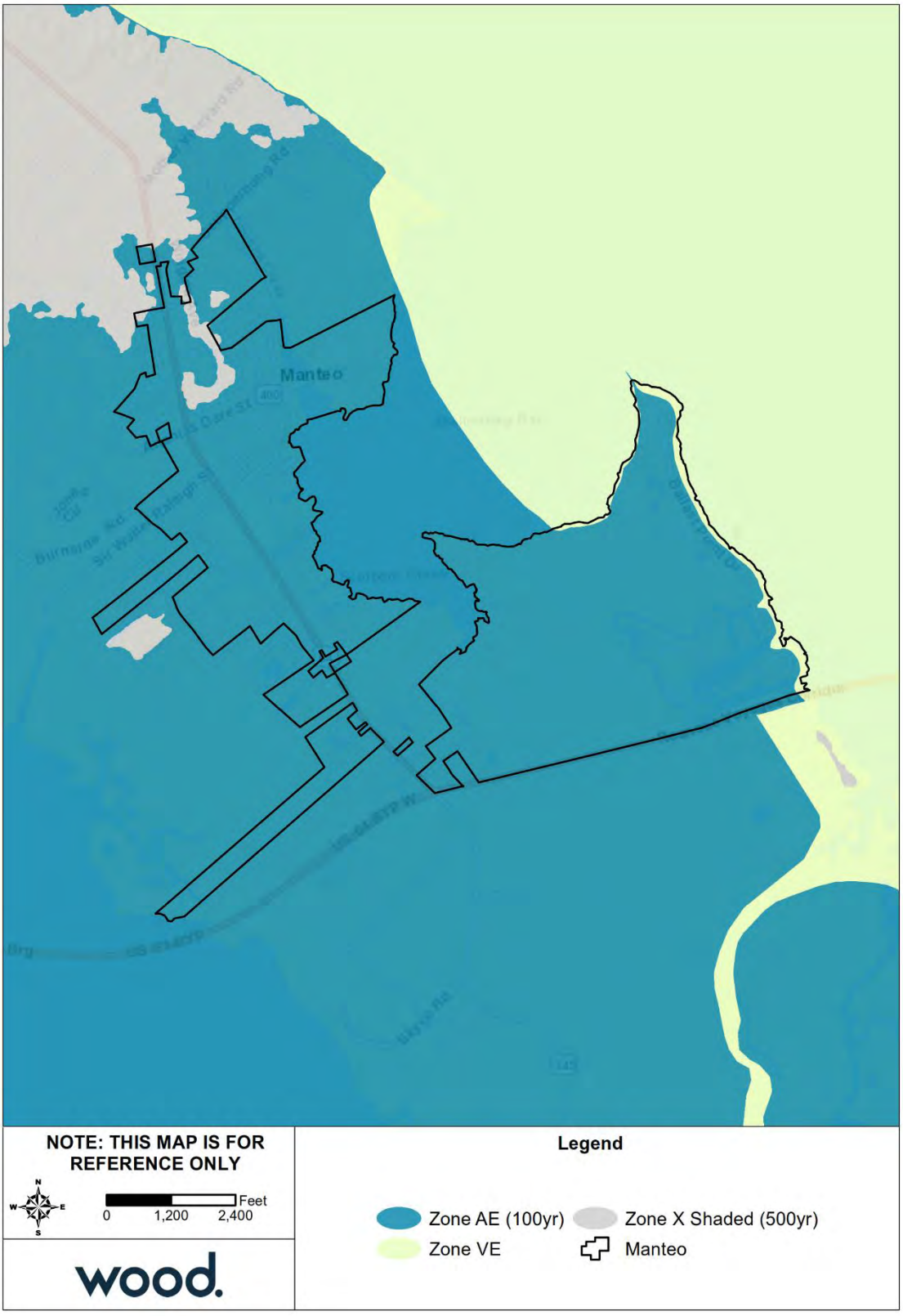
Source: NCEM Risk Management Tool

Table F.15 – High Potential Loss Properties Exposed to Flooding, Town of Manteo

Category	Number of Buildings at Risk	Estimated Damages
Commercial	6	$2,877,877
Residential	3	$2,415,155
All Categories	**9**	**$5,293,032**

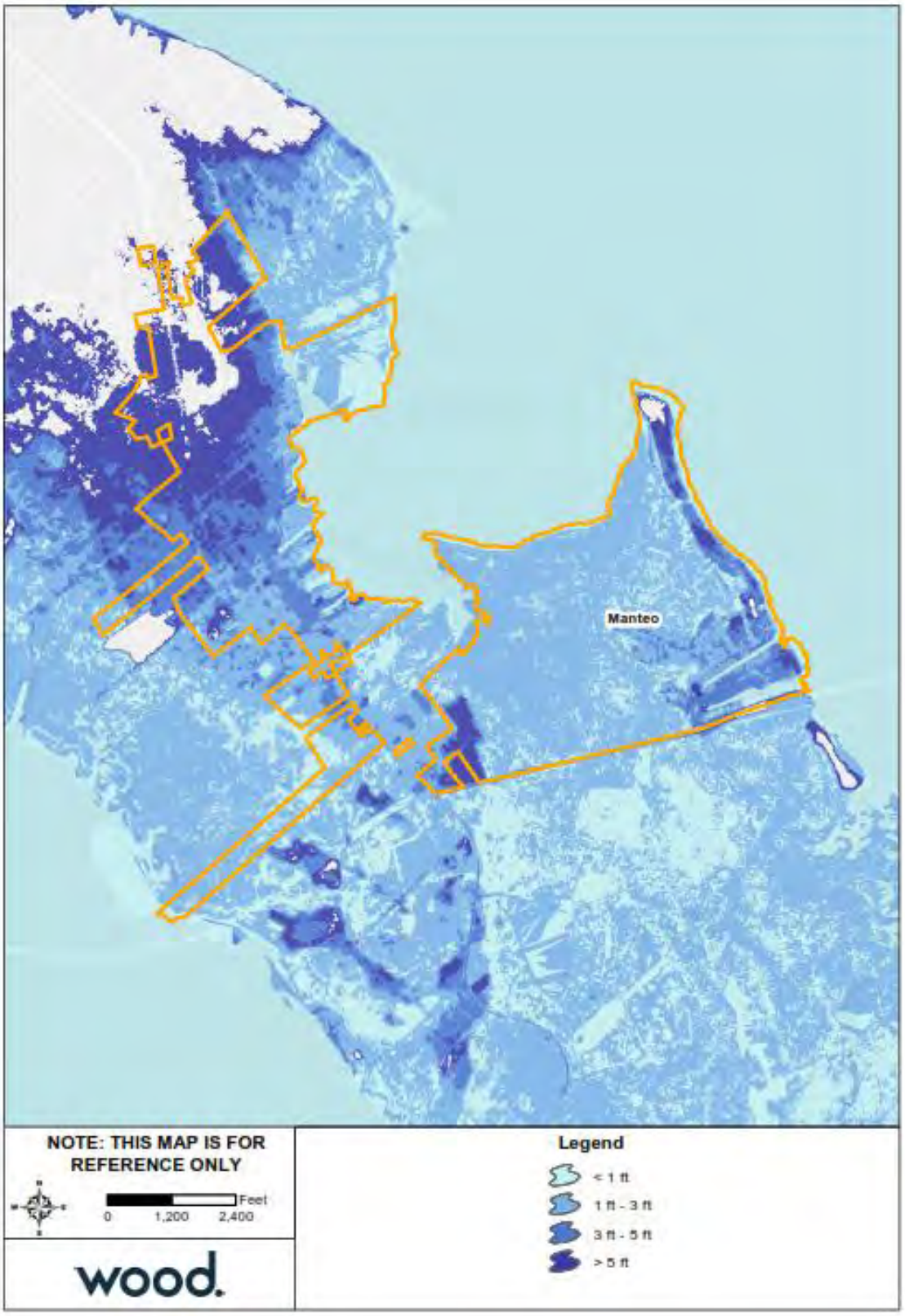
Source: NCEM Risk Management Tool

Figure F.5 – FEMA Flood Hazard Areas, Town of Manteo



Source: FEMA Effective DFIRM

Figure F.6 – Flood Depth, 1%-Annual-Chance Floodplain, Town of Manteo



Source: FEMA Effective DFIRM

F.3.2 Wildfire

Table F.16 summarizes the acreage in the Town of Manteo 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 Manteo is not included in the WUI.

Table F.16 – Wildland Urban Interface Acreage, Town of Manteo

	Housing Density	Total Acreage	Percent of Total Acreage
	Not in WUI	*425.4*	*34.0%*
	LT 1hs/40ac	56.9	4.5%
	1hs/40ac to 1hs/20ac	16.3	1.3%
	1hs/20ac to 1hs/10ac	25.7	2.1%
	1hs/10ac to 1hs/5ac	45.5	3.6%
	1hs/5ac to 1hs/2ac	90.9	7.3%
	1hs/2ac to 3hs/1ac	413.7	33.1%
	GT 3hs/1ac	176.5	14.1%
	Total	**1,250.8**	

Source: Southern Wildfire Risk Assessment

Figure F.7 depicts the WUI the Town of Manteo. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure F.8 depicts the Fire Intensity Scale, which indicates the potential severity of fire based on fuel loads, topography, and other factors. Figure F.9 depicts Burn Probability based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Data is not available on past acreage burned at the jurisdictional level.

Potential fire intensity is moderate to high along the waterfront and throughout the southeastern portion of the Town. The southeastern area has moderate burn probability and overlaps areas of the WUI, indicating development is at risk. These are the most significant areas of wildfire risk in Manteo.

Table F.17 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table F.18 provides counts and estimated damages for High Potential Loss Properties in the Town of Manteo.

Table F.17 – Critical Facilities Exposed to Wildfire, Town of Manteo

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	1	$933,500
Commercial Facilities	74	$46,541,171
Communications	1	$490,917
Critical Manufacturing	5	$2,436,153
Food and Agriculture	1	$994,965
Government Facilities	12	$44,291,893
Healthcare and Public Health	1	$415,154
Transportation Systems	10	$5,741,321
All Categories	**105**	**$101,845,074**

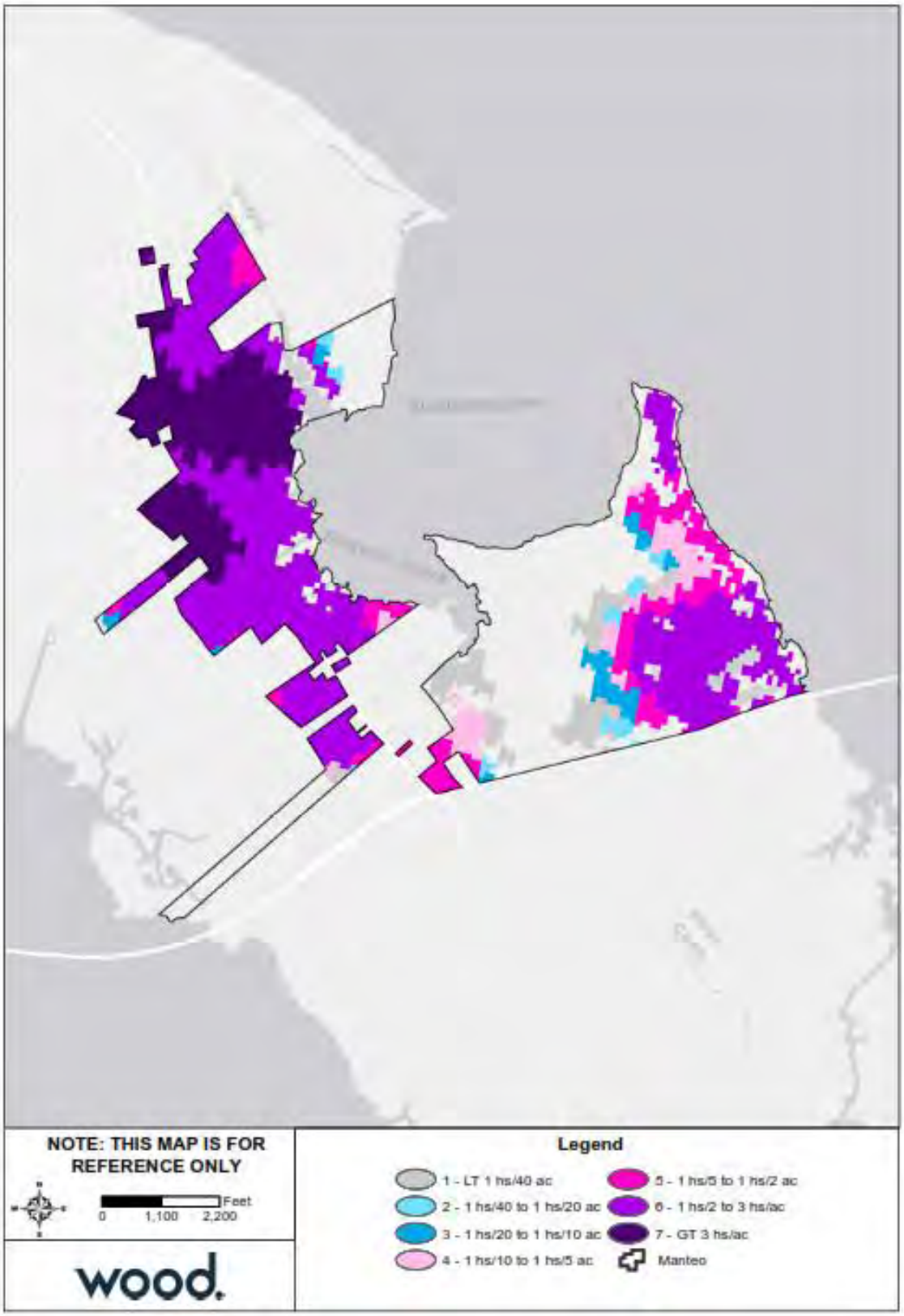
Source: NCEM Risk Management Tool

Table F.18 – High Potential Loss Properties Exposed to Wildfire, Town of Manteo

Category	Number of Buildings at Risk	Estimated Damages
Commercial	9	$24,062,946
Government	5	$41,593,898
Religious	2	$3,196,503
Residential	3	$5,657,485
All Categories	**19**	**$74,510,832**

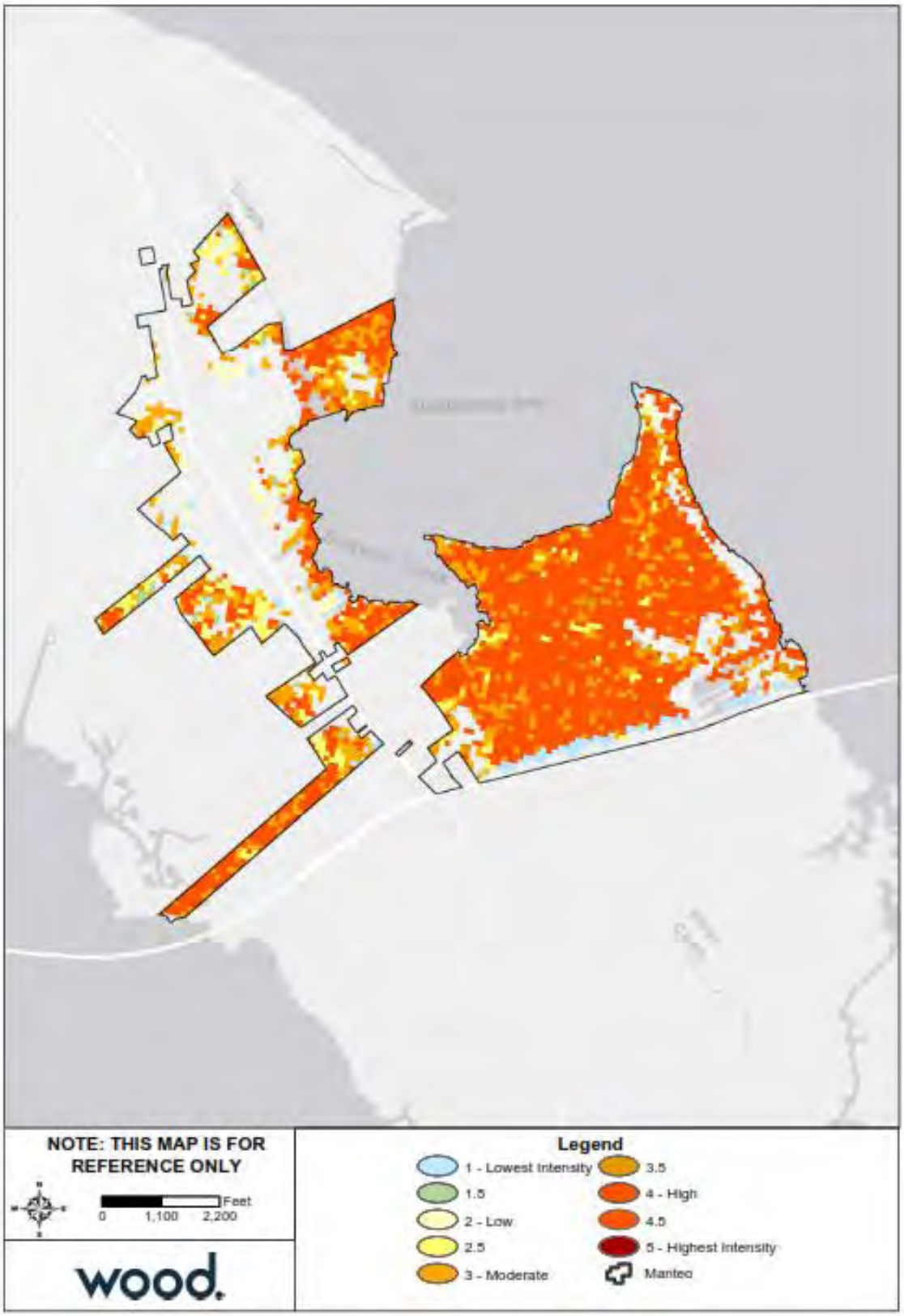
Source: NCEM Risk Management Tool

Figure F.7 – Wildland Urban Interface, Manteo



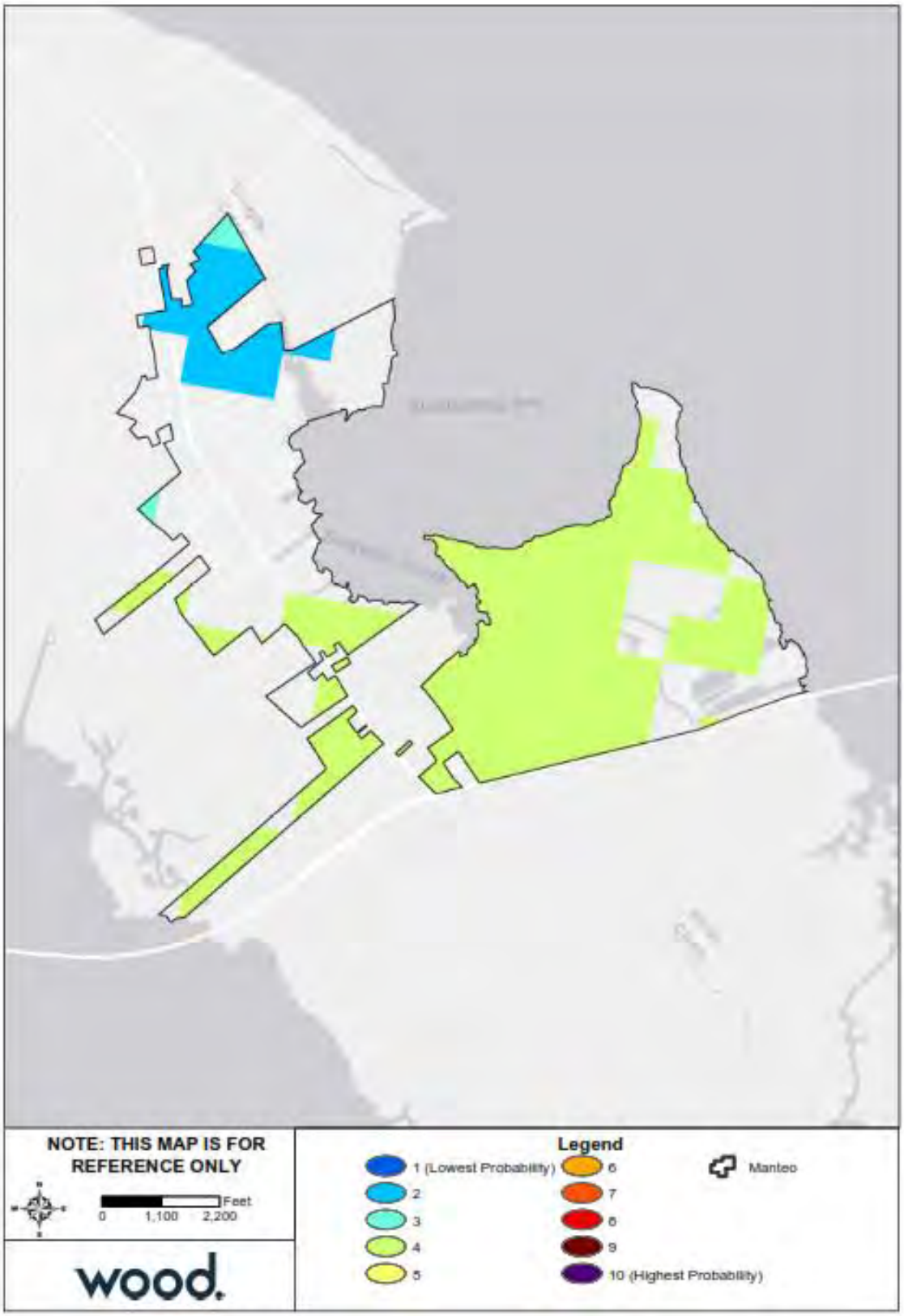
Source: Southern Wildfire Risk Assessment

Figure F.8 – Fire Intensity Scale, Manteo



Source: Southern Wildfire Risk Assessment

Figure F.9 – Burn Probability, Manteo



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 Manteo were provided by the Town's HMPC representatives and are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Manteo has an overall capability rating of Moderate. The Town's Self-Assessment of key capability areas is summarized in Table F.19 below.

Table F.19 – Capability Self-Assessment, Manteo

Capability Area	Rating
Plans, Ordinances, Codes and Programs	Moderate
Administrative and Technical Capability	Moderate
Fiscal Capability	Moderate
Education and Outreach Capability	Limited
Mitigation Capability	Moderate
Political Capability	Moderate
Overall Capability	Moderate

F.4.2 Floodplain Management

The Town of Manteo has been a regular participant since January 1973. 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.20 – 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	435	$296,463	$110,692,200	54	$572,003.69
2-4 Family	12	$4,287	$3,014,100	1	$43,791.46
All Other Residential	471	$125,310	$96,185,800	55	$815,614.22
Non Residential	80	$191,784	$26,738,400	109	$3,586,552.39
Total	**998**	**$617,844**	**$236,630,500**	**219**	**$5,017,961.76**

Source: FEMA Community Information System, accessed December 2019

Table F.21 – 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	983	$587,657	$230,934,900	200	$4,648,428.46
B, C & X Zone					
Standard	13	$29,385	$4,995,600	19	$369,533.30
Preferred	2	$802	$700,000	0	$0.00
Total	**998**	**$617,844**	**$236,630,500**	**219**	**$5,017,961.76**

Source: FEMA Community Information System, accessed December 2019

Table F.22 – 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	123	$218,386	$24,715,300	98	$3,442,259.40
B, C & X Zone	2	$802	$700,000	0	$0.00
Standard	0	$0	$0	0	$0.00
Preferred	2	$802	$700,000	0	$0.00
Total	**125**	**$219,188**	**$25,415,300**	**98**	**$3,442,259.40**

Source: FEMA Community Information System, accessed August 2019

Table F.23 – 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	860	$369,271	$206,219,600	101	$1,206,031.73
B, C & X Zone	13	$29,385	$4,995,600	19	$369,533.30
Standard	13	$29,385	$4,995,600	19	$369,533.30
Preferred	0	$0	$0	0	$0.00
Total	**873**	**$398,656**	**$211,215,200**	**120**	**$1,575,565.03**

Source: FEMA Community Information System, accessed December 2019

F.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
MAN1	Continue to stay current with all Community Rating System reporting requirements to ensure continued program participation.	Hurricane, Severe Thunderstorm, Flood	3.3	7 - High	Planning Department	General Fund	Ongoing	Carry Forward	Ongoing effort
MAN2	Replace heat strips on *utility lines running under* the Cora Mae Basnight Bridge	Severe Winter Storm	2.1	3 - Medium	Utilities Department	Water Sewer Enterprise Fund	2025	New	January 2020, the Town repaired insulation surrounding the pipes as funds for heat strips are not yet available.
Property Protection									
MAN3	Maintain and improve Town wide stormwater system for appropriate performance.	Hurricane, Severe Thunderstorm, Flood	2.1	7 - High	Planning Department	Stormwater Fund	2025	Carry Forward	Revised to expand upon ditching to include other maintenance and improvement efforts
MAN4	Replace or retrofit critical and high risk failities that are located below base flood elevation	Flood, Hurricane, Coastal Hazards	2.1	7 - High	Planning Department	HMG Grant	Ongoing	New	
MAN5	Generator for Town Hall for continued services during disasters. The Town stands up an EOC at Town Hall during disasters.	All Hazards	2.1	7 - High	All Departments	HMG Grant	2020-2021	New	Application pending
Natural Resource Protection									
MAN6	Upgrade and improve stormwater and wastewater systems to improve water quality in Shallowbag Bay	Flood, Hurricane, Coastal Hazards	2.1	7 - High	Planning Department	Stormwater Fund/Clean Water Trust Fund	Ongoing	New	Major project in 2018 to install oil grit separators on lines for 14 acre outfall. Town stormwater fund now reubilding.
MAN7	Protect natural wetland areas	Flood, Hurricane, Coastal Hazards	3.2	7 - High	Planning Department	National Wetlands Conservation Grant Program/Clean Water Management Trust Fund	Ongoing	New	
MAN8	Cora Mae Basnight Bridge-water sewer line repair and replacement	All Hazards	2.1	3 - Medium	Utilities Department	Water Sewer Enterprise Fund	2025	New	
Structural Projects									
MAN9	Continue to encourage projects undertaken by Town Departments that will lessen the vulnerability of the Town and its residents to natural hazards.	All Hazards	3.3	7 - High	ALL	HMG Grant	Ongoing	Carry Forward	Revised to include all Town Department efforts
MAN10	Phase V stormwater improvements for west side of Highway 64	Flood, Hurricane, Coastal Hazards	2.1	7 - High	Planning Department	Stormwater Fund	Ongoing	New	July 2019, hired contractor to clean and conduct inspection of major section of west side stormwater system
MAN11	Capital Improvement Plan development with resiliency as a priority	All Hazards	3.3	7 - High	Administration Department	General Fund	2022	New	
MAN12	Boardwalk, bulkhead and docks replcement with higher standards/higher quality materials	All Hazards	2.1	7 - High	Planning Department	CAMA Access, General Fund	Ongoing	New	Received CAMA access grant to replace decking on almost 30 year old section of the boardwalk
MAN13	Floodproofing of East, West Hammock, and Ballast Point, Penninsula lift stations	Flood, Hurricane, Coastal Hazards	2.1	7 - High	Utilities Department	HMG Grant	2025	New	2019 Elevated electrical units in East Hammock station above flooding level
MAN14	Implement 2018 lightening study for water and sewer plant	Severe Weather	2.1	7 - High	Utilities Department	Water Sewer Enterprise Fund	2025	New	
MAN15	Repair and maintain Town Waterfront Gazebo with higher standards/higher quality materials for improved resiliency		1.2	7 - High	Town Marina/Maritime Museum	CAMA Access, General Fund	Ongoing	New	
MAN16	Full replacement of waterfront lift station	Flood, Hurricane, Coastal Hazards	2.1	7 - High	Utilities Department	Clean Water State Revolving Fund	2021 (bidding)	New	

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Emergency Services									
MAN17	Continue to enhance the Water and Sewer Department's back-up generator system for all lift stations	All Hazards	2.2	7 - High	Utilities Department	HMG Grant	Ongoing	Carry Forward	11 total liftstations. 3 have generators. Need 7 generators.
MAN18	Participate in and conduct Emergency Management training for appropriate Town elected officials and staff.	All Hazards	2.2	7 - High	All Departments	General Fund	Ongoing	Carry Forward	Revised from "Mayor and other council members to participate in Dare County Emergency Management training sessions." to include various training opportunities
MAN19	Develop new Town of Manteo Emergency Operations Plan to supersede Manteo Police Emergency Plan	All Hazards	3.3	7 - High	Planning Department	General Fund	Ongoing	Carry Forward	New plan developed in 2019. Updates to plan coming in 2020.
MAN20	Implement essential spare equipment (standby equipment) program for water sewer plant	All Hazards	2.1	7 - High	Utilities Department	Water Sewer Enterprise Fund	Ongoing	New	
MAN21	Generator for Water and Sewer Plant to power to full operational	All Hazards	2.1	7 - High	Utilities Department	HMG Grant	2025	New	
Public Education & Awareness									
MAN22	Develop Communications Plan for hazards.	All Hazards	1.1	7 - High	All Departments	General Fund	Ongoing	Carry Forward	Action was revised to encompass all-hazards outreach from "Send a flood protection flyer to all property owners in Manteo through a community newsletter, utility bill or other document. The flyer would include a general identification of the local flood hazard, flood safety, flood insurance, property protection, flood plain development permit requirements, and drainage system maintenance." *Town will hire a PIO (new position) in early 2020.
MAN23	Educate Residents on water saving techniques	Drought	1.1	7 - High	All Departments	Water Sewer Enterprise Fund	Ongoing	New	

Annex G Town of Nags Head

G.1 PLANNING PROCESS

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

Table G.1 – HMPC Members

Representative	Agency/Department	Position or Title
Holly White	Planning & Development	Principal Planner
Shane Hite	Fire Department	Deputy Fire Chief
Michael Zehner	Planning & Development	Director
Ed Snyder	Planning & Development	Code Enforcement
Meade Gwinn	Citizen	Planning Board member and Village of Nags Head HOA member with good working knowledge of historical town issues
Megan Lambert	Citizen	Business owner, Planning Board & Stormwater Committee member; business was flooded during Hurricane Matthew

G.2 COMMUNITY PROFILE

Geography

The Town of Nags Head is a barrier island community located in northern Dare County. It is neighbored by Kill Devil Hills to the north and unincorporated Dare County to the south. Route 64 and the Melvin R. Daniels Bridge run from Roanoke Island to Nags Head, making the town one of the few entry points from the mainland to the Outer Banks barrier islands. The Town comprises a total land area of 6.59 square miles.

According to data from the U.S. Fish and Wildlife Service's National Wetlands Inventory, there are approximately 133 acres of wetlands in Nags Head.

Figure G.1 shows a base map of the Town of Nags Head.

Figure G.1 – Location Map, Town of Nags Head



Source: U.S. Census Bureau

Population and Demographics

Table G.2 provides population counts and growth estimates for the Town of Nags Head as compared to the Region overall. Table G.3 provides demographic information for the Town as compared to the Region.

Table G.2 – Population Counts, Nags Head, 2010-2017

Jurisdiction	2000 Census Population	2010 Census Population	2017 ACS Population Estimate	Total Change 2010-2017	% Change 2010-2017
Region Total	**48,157**	**57,467**	**60,659**	**3,192**	**5.55%**
Town of Nags Head	2,700	2,757	2,855	98	3.55%

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2013-2017 5-Year Estimates

Table G.3 – Racial Demographics, Nags Head, 2017

Jurisdiction	White, %	Black, %	Asian, %	Other Race, %	Two or More Races, %	Persons of Hispanic or Latino Origin*, %
Region Total	**91.0**	**3.5**	**0.5**	**2.2**	**2.7**	**5.7**
Town of Nags Head	92.1	1.2	0.8	2.1	3.8	1.6

Source: US Census Bureau, American Community Survey 2013-2017 5-Year Estimates
*Persons of Hispanic origin may be of any race, so also are included in applicable race categories

Asset Inventory

The following tables summarize the Critical Infrastructure and Key Resources (CIKR) and high potential loss facilities identified in IRISK for the Town of Nags Head. Critical facilities, which include a subset of identified assets form the CIKR dataset as well as facilities identified by the HMPC, are shown in Figure G.2 on the following page and summarized in Table G.6. The County provided information is not included in IRISK vulnerability assessments. Note that the IRISK counts are by building; where a critical facility identified by IRISK comprises a cluster of buildings, each building is counted and displayed.

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

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	EM	Healthcare	Government Facilities	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Town of Nags Head	6	27	0	831	12	48	0	36	48	0	0	12	6	12	24	**1,062**

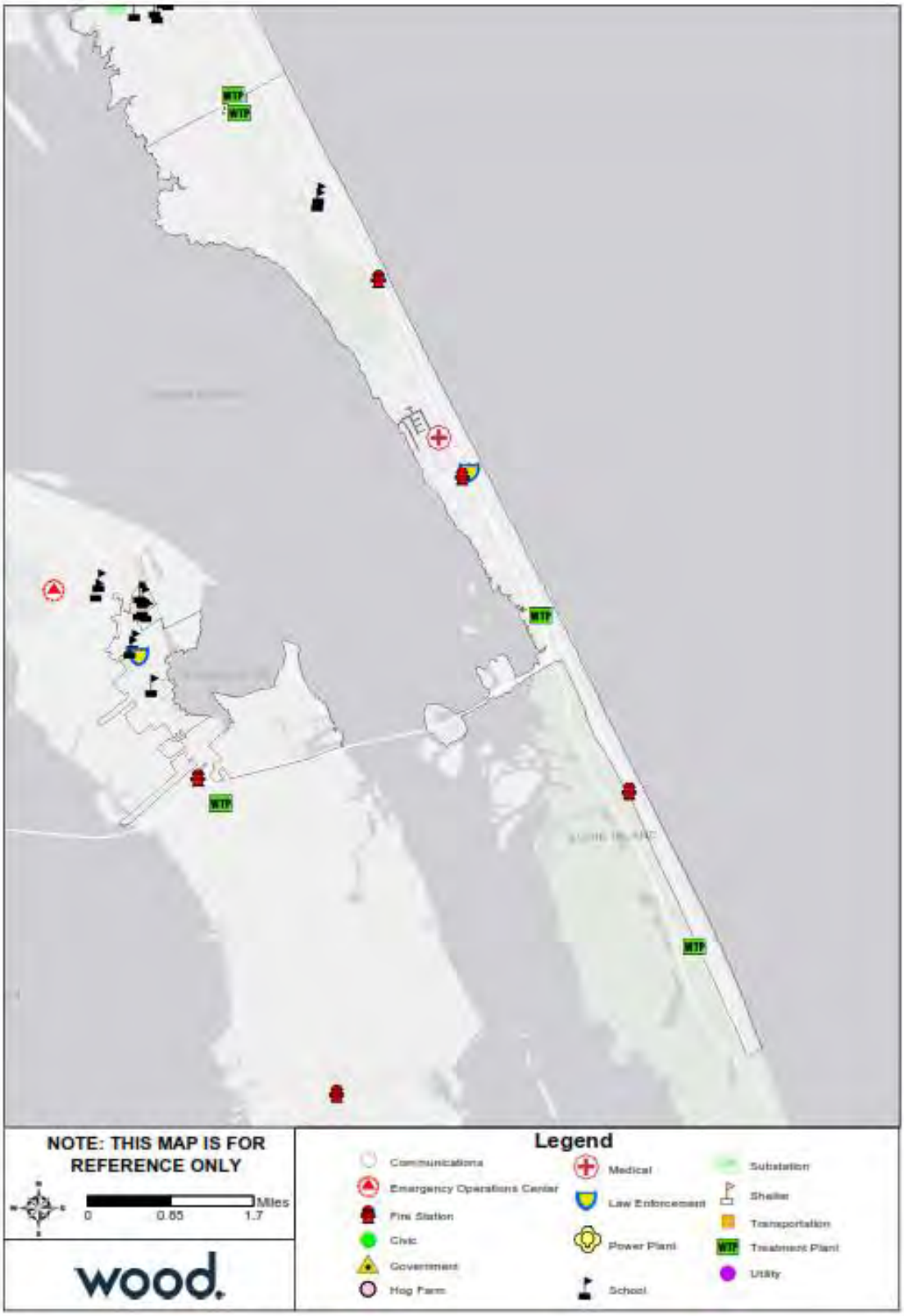
Source: NCEM Risk Management Tool

Table G.5 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Town of Nags Head	66	78	0	18	0	6	0	**168**

Source: NCEM Risk Management Tool

Figure G.2 – Critical Facilities, Town of Nags Head



Source: NCEM IRISK Database, HMPC input, GIS Analysis

Table G.6 – Critical Facilities List, Town of Nags Head

Facility Type	Count
Fire Station	3
Hospital	1
Police Station	1
School	2
Treatment Plant	8
Total	**15**

Source: NCEM IRISK Database, HMPC input, GIS Analysis

To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Town of Nags Head, current parcel data was evaluated to identify recent development not included in NCEM's IRISK database. Based on this assessment, property value exposure in Nags Head has increased by 6.8 percent since IRISK data was compiled.

Table G.7 – Recent Development Not Included in IRISK

Recent Improved Parcels		IRISK Buildings		Percent Change	
Count	Value	Count	Value	Building Count	Building Value
288	$74,889,500	4,827	$1,094,947,456	6.0%	6.8%

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

Note: This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

There are nine listings on the National Register of Historic Places for the Town of Nags Head, listed below.

Table G.8 – Historic Properties

Ref#	Property Name	Status Date	Category	City
03000607	Bodie Island Light Station	7/4/2003	District	Nags Head
04001389	Midgett, Mattie, Store and House	12/23/2004	Building	Nags Head
04001392	Sea Foam Motel	12/23/2004	Building	Nags Head
05001544	Markham--Albertson--Stinson Cottage	1/13/2006	Building	Nags Head
15000805	U-85 (submarine) shipwreck and remains	11/12/2015	Site	Nags Head
77000997	Nags Head Beach Cottages Historic District	8/19/1977	District	Nags Head
79000251	Bodie Island Lifesaving/Coast Guard Station	2/9/1979	District	Nags Head
91001625	USS HURON	11/15/1991	Structure	Nags Head
92001835	First Colony Inn	1/21/1993	Building	Nags Head

Source: National Parks Service, National Register of Historic Places, October 2018

Housing

The table below details key housing statistics for Nags Head as compared to the County overall.

Table G.9 – Housing Statistics, Nags Head, 2010-2017

Jurisdiction	Housing Units (2010)	Housing Units (2017)	Housing Units Percent Change (2010-2017)	Owner-Occupied, % (2017)	Vacant Units, % (2017)	Median Home Value (2017)
Region Total	**47,945**	**49,616**	**3.5%**	**74.5**	**49.6**	**$285,000**
Town of Nags Head	4,884	4,882	0.0%	66.2	73.6	$319,300

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2013-2017 5-Year Estimates

Note: Owner-Occupied and vacant-unit measures are reported as a percent of the total number of housing units.

This data indicates minimal change in housing stock from 2010 to 2017; however, the Nags Head 2017 Comprehensive Plan provides more nuance, indicating that between 2005 and 2017 the Town lost approximately 48 1-2 bedroom single-family homes but gained more than 200 larger single family homes, and increased total housing units by more than 300 properties overall. Additional losses may have occurred prior to 2005 to explain these differences. Regardless, despite minor changes in overall property counts, the potential persons at peak population during the tourist season has increased due to redevelopment and conversion to larger properties.

Economy

The following tables present key economic statistics for Nags Head as compared to the County overall.

Table G.10 – Employment Statistics, Nags Head, 2017

Jurisdiction	Population in Labor Force	Percent Employed* (%)	Percent Unemployed* (%)	Percent Not in Labor Force* (%)	Unemployment Rate (%)
Region Total	32,463	61.7	3.3	34.4	5.0
Nags Head	1,640	64.4	1.7	33.9	2.6

Source: U.S. Census Bureau, American Community Survey 2013-2017 5-Year Estimates
Note: This table reports only the civilian labor force. The labor force in armed services accounted for 0.6% of the population 16 and over across the region. *Population employed, population unemployed, and Population not in labor force are reported as a percent of the total population aged 16 years and older.

Table G.11 – Percent of Employed Population by Occupation, Nags Head, 2017

Occupation	Management, business, science and arts (%)	Service (%)	Sales and Office (%)	Natural Resources, Construction, and Maintenance (%)	Production, transportation, and material moving (%)
Region Total	30.6	18.7	27.8	14.0	8.9
Nags Head	44.7	14.8	23.4	7.4	9.7

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

Land Use and Future Development

The Town of Nags Head Planning and Development Department is responsible for land-use planning. The 2017 Comprehensive Plan was used to assess future development.

Current Land Use

Since the Town has island geography and narrow strips of land, much of the development is located around the main transportation corridors. Land use is split into fourteen categories. The current categories are shown below with their total acreage in Table G.12. Percentages have been rounded to the nearest whole number.

Table G.12 – Land Use, Town of Nags Head

Land Use	Total Acres	Percent of Town (%)
Single Family Residential	1,291	33
Multi-Family	85	2
Hotel/Motel/ Cottage Court	41	1
Commercial	305	7
Multiple-Use	26	1
Government	15	1

Land Use	Total Acres	Percent of Town (%)
Institutional/ Religious	51	1
Warehouse	3	1
Park/Open Space public	1,052	27
Park/Open Space Private	340	8
Cemetery	1	1
Secondary Improvements	17	1
Total Developed	*3,227*	*84*
Undeveloped	610	15
Washout	8	1
Total	**3,845**	**100**

Source: Town of Nags Head 2017 Comprehensive Plan

Secondary improvements are areas indicated for utility company substations. Washout areas are where land has been washed out by the ocean and is now unable to be built on. Most of the Town is developed (84%) with 33 percent of the Town land classified as single family residential and almost a third of the town classified as public open space (27%).

Future Development

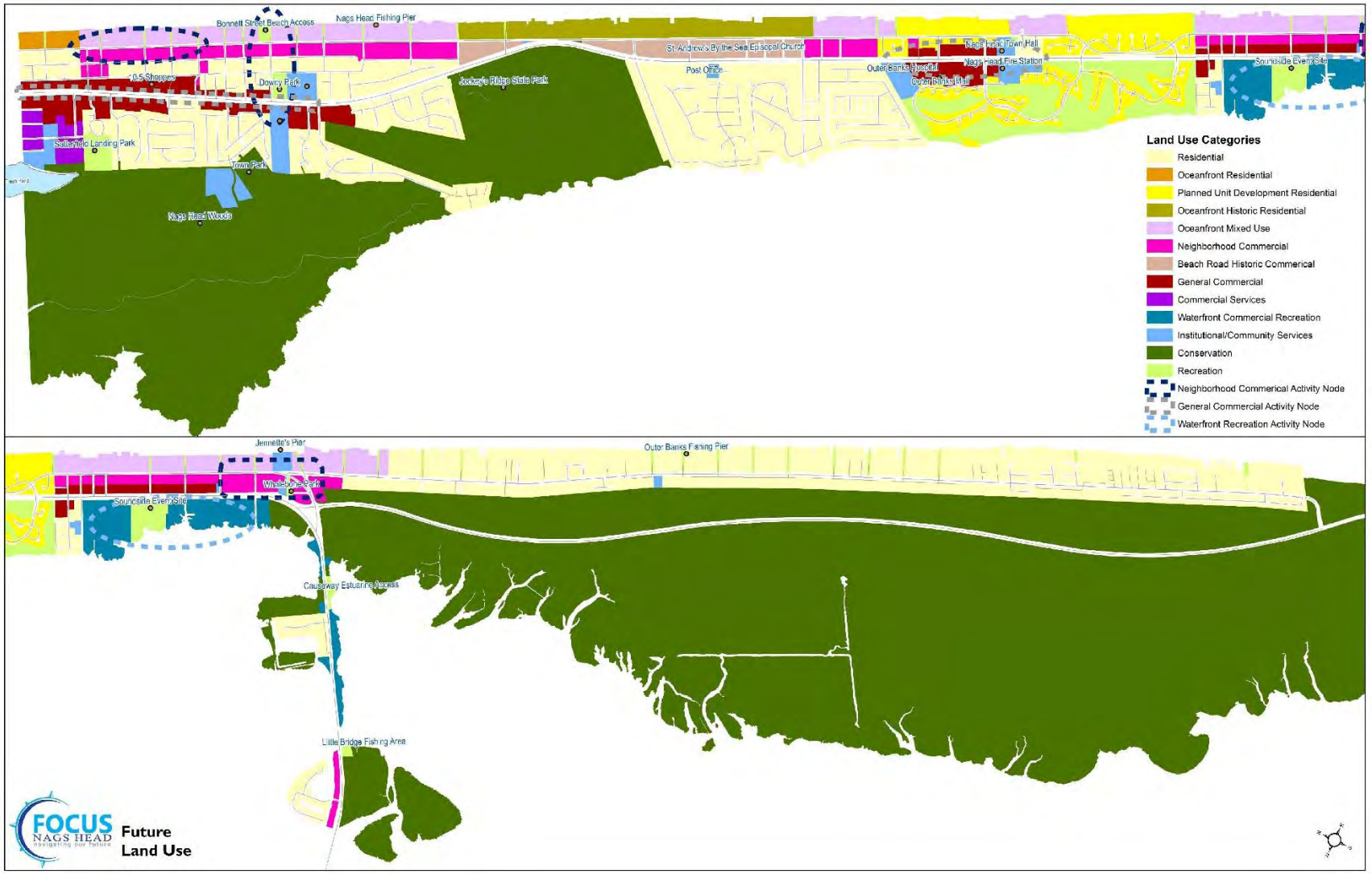
The Town anticipates that it will continue to grow as a low density, single family residential community and hopes to preserve open space. The land use plan discusses the option of a program to incentivize developers to set aside open space. Nags Head chose to directly relate their land use designations to their zoning map. The future land use map uses thirteen land classifications that are like the current classifications. They are

- Residential
- Oceanfront residential
- Planned unit development residential
- Oceanfront historic residential
- Oceanfront mixed use
- Neighborhood commercial
- Beach Road historic commercial
- General commercial
- Commercial services
- Waterfront commercial recreation
- Institutional/community services
- Conservation
- Recreation

All but one acre of undeveloped land will be developed into single family residential or commercial. There are currently no specified locations for major development or redevelopment in the town other than the currently undeveloped parcels.

Figure G.3 on the following page shows the future land use of the Town of Nags Head as envisioned in the Focus 2017 Comprehensive Plan. Activity nodes indicate areas that may experience infill or redevelopment.

Figure G.3 – Town of Nags Head Future Land Use Map



Source: Town of Nags Head, Focus 2017 Comprehensive Plan

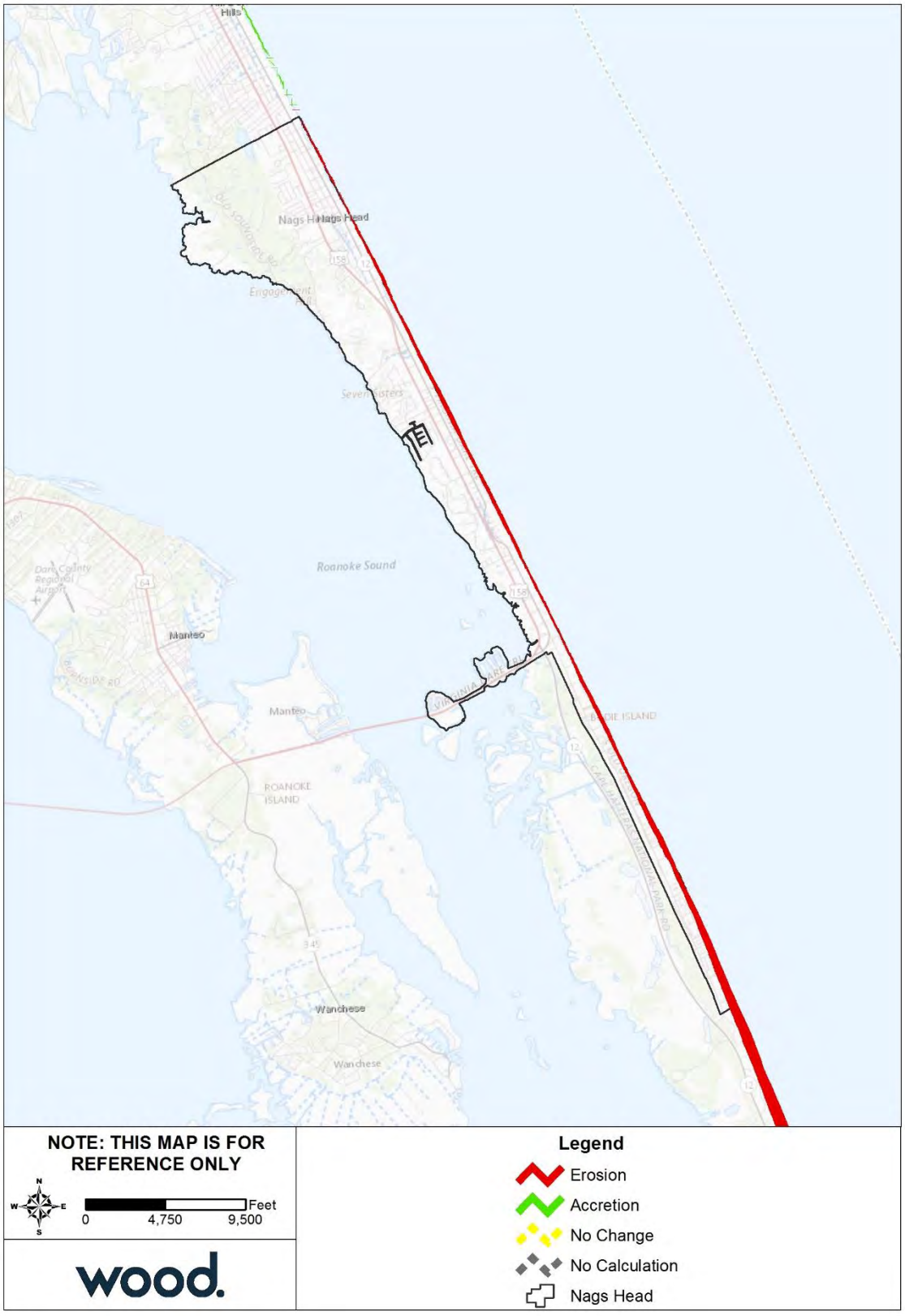
G.3 RISK ASSESSMENT

This section contains a hazard profile and vulnerability assessment for those hazards that were rated with a higher priority for the Town of Nags Head than for the Region as a whole. Risk and vulnerability findings are also presented here for those hazards that are spatially defined and have variations in risk that could be evaluated quantitatively on a jurisdictional level. The hazards included in this section are: Flood and Wildfire.

G.3.1 Coastal Hazards

Figure G.4 on the following page shows coastal erosion rates along the Town of Nags Head oceanfront coastline according to data from the DCM 2019 Long-Term Average Annual Erosion Rate Update Study. The entire Nags Head oceanfront coastline is experiencing erosion, with more severe erosion in the southern areas of the Town.

Figure G.4 – Erosion Rates, Town of Nags Head



Source: North Carolina Division of Coastal Management

G.3.2 Flood

Table G.13 details the acreage of the Town of Nags Head by flood zone on the effective DFIRM. Per this assessment, over 64 percent of Nags Head falls within the mapped 1%-annual-chance floodplains and the remainder falls within the 0.2 percent annual chance floodplain.

Table G.13 – Flood Zone Acreage in the Town of Nags Head

Flood Zone	Acreage	Percent of Total (%)
Zone A	11.84	0.3%
Zone AE	1,975.50	47.4%
Zone VE	680.83	16.3%
Zone X (500YR)	1,496.90	35.9%
Total	**4,165.07**	--

Source: FEMA 2006 DFIRM

Figure G.5 reflects the effective mapped flood hazard zones for the Town of Nags Head, and Figure G.6 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the Town of Nags Head, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. According to this assessment, approximately 32 percent of recent development in the Town of Nags Head is located in or near the SFHA.

Table G.14 – Recent Development at Risk to Flood, Town of Nags Head

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
93	$20,035,500	32.3%	26.8%

Source: Parcel data retrieved November 2019; FEMA 2006 DFIRM

This assessment does not evaluate flood impacts or provide damage estimates. However, this summary of recent development in or near the floodplain provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

Table G.15 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector and flood event in the Town of Nags Head. Table G.16 provides counts and estimated damages for High Potential Loss Properties in the Town of Nags Head.

Table G.15 – Critical Facilities Exposed to Flooding, Town of Nags Head

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	1	$91,999
Commercial Facilities	154	$6,488,767
Communications	1	$2,395
Critical Manufacturing	3	$18,155
Emergency Services	2	$81,067
Food and Agriculture	1	$11,545

Sector	Number of Buildings at Risk	Estimated Damages
Government Facilities	3	$226,554
Healthcare and Public Health	1	$2,732
Transportation Systems	2	$36,763
All Categories	**168**	**$6,959,977**

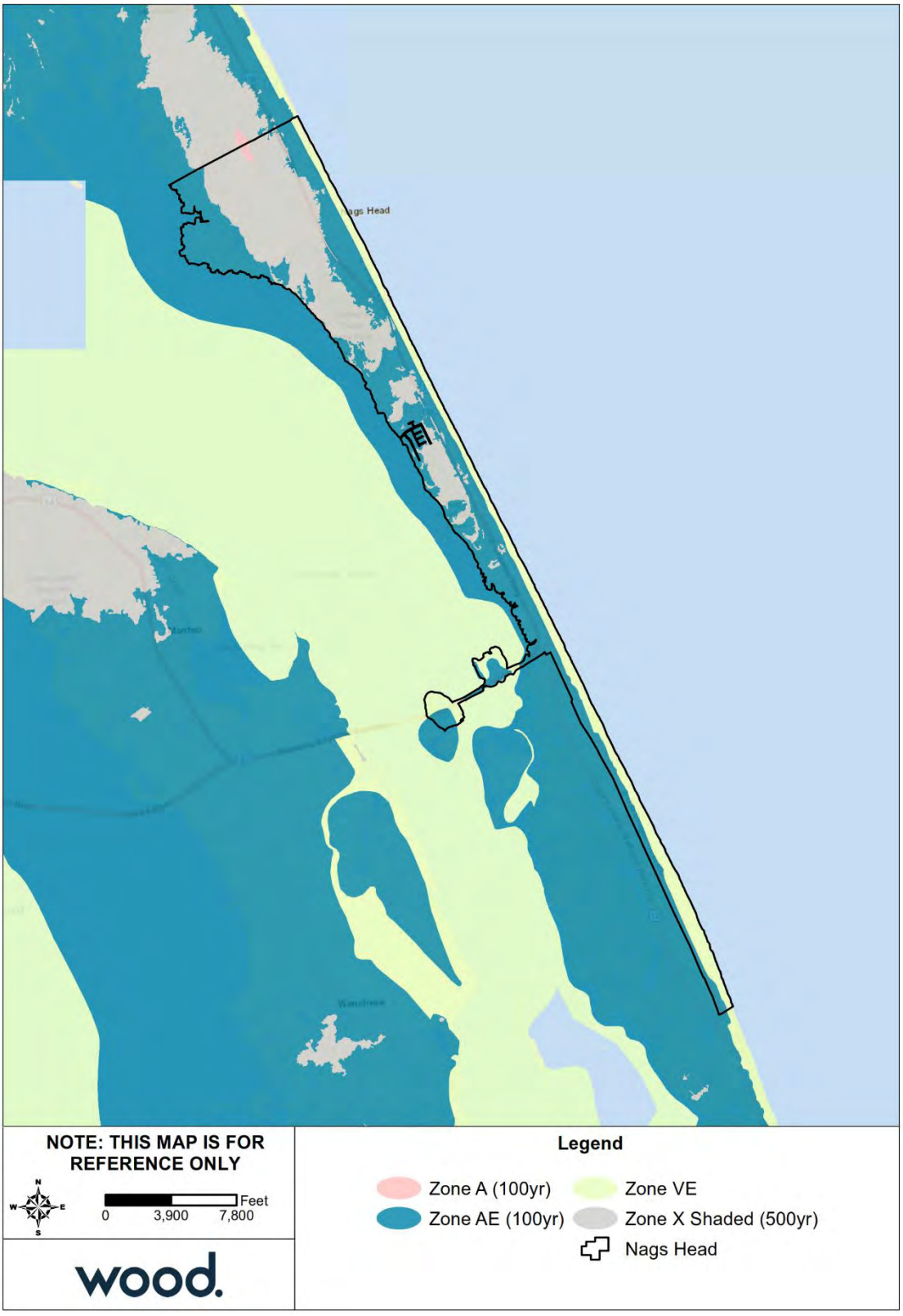
Source: NCEM Risk Management Tool

Table G.16 – High Potential Loss Properties Exposed to Flooding, Town of Nags Head

Category	Number of Buildings at Risk	Estimated Damages
Commercial	4	$1,023,466
Government	2	$415,712
Residential	9	$1,714,428
All Categories	**15**	**$3,153,606**

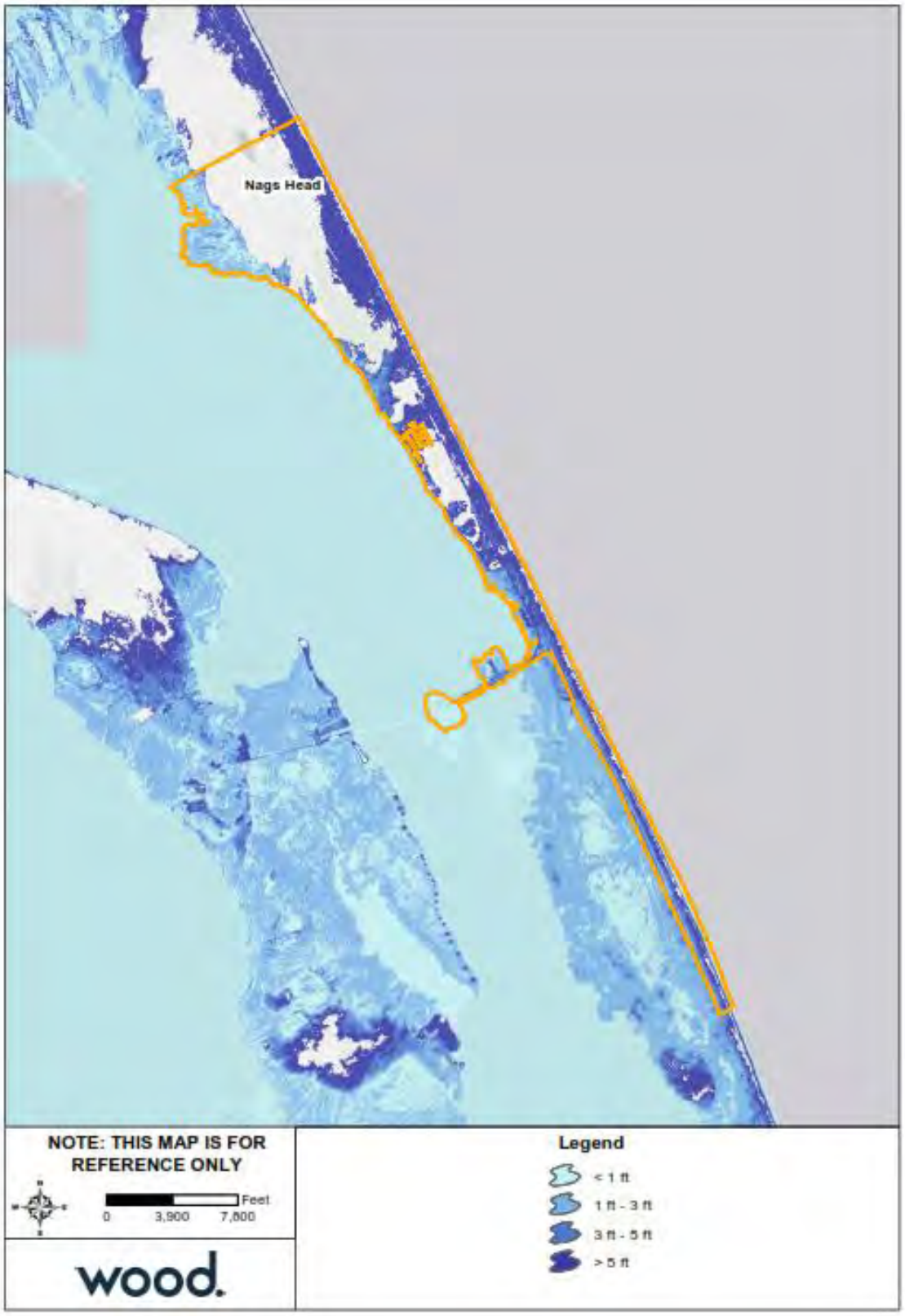
Source: NCEM Risk Management Tool

Figure G.5 – FEMA Flood Hazard Areas, Town of Nags Head



Source: FEMA Effective DFIRM

Figure G.6 – Flood Depth, 1%-Annual-Chance Floodplain, Town of Nags Head



Source: FEMA Effective DFIRM

The Town of Nags Head provided the following additional details on past flooding occurrences, which detail potential flood extent, areas exposed to flooding, and the cause of certain flood problems:

- **Hurricane Irene:** During Hurricane Irene, the town documented soundside flooding with flood heights reaching properties as high as seven feet above mean sea level. Many structures along the sound were damaged, and post-storm inspections revealed flood heights within structures between one and three feet. The average ground elevation in these same areas ranges between four and six feet above mean sea level.
- **Hurricane Matthew: I**n the northern portion of town, flooding associated with rainfall from Hurricane Matthew was documented up to 3.5 feet within structures. Rainfall measurements recorded range between 11.7 inches to 13.7 inches across the Town of Nags Head, most of which occurred during a six hour period. The affected area is currently in the AE flood zone with a BFE of 10 feet. The extent of the floodwater surface elevations were documented between 10.0' msl and 11.5' msl.
- **July 2017-August 2017 Rainfall Events:** During this period an exceptional amount of rainfall occurred, and the time interval can derived from the North Ridge Weather station located in the north section of the Town of Nags Head. For the period between July 2, 2017 and July 16, 2017, three separate significant rainfall events occurred; a 25-yr rainfall event, a 50-yr rainfall, and a 200-yr event. Cumulatively, when combined with other rainfall occurrences and extended over a 47-day time period, this equates to an approximate 200-yr recurrence interval. The rainfall amount during this period accounts for approximately one-half of the annual average rainfall for the town. These circumstances were similar to conditions experienced in the Fall of 2016 when approximately one-half of the annual average rainfall occurred over the course of a 45-day period. Again, flood depths ranged between one and three feet and approximately 300 homes were impacted.

The Town's HMPC representatives noted that the topography and development patterns in the Town result in vulnerability to flood damages from heavy rainfall events. The natural topography of the barrier island creates a low-lying "trough" between the maritime forest zone west of US 158 and the primary beach and foredunes in the vicinity of NC 12. In general, the maritime ridge serves as the breakpoint for overland surface runoff and subsurface groundwater flow between the Atlantic Ocean and the Roanoke Sound. A majority of the developed properties exist east of the maritime ridge and are concentrated in the lower lying areas between the beach and maritime forest zones. Runoff tends to accumulate in the lower elevations of developed areas, creating a bowl like effect which leads to localized flooding by way of elevated groundwater conditions, surface runoff, or a combination of the two.

Additionally, the Town noted an increase in chronic flooding resulting from an increase in occurrences of "extreme" rainfall events. The Town noted that the significant flood risk associated with heavy rainfall events is not accounted for in upcoming changes to the Town's FIRM.

It was also noted that the Town's stormwater drainage system is very limited and relies heavily on five ocean outfalls maintained by NCDOT. These outfalls are undersized for the Town's needs.

G.3.3 Wildfire

Table G.17 summarizes the acreage in the Town of Nags Head 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 50 percent of the Town of Nags Head is not included in the WUI.

Table G.17 – Wildland Urban Interface Acreage, Town of Nags Head

	Housing Density	Total Acreage	Percent of Total Acreage
	Not in WUI	*2,149.4*	*50.4%*
	LT 1hs/40ac	57.3	1.3%
	1hs/40ac to 1hs/20ac	19.8	0.5%
	1hs/20ac to 1hs/10ac	117.6	2.8%
	1hs/10ac to 1hs/5ac	252.9	5.9%
	1hs/5ac to 1hs/2ac	787.7	18.5%
	1hs/2ac to 3hs/1ac	782.3	18.4%
	GT 3hs/1ac	93.8	2.2%
	Total	**4,260.9**	

Source: Southern Wildfire Risk Assessment

Figure G.7 depicts the WUI for the Town of Nags Head. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure G.8 depicts the Fire Intensity Scale, which indicates the potential severity of fire based on fuel loads, topography, and other factors. Figure G.9 depicts Burn Probability based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Data is not available on past acreage burned at the jurisdictional level.

Potential fire intensity is highest in northern Nags Head and along the sound toward Cedar Island and Pond Island. Northern Nags Head and Cedar Island also contain low to moderate burn probability and coincide with areas in the WUI. Therefore, these are the areas of greatest wildfire risk in the Town.

Table G.18 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table G.19 summarizes the High Potential Loss Properties at risk to wildfire in Nags Head.

Table G.18 – Critical Facilities Exposed to Wildfire, Town of Nags Head

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	12	$3,774,798
Chemical	1	$78,007
Commercial Facilities	489	$321,595,298
Communications	2	$1,603,225
Critical Manufacturing	109	$60,728,311
Emergency Services	8	$14,558,656
Energy	4	$20,363,915
Food and Agriculture	223	$14,503,941
Government Facilities	75	$115,026,856
Healthcare and Public Health	26	$13,563,814
Nuclear Reactors, Materials and Waste	1	$327,280
Transportation Systems	107	$68,696,604
Water	11	$1,252,630
All Categories	**1,068**	**$636,073,335**

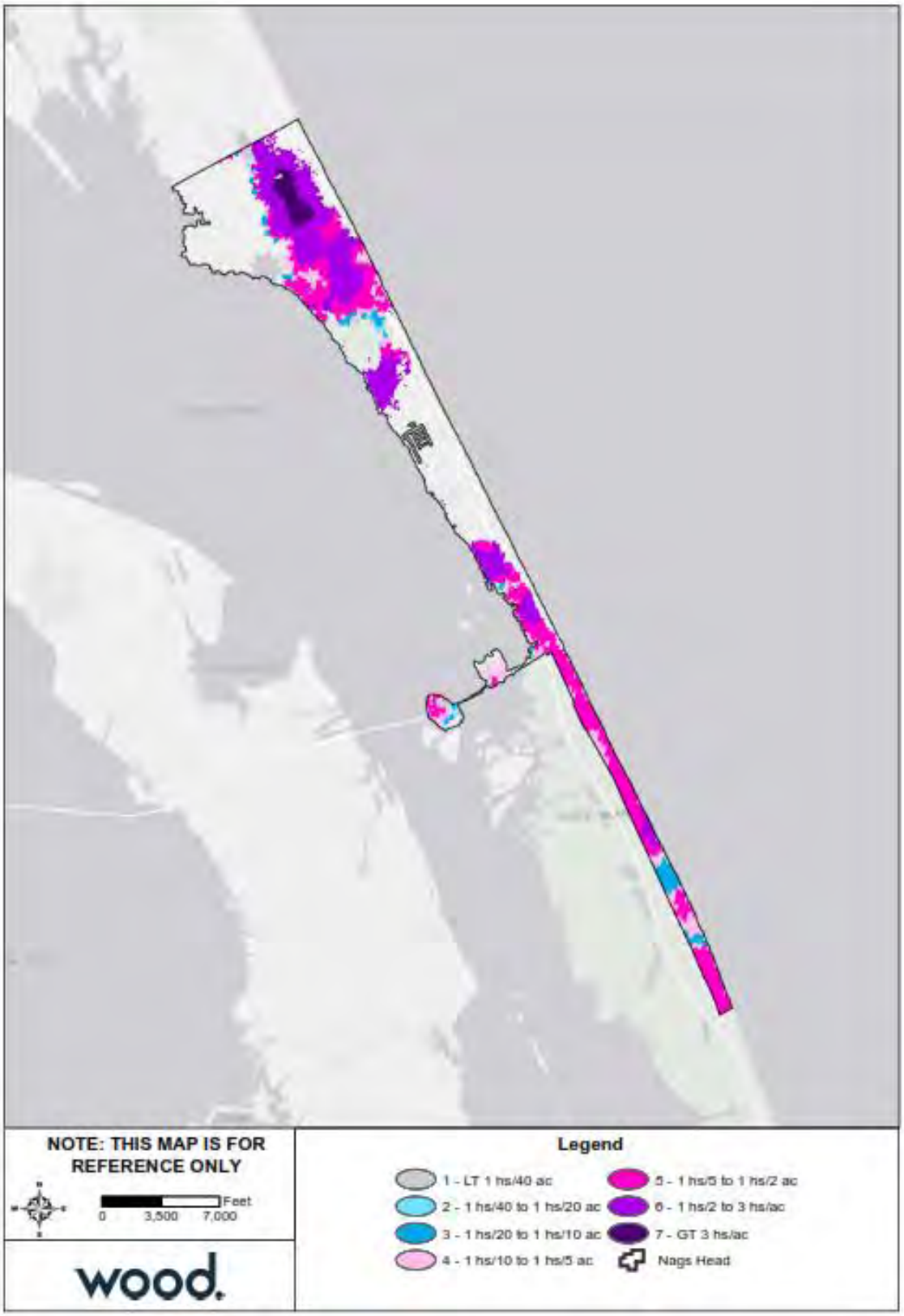
Source: NCEM Risk Management Tool

Table G.19 – High Potential Loss Properties Exposed to Wildfire, Town of Nags Head

Category	Number of Buildings at Risk	Estimated Damages
Commercial	8	$22,995,926
Government	4	$15,121,159
Religious	1	$1,905,421
Residential	10	$15,456,790
All Categories	**23**	**$55,479,296**

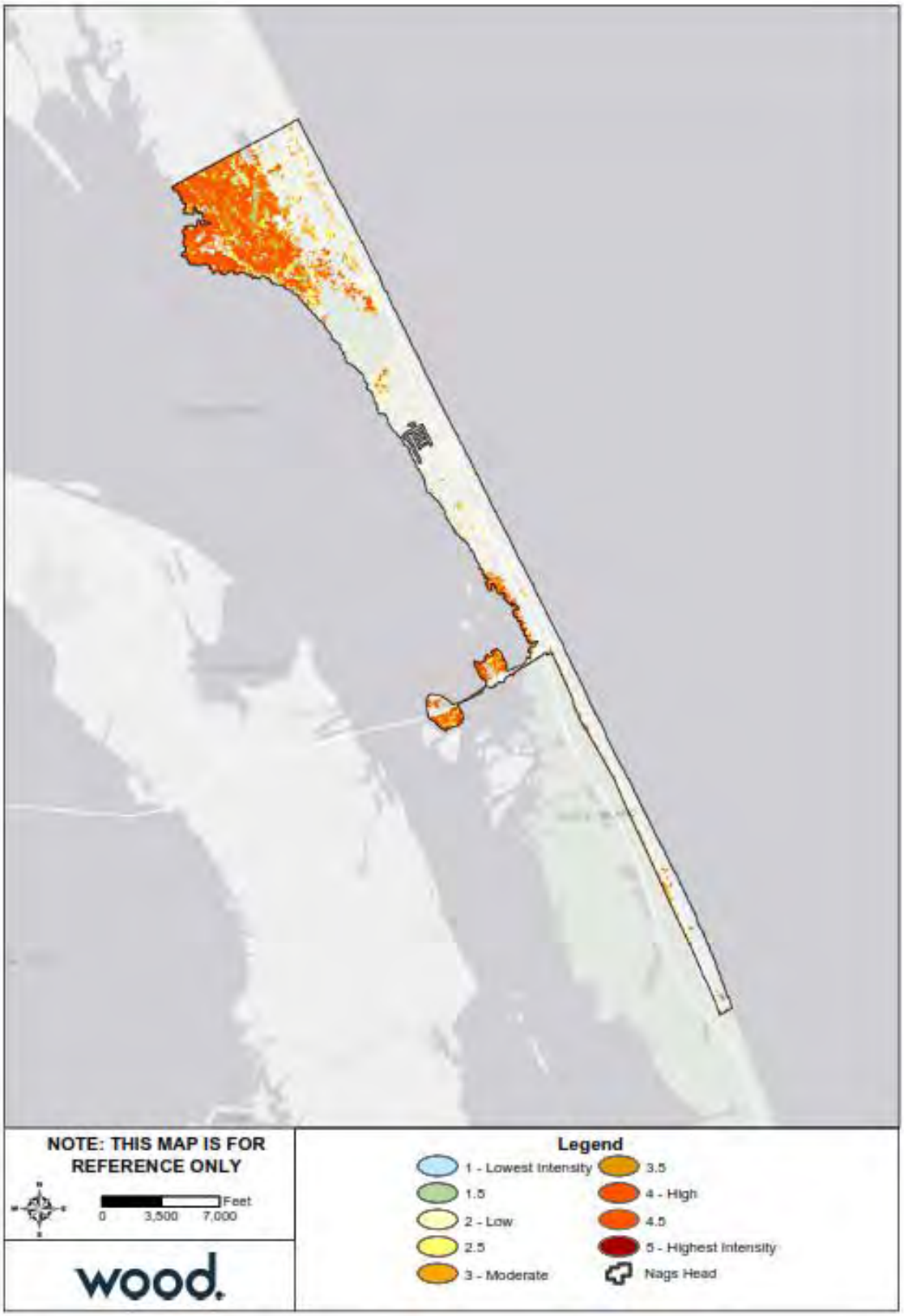
Source: NCEM Risk Management Tool

Figure G.7 – Wildland Urban Interface, Town of Nags Head



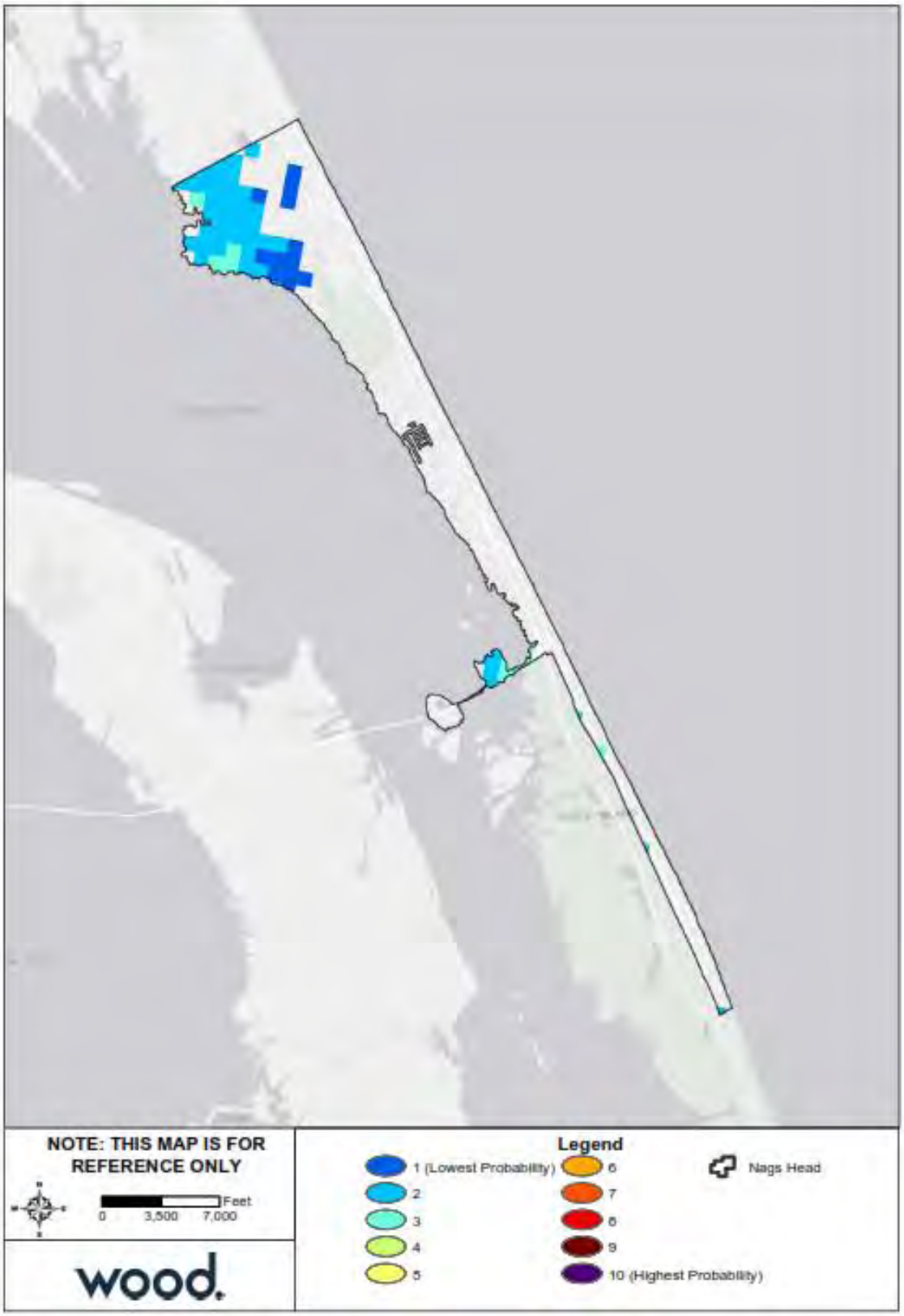
Source: Southern Wildfire Risk Assessment

Figure G.8 – Fire Intensity Scale, Town of Nags Head



Source: Southern Wildfire Risk Assessment

Figure G.9 – Burn Probability, Town of Nags Head



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 Nags Head were provided by the Town's HMPC representatives and are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Nags Head has an overall capability rating of High. The Town's Self-Assessment of key capability areas is summarized in Table G.20 below.

Table G.20 – Capability Self-Assessment, Nags Head

Capability Area	Rating
Plans, Ordinances, Codes and Programs	High
Administrative and Technical Capability	High
Fiscal Capability	High
Education and Outreach Capability	High
Mitigation Capability	High
Political Capability	High
Overall Capability	High

G.4.2 Floodplain Management

The Town of Nags Head has been a regular participant since November 1972. 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.21 – 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	2,846	$2,387,413	$785,820,100	1,749	$19,508,635.00
2-4 Family	110	$187,025	$27,426,200	132	$2,589,360.63
All Other Residential	263	$119,362	$56,685,100	35	$2,262,457.35
Non Residential	240	$564,804	$106,577,900	223	$9,014,985.51
Total	**3,459**	**$3,258,604**	**$976,509,300**	**2,139**	**$33,375,438.49**

Source: FEMA Community Information System, accessed December 2019

Table G.22 – NFIP Policy and Claims Data by Flood Zone

Flood Zone	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	2,686	$1,796,773	$752,735,200	1,018	$12,896,866.78
A Zones	0	$0	$0	3	$34,599.18
V01-30 & VE Zones	196	$870,018	$50,056,300	490	$9,899,979.57
B, C & X Zone					
Standard	353	$455,400	$94,184,800	592	$10,105,701.82
Preferred	224	$136,413	$79,533,000	36	$438,291.14
Total	**3,459**	**$3,258,604**	**$976,509,300**	**2,139**	**$33,375,438.49**

Source: FEMA Community Information System, accessed December 2019

Table G.23 – 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	322	$463,776	$70,104,200	374	$7,280,477.80
A Zones	0	$0	$0	3	$34,599.18
V01-30 & VE Zones	61	$272,765	$13,926,900	220	$6,101,646.81
B, C & X Zone	72	$110,123	$23,415,400	276	$5,638,169.67
Standard	61	$103,256	$20,205,400	272	$5,579,070.61
Preferred	11	$6,867	$3,210,000	4	$59,099.06
Total	**455**	**$846,664**	**$107,446,500**	**873**	**$19,054,893.46**

Source: FEMA Community Information System, accessed December 2019

Table G.24 – 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	2,364	$1,332,997	$682,631,000	644	$5,616,388.98
A Zones	0	$0	$0	0	$0.00
V01-30 & VE Zones	135	$597,253	$36,129,400	263	$3,781,298.54
B, C & X Zone	505	$481,690	$150,302,400	352	$4,905,823.29
Standard	292	$352,144	$73,979,400	320	$4,526,631.21
Preferred	213	$129,546	$76,323,000	32	$379,192.08
Total	**3,004**	**$2,411,940**	**$869,062,800**	**1,259**	**$14,303,510.81**

Source: FEMA Community Information System, accessed December 2019

G.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
NGH1	Petition FEMA through the Town's state and regional NFIP representatives to consider adopting realistic regulations regarding the determination of destroyed structures. Specifically, this would apply to structures which are located on the public beach that are not eligible for flood insurance until they collapse.	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	3.1	Low	Planning, Town Manager	General Fund	5+ years	Carry Forward	There has been no action on this item at this time.
NGH2	Explore seeking authority and adopting regulations which would allow qualified Town staff to inspect sewer treatment facilities and on-site septic systems after a storm. These regulations should also allow staff to request the corrective actions necessary to ensure proper operation of these systems.	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	2.2	Low	Planning, Town Manager	General Fund	5+ years	Carry Forward	A legal authority memo was produced in conjunction with the University of Georgia and NC Sea Grant to explore the town's legal authority to regulate beyond state standards.
NGH3	Lobby for a state policy and strategy on beach nourishment and beach re-nourishment through joint efforts with other local governments and organization. This includes an annually funded state program to support local nourishment activities.	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	4.1	High	Board of Commissioners	General Fund	3-5 years	Carry Forward	Revised. No action taken as of this date.
NGH4	Develop a long-term plan for shoreline management which includes the oceanfront and estuarine shoreline. This may include financing, permitting, ongoing project implementation (in coordination with Dare County and other Dare County municipalities), and monitoring of changing shoreline conditions.	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	4.1	High	Town Engineer	General Fund, Dare County Shoreline Fund	3-5 years	Carry Forward	Revised. The Town has not yet started a long term beach nourishment strategy. The Town is conducting nourishment in 5-7 year cycles.
NGH5	Develop contingency plans for infrastructure or services that may be lost as a result of exposure to hazards. Potential infrastructure includes roads/streets, waterlines, wastewater, stormwater, and other key utilities.	All Hazards	2.2	Medium	Planning, Town Engineer, Public Works	General Fund/Stormwater	5+	Carry Forward	Revised. The Town has identified alternative means of access to several properties along the ocean front where property owners agreed to work cooperatively. The Town modified development regulations to assist with providing access to properties where a Town road has been damaged or lost.
NGH6	Evaluate the Nags Head Woods Fire Plan annually and coordinate information with Nature Conservancy staff and seek grant funding for fuel reduction activities.	Wildfire	3.3	Medium	Town Manager, Fire, Police	General Fund, Grant Funds	1 year	Carry Forward	Staff discusses and reviews the Nags Head Woods Fire Plan annually for update and to discuss areas for fuel reduction. Staff seeks grant opportunities as needed.
NGH7	Plan and participate with partners to evaluate the need and maintenance of wild land urban interface areas including removal of dead wood in critically fire prone areas and controlled burn activities.	Wildfire	1.2	Medium	Public Safety – Fire/Nature Conservancy/NPS	General Fund, Grant Funds	1 year	New	
NGH8	Explore the feasibility of becoming a Firewise Community.	Wildfire	3.3	Medium	Fire	General Fund	2-3 years	New	
NGH9	Purchase and install weather stations to track rainfall and weather in the Town that will be helpful in identifying changing weather patterns and future stormwater planning and modeling needs. Explore partnerships with agencies where this weather information would be relevant (i.e. NC Climate Center).	Coastal Hazards, Drought, Flood, Hurricane and Tropical Storm, Severe Weather	3.3	High	Planning, Town Engineer	General Fund, Grant Funds	2-3 years	New	
NGH10	Work with Dare County to expand Town representation on the Local Emergency Planning Committee.	All Hazards	4.2	Low	Fire	General Fund	1 year	New	
NGH11	Acquire equipment and materials and retrofit critical facilities to ensure critical facilities and infrastructure remain operational during events.	All Hazards	2.1	High	Town Manager, Fire, Police, Public Works, Planning,	General Fund	3-5 years	New	

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Property Protection									
NGH12	Purchase property, utilizing grants when possible, to acquire property for the purpose of mitigating damage and co-locating (dual use) Town facilities.	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	1.2	High	Planning, Town Engineer, Town Manager	General Fund/Grants	2-3 years	Carry Forward	Staff seeks any viable opportunity, on a case by case as needed basis, for funds to acquire properties for the purposed of mitigating damage, improvement water quality, preserving open space, protecting natural resources, and co-locating Town facilities.
NGH13	Identify and evaluate solutions to mitigate areas of repetitive flooding.	Coastal Hazards, Flood, Hurricane and Tropical Storm	1.2	High	Planning, Town Engineer, Public Works	General Fund/Stormwater	1 year	Carry Forward	The master planning process is identifying CIP projects designed to alleviate chronic flooding issues. Several areas for repetitive flooding have already been addressed.
NGH14	Pursue the installation of flood gauges, through partnership with Dare County and the State, that will notify citizens and Town officials of changing water levels.	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	1.1	High	Planning, Town Engineer, Town Manager	General Fund/Grants	1 year	New	
NGH15	Support public and private mitigation projects that reduce the potential damaging effects of hazards on the town. Homes that are pre-firm and repetitive loss structures should be prioritized.	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	1.2	High	Planning, Town Engineer, Town Manager	General Fund/Grants	1 year	New	
Natural Resource Protection									
NGH16	Seek methods to remove structures located on the public beach which degrade the recreational and natural quality of the environment, create public health and safety hazards, and impede the ability of life safety personnel to move along the shoreline.	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	3.2	High	Town Manager, Planning, Town Engineer	General Fund	5+ years	Carry Forward	The Town has been working with property owners on a case by case basis to remove structures from the public beach. This approach is a slow and incremental process, but there have been several successful removals.
NGH17	The town will identify, acquire, and seek grant funding of property for the purposes of open space, improving water quality, protecting natural resources, and recreational purposes.	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	1.2	High	Town Manager, Planning, Town Engineer	General Fund, Grant Funds	2-3 years	Carry Forward	Revised. The Town will continue to identify and acquire properties for open space as opportunities become available. There have been several properties acquired for open space and stormwater.
NGH18	Consider incentives rewarding developers, property owners, and builders that set aside additional open space in perpetuity.	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	3.3	Low	Planning	General Fund	3-5 years	Carry Forward	Revised. No action taken as of this date.
Structural Projects									
NGH19	Nourish the Town's beaches as a means to mitigate damage to oceanfront properties and infrastructure. This includes the pursuit of potential funding sources to supplement Town funds and programmatic permitting to assist with future nourishment projects.	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	3.2	High	Town Manager, Town Engineer	Dare County Shoreline Fund, Town Municipal Service Districts	3-5 years	Carry Forward	The Town has just completed a second successful nourishment project.
NGH20	Investigate innovative solutions to unconventional drainage problems. This may include the implementation of groundwater management techniques and low impact development practices which address stormwater runoff at or near its source. Possible solutions will consider improvements to address both water quality and water quantity. Continue to evaluate and assess existing infrastructure for replacement and improvement to include drainage systems maintained by NCDOT that may be impacted by other Town initiatives (i.e. beach nourishment).	Coastal Hazards, Flood, Hurricane and Tropical Storm, Severe Weather	3.3	High	Town Engineer, Public Works, Planning	General Fund/Stormwater	1 year	Carry Forward	Revised. The Town continues to implement innovative projects. Since the completion of Vista Colony, a similar project has been completed in Nags Head Acres. Other areas of the Town are in consideration.
NGH21	Improve fire protection and access in Nags Head Woods with the installation of 'dry hydrants' and maintenance and improvements to Nags Head Woods Road.	Wildfire	3.3	Medium	Fire, Public Works	General Fund, Water Fund	3-5 years	Carry Forward	The Nags Head Woods road is maintained by Nags Head Public Works and roadway material is added as needed to maintain an acceptable driving surface.

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Emergency Services									
NGH22	Adhere to the Incident Command Structure to maintain and improve emergency operations and communications. This includes the annual update of the critical facilities list in the Emergency Operations Plan (EOP) and purchase of additional emergency operations communication equipment.	All Hazards	2.2	Medium	Fire, Police, Town Manager	General Fund	5+ years	NEW	
Public Education & Awareness									
NGH23	Continue to educate property owners to maintain fire safe landscaping and vegetation adjacent to structures.	Wildfire	1.1	Low	Fire	General Fund	5+ years	Carry Forward	This is accomplished on a case by case basis as needed. In addition, during fuel reduction burns staff meets with the community to explain the need for reduction of fuel loads.
NGH24	Develop outreach materials to educate the public and increase awareness on hazards, how to develop and retrofit their properties against hazards, and individual tasks that can help them better prepare and respond to hazards. Staff should explore alternative options to traditional on-site meetings. This may include increased use of social media, the public access channel and short videos and handouts.	All Hazards	1.1	High	Planning, Town Manager, Town Engineer, Fire/Ocean Rescue	General Fund	2-3 years	Carry Forward	The Town has utilized social media, videos, the website, and mailed information to inform residents about the new flood maps, flooding, stormwater, hurricane preparedness, and other coastal hazards.
NGH25	Educate and assist vulnerable populations in preparing for and recovering from impacts by hazards. This may include hazard awareness, evacuation planning, or disaster relief.	All Hazards	1.1	Low	Fire/Ocean Rescue, Police, Planning, Town Manager	General Fund	3-5 years	New	

Annex H Town of Southern Shores

H.1 PLANNING PROCESS

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

Table H.1 – HMPC Members

Representative	Agency/Department	Position or Title
Wes Haskett	Planning & Code Enforcement	Planning Director / Deputy Town Manager
Dabni Shelton	Planning & Code Enforcement	Permit Officer
Andy Ward	Citizen	Planning Board member, 30+ year resident, licensed general contractor familiar with oceanfront development/flood requirements.

H.2 COMMUNITY PROFILE

Geography

The Town of Southern Shores is a barrier island community located in northern Dare County. It is neighbored by Duck to the north and Kitty Hawk to the south. Southern Shores comprises a total land area of 6.2 square miles.

According to data from the U.S. Fish and Wildlife Service's National Wetlands Inventory, there are approximately 39 acres of wetlands in Southern Shores, primarily forested/shrub wetland.

Figure H.1 shows a base map of the Town of Southern Shores.

Figure H.1 – Location Map, Town of Southern Shores



Source: U.S. Census Bureau

Population and Demographics

Table H.2 provides population counts and growth estimates for the Town of Southern Shores as compared to the Region. Table H.3 provides demographic information for Southern Shores as compared to the Region.

Table H.2 – Population Counts, Southern Shores, 2010-2017

Jurisdiction	2000 Census Population	2010 Census Population	2017 ACS Population Estimate	Total Change 2010-2017	% Change 2010-2017
Region Total	**48,157**	**57,467**	**60,659**	**3,192**	**5.55%**
Town of Southern Shores	2,201	2,714	2,829	115	4.24%

Source: US Census Bureau Decennial Census 2000, Decennial Census 2010; American Community Survey 2013-2017 5-Year Estimates

Table H.3 – Racial Demographics, Southern Shores, 2017

Jurisdiction	White, %	Black, %	Asian, %	Other Race, %	Two or More Races, %	Persons of Hispanic or Latino Origin*, %
Region Total	**91.0**	**3.5**	**0.5**	**2.2**	**2.7**	**5.7**
Town of Southern Shores	93.6	0.0	0.0	2.6	3.9	1.6

Source: US Census Bureau, American Community Survey 2013-2017 5-Year Estimates
*Persons of Hispanic origin may be of any race, so also are included in applicable race categories

Asset Inventory

The following tables summarize the Critical Infrastructure and Key Resources (CIKR) and high potential loss facilities identified in IRISK for the Town of Southern Shores. Critical facilities, which include a subset of identified assets form the CIKR dataset as well as facilities identified by the HMPC, are shown in Figure H.2 on the following page and summarized in Table H.6. The County provided information is not included in IRISK vulnerability assessments. Note that the IRISK counts are by building; where a critical facility identified by IRISK comprises a cluster of buildings, each building is counted and displayed.

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

Jurisdiction	Food and Agriculture	Banking and Finance	Chemical & Hazardous	Commercial	Communications	Critical Manufacturing	EM	Healthcare	Government Facilities	Nuclear Reactors, Materials and Waste	Postal and Shipping	Transportation Systems	Energy	Emergency Services	Water	Total
Town of Southern Shores	0	6	0	57	3	39	0	6	3	0	0	21	0	9	3	**147**

Source: NCEM Risk Management Tool

Table H.5 – High Potential Loss Facilities by Use

Jurisdiction	Residential	Commercial	Industrial	Government	Agricultural	Religious	Utilities	Total
Town of Southern Shores	30	9	0	3	0	3	0	**45**

Source: NCEM Risk Management Tool

Figure H.2 – Critical Facilities, Town of Southern Shores



Source: NCEM IRISK Database, HMPC input, GIS Analysis

Table H.6 – Critical Facilities List, Town of Southern Shores

Facility Type	Count
Civic	4
Communications	2
Fire Station	2
Government	1
Police Station	1
School	1
Treatment Plant	1
Utility	2
Total	**14**

Source: NCEM IRISK Database, HMPC input, GIS Analysis

To supplement the asset inventory and provide a clearer picture of the current asset exposure in the Town of Southern Shores, current parcel data was evaluated to identify recent development not included in NCEM's IRISK database. Based on this assessment, property exposure in Southern Shores has increased by 7 percent since IRISK data was compiled.

Table H.7 – Recent Development Not Included in IRISK

Recent Improved Parcels		IRISK Buildings		Percent Change	
Count	Value	Count	Value	Building Count	Building Value
167	$47,677,000	2,496	$685,384,316	6.7%	7.0%

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

Note: This information is not incorporated into the risk assessment, which was prepared using IRISK. However, this summary of recent development provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

There are no listings on the National Register of Historic Places for the Town of Southern Shores.

Housing

The table below details key housing statistics for Southern Shores as compared to the Region overall.

Table H.8 – Housing Statistics, Southern Shores, 2010-2017

Jurisdiction	Housing Units (2010)	Housing Units (2017)	Housing Units Percent Change (2010-2017)	Owner-Occupied, % (2017)	Vacant Units, % (2017)	Median Home Value (2017)
Region Total	**47,945**	**49,616**	**3.5%**	**74.5**	**49.6**	**$285,000**
Town of Southern Shores	2,369	2,374	0.2%	93.0	50.3	$446,500

Source: U.S. Census Bureau 2010 Decennial Census, American Community Survey 2013-2017 5-Year Estimates
Note: Owner-Occupied and vacant-unit measures are reported as a percent of the total number of housing units.

Economy

The following tables present key economic statistics for Southern Shores as compared to the Region.

Table H.9 – Employment Statistics, Southern Shores, 2017

Jurisdiction	Population in Labor Force	Percent Employed* (%)	Percent Unemployed* (%)	Percent Not in Labor Force* (%)	Unemployment Rate (%)
Region Total	32,463	61.7	3.3	34.4	5.0
Southern Shores	1,365	54.3	1.0	44.3	1.9

Source: U.S. Census Bureau, American Community Survey 2013-2017 5-Year Estimates
Note: This table reports only the civilian labor force. The labor force in armed services accounted for 0.6% of the population 16 and over across the region. *Population employed, population unemployed, and Population not in labor force are reported as a percent of the total population aged 16 years and older.

Table H.10 – Percent of Employed Population by Occupation, Southern Shores, 2017

Occupation	Management, business, science and arts (%)	Service (%)	Sales and Office (%)	Natural Resources, Construction, and Maintenance (%)	Production, transportation, and material moving (%)
Region Total	30.6	18.7	27.8	14.0	8.9
Southern Shores	40.8	18.1	33.1	4.8	3.2

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

Land Use and Future Development

The Town of Southern Shores Planning and Code Enforcement Department is responsible for land-use planning for the Town. Information for this section came from the Town of Southern Shores 2012 CAMA Land Use Plan Update.

Current Land Use

Since the Town has island geography and narrow strips of land, much of the development is located around the main transportation corridors. The Town is currently divided into six land use categories. These categories are shown below with their total acreage in Table H.11. Percentages are rounded to the nearest whole number.

Table H.11 – Land Use, Town of Southern Shores

Land Use	Total Acres	Percent of County (%)
Residential	1,593	73
Commercial	56	3
Municipal	3	1
Recreational	322	13
Educational	14	1
Total Developed	*1,988*	*91*
Conservation	187	9
Total	**2,175**	**100**

Source: Town of Southern Shores 2012 CAMA Land Use Plan Update

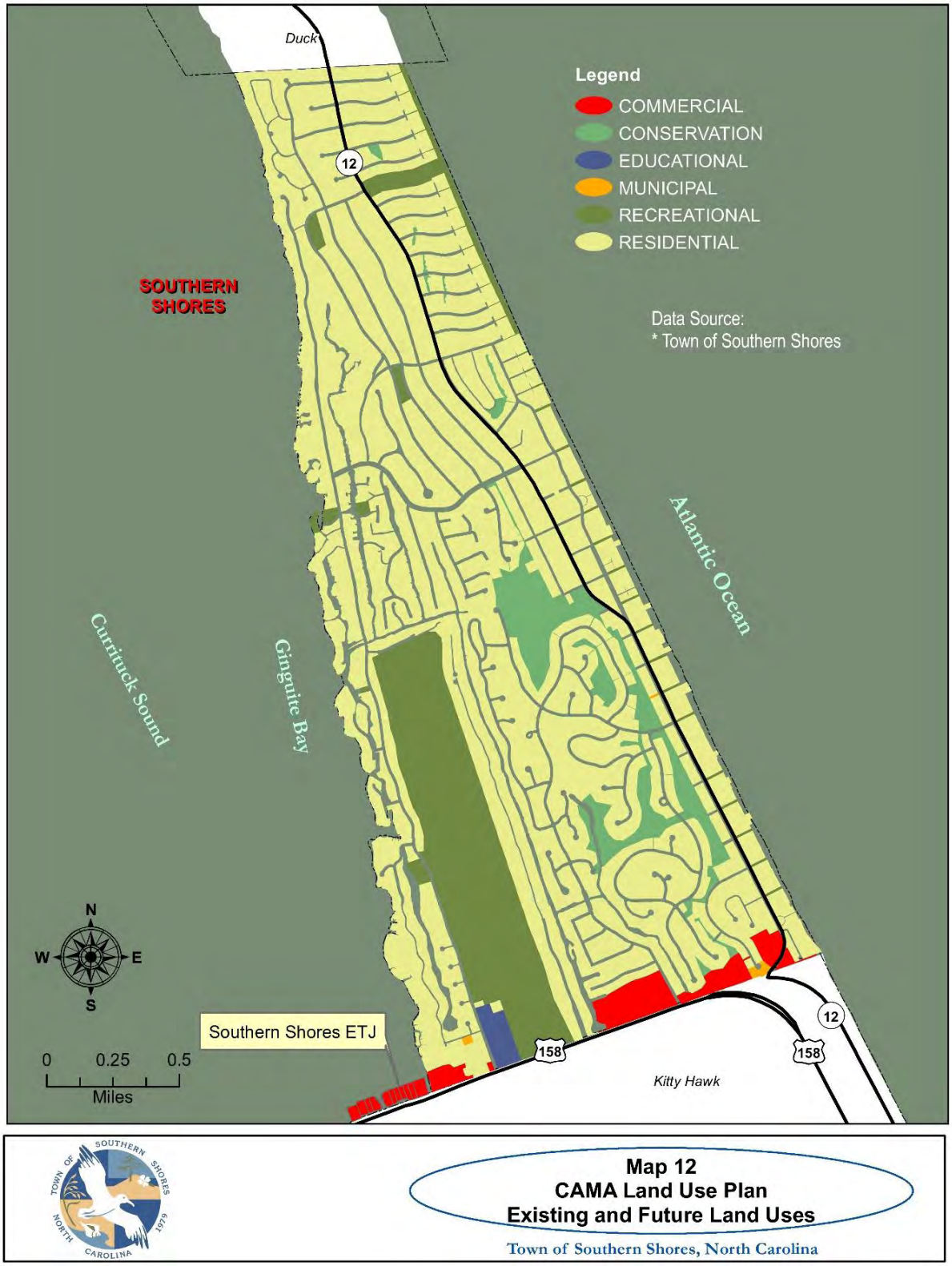
Most of the Town is developed (91%) with most of the land falling under the residential category (73%).

Future Development

There are some land use conflicts caused by flood hazards, water quality, and soil septic limitations. However, these conflicts should not cause major issues. Development will continue at the current rate for the coming years. It is expected that many parcels will be re-developed. There is no room to expand the Town because of its geographic location (between the Atlantic Ocean, Currituck Sound, and the Towns of Kitty Hawk and Duck). There is not one area that will see the majority of development. Residents expressed a strong preference for keeping things somewhat the same as current development. Future development within the Town will use the same six classifications.

Figure H.3 on the following page shows the future land use of the Town of Southern Shores as envisioned in the 2012 CAMA Land Use Plan Update.

Figure H.3 – Town of Southern Shores Future Land Use Map



Source: Town of Southern Shores 2012 CAMA Land Use Plan Update

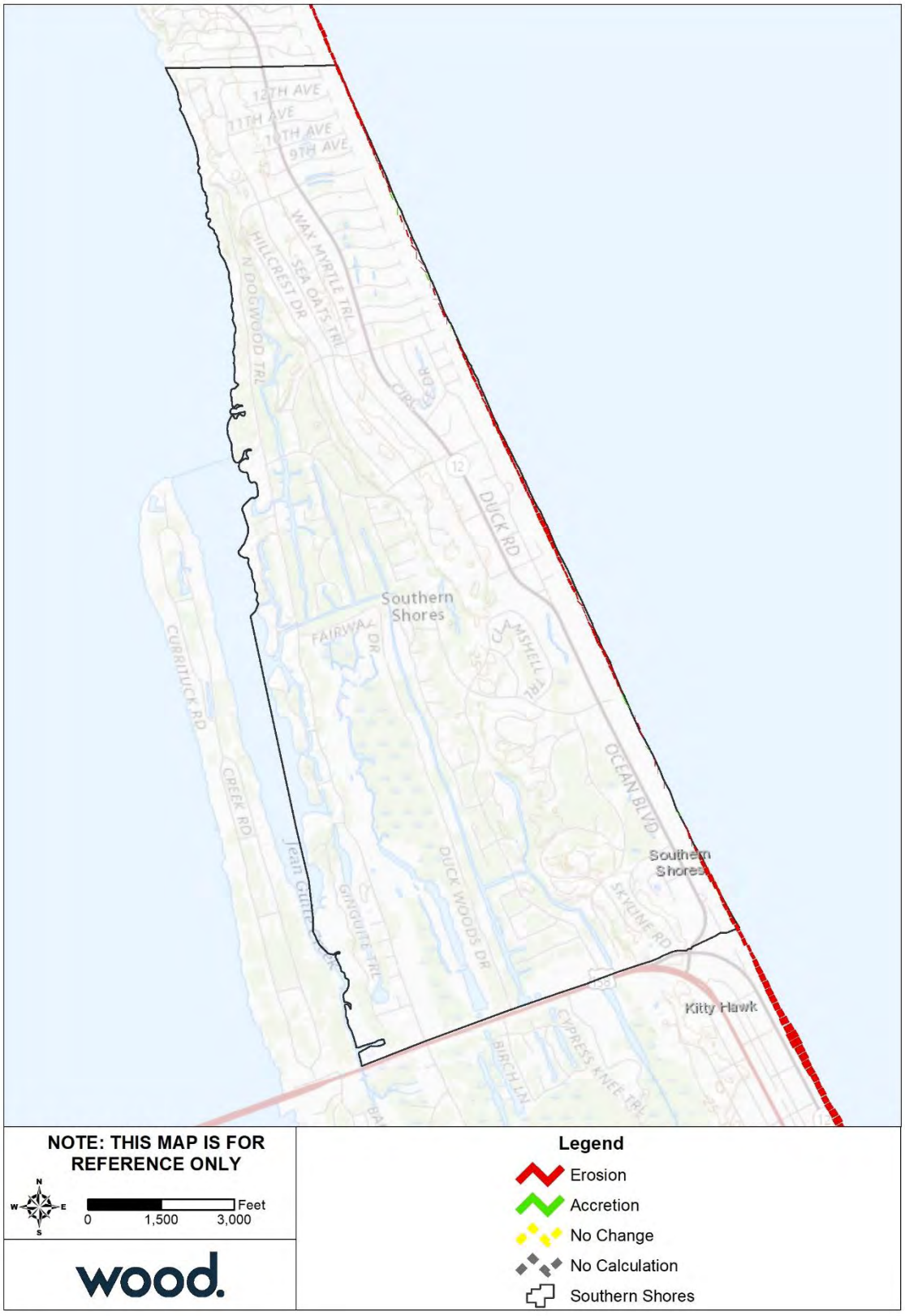
H.3 RISK ASSESSMENT

This section contains a hazard profile and vulnerability assessment for those hazards that were rated with a higher priority for the Town of Southern Shores than for the Region as a whole. Risk and vulnerability findings are also presented here for those hazards that are spatially defined and have variations in risk that could be evaluated quantitatively on a jurisdictional level. The hazards included in this section are: Flood and Wildfire.

H.3.1 Coastal Hazards

Figure H.4 on the following page shows coastal erosion rates along the Town of Southern Shores oceanfront coastline according to data from the DCM 2019 Long-Term Average Annual Erosion Rate Update Study.

Figure H.4 – Erosion Rates, Town of Southern Shores



Source: North Carolina Division of Coastal Management

H.3.2 Flood

Table H.12 details the acreage of the Town of Southern Shores by flood zone on the effective DFIRM. Per this assessment, over 51 percent of the Southern Shores falls within the mapped 1%-annual-chance floodplains and the remainder is within the 0.2 percent annual chance floodplain.

Table H.12 – FEMA Flood Hazard Areas, Town of Southern Shores

Flood Zone	Acreage	Percent of Total (%)
Zone AE	1,166.48	44.3%
Zone VE	182.80	6.9%
Zone X (500YR)	1,286.76	48.8%
Total	**2,636.04**	--

Source: FEMA 2006 DFIRM

Figure H.5 reflects the effective mapped flood hazard zones for the Town of Southern Shores, and Figure H.6 displays the depth of flooding estimated to occur in these areas during the 1%-annual-chance flood.

To supplement the IRISK assessment of property at risk from the 1% annual chance flood event in Section 4 and provide a clearer picture of the current property at risk in the Town of Southern Shores, recent development not included in IRISK was analyzed using GIS to determine additional exposure to flood risk. Improved parcels in contact with the SFHA were considered at risk to the 1 percent annual chance flood. The count and total value of these parcels are summarized below. Note that this assessment does not account for the degree of exposure, so the result is a maximum exposure estimate for the modeled 1 percent annual chance flood. According to this assessment, approximately 41 percent of recent development in the Town of Southern Shores is located in or near the SFHA.

Table H.13 – Recent Development at Risk to Flood, Town of Southern Shores

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
70	$17,113,500	41.9%	35.9%

Source: Parcel data retrieved November 2019; FEMA 2006 DFIRM

This assessment does not evaluate flood impacts or provide damage estimates. However, this summary of recent development in or near the floodplain provides some context to understand the degree to which the IRISK exposure and vulnerability numbers differ from current conditions.

Table H.14 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector and flood event in the Town of Nags Head. Table H.15 provides counts and estimated damages for High Potential Loss Properties in the Town of Nags Head.

Table H.14 – Critical Facilities Exposed to Flooding, Town of Southern Shores

Sector	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	3	$67,094
Transportation Systems	3	$13,307
All Categories	**6**	**$80,401**

Source: NCEM Risk Management Tool

Table H.15 – High Potential Loss Properties Exposed to Flooding, Town of Southern Shores

Category	Number of Buildings at Risk	Estimated Damages
Residential	2	$148,585
All Categories	**2**	**$148,585**

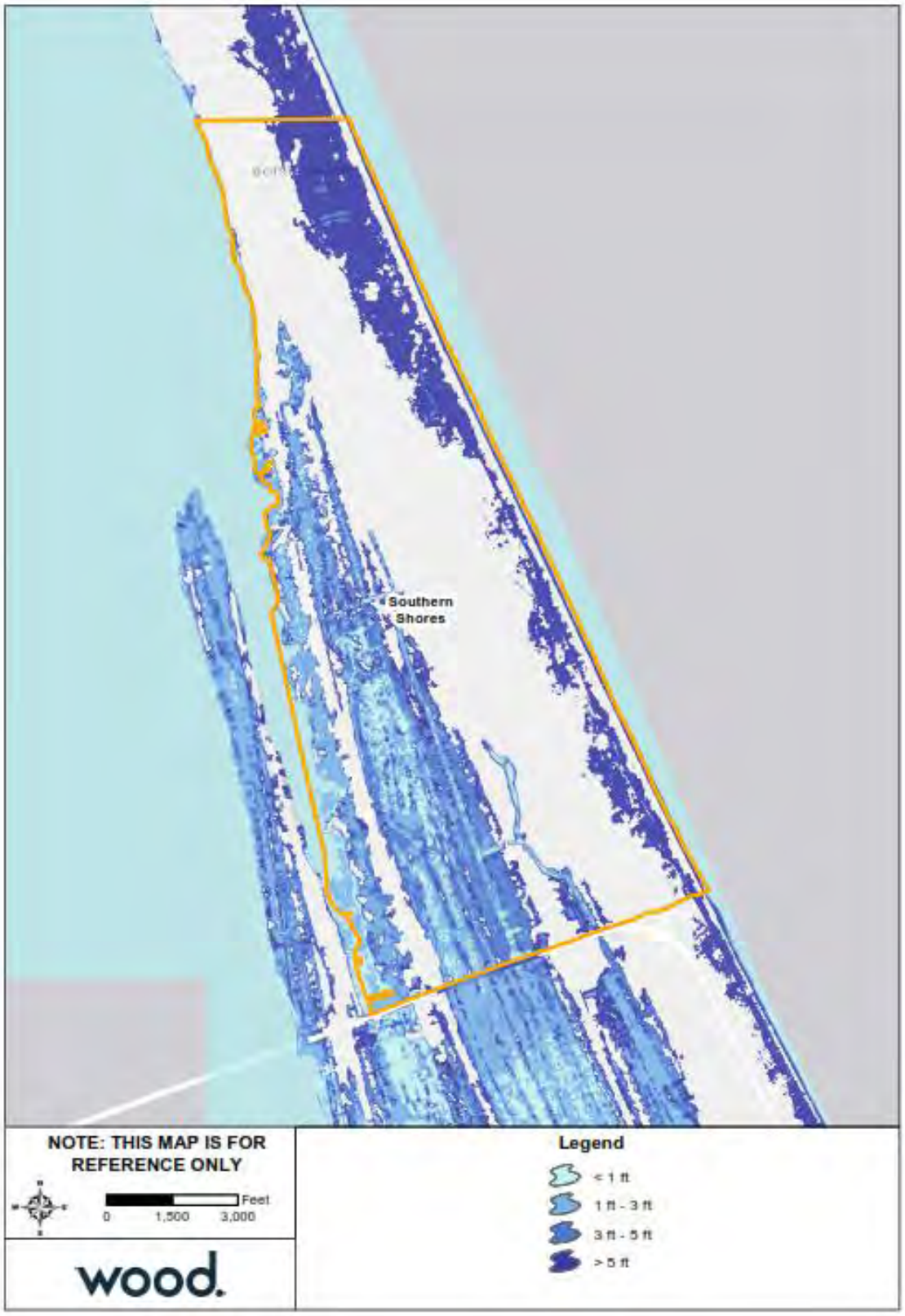
Source: NCEM Risk Management Tool

Figure H.5 – FEMA Flood Hazard Areas, Town of Southern Shores



Source: FEMA Effective DFIRM

Figure H.6 – Flood Depth, 1%-Annual-Chance Floodplain, Town of Southern Shores



Source: FEMA Effective DFIRM

H.3.3 Wildfire

Table H.16 summarizes the acreage in the Town of Southern Shores 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 11 percent of the Town of Southern Shores is not included in the WUI.

Table H.16 – Wildland Urban Interface Acreage, Town of Southern Shores

	Housing Density	Total Acreage	Percent of Total Acreage
	Not in WUI	*299.7*	*11.3%*
	LT 1hs/40ac	12.0	0.5%
	1hs/40ac to 1hs/20ac	6.4	0.2%
	1hs/20ac to 1hs/10ac	34.6	1.3%
	1hs/10ac to 1hs/5ac	104.6	3.9%
	1hs/5ac to 1hs/2ac	345.2	13.0%
	1hs/2ac to 3hs/1ac	1,844.0	69.4%
	GT 3hs/1ac	10.5	0.4%
	Total	**2,657.1**	

Source: Southern Wildfire Risk Assessment

Figure H.7 depicts the WUI for the Town of Southern Shores. The WUI is the area where housing development is built near or among areas of vegetation that may be prone to wildfire. Figure H.8 depicts the Fire Intensity Scale, which indicates the potential severity of fire based on fuel loads, topography, and other factors. Figure H.9 depicts Burn Probability based on landscape conditions, percentile weather, historical ignition patterns, and historical prevention and suppression efforts. Data is not available on past acreage burned at the jurisdictional level.

Most of Southern Shores falls within the WUI, but there is minimal burnable land in the Town. There are areas of moderate to high potential fire intensity throughout the Town. The only significant cluster of higher potential fire intensity, burn probability, and WUI occurs in the southwestern portion of the Town along Jean Guite Creek.

Table H.17 provides building counts and estimated damages for Critical Infrastructure and Key Resources (CIKR) buildings by sector at risk to wildfire hazard. Table H.18 summarizes High Potential Loss Properties that are at risk to wildfire in Southern Shores.

Table H.17 – Critical Facilities Exposed to Wildfire, Town of Southern Shores

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	1,118	$1,277,474,451
Chemical	42	$358,071,323
Commercial Facilities	51,659	$48,740,130,249
Communications	68	$136,764,022
Critical Manufacturing	14,483	$19,441,380,418
Defense Industrial Base	25	$324,889,893
Emergency Services	587	$780,155,751

Sector	Number of Buildings at Risk	Estimated Damages
Energy	461	$15,056,451,053
Food and Agriculture	49,220	$5,326,299,901
Government Facilities	9,963	$19,297,146,967
Healthcare and Public Health	3,062	$5,679,990,421
Information Technology	1	$530,450
National Monuments and Icons	1	$471,030
Nuclear Reactors, Materials and Waste	18	$22,210,225
Other	10	$30,408,115
Postal and Shipping	35	$18,896,556
Transportation Systems	8,283	$10,056,254,482
Water	395	$8,040,172,776
All Categories	**139,431**	**$134,587,698,083**

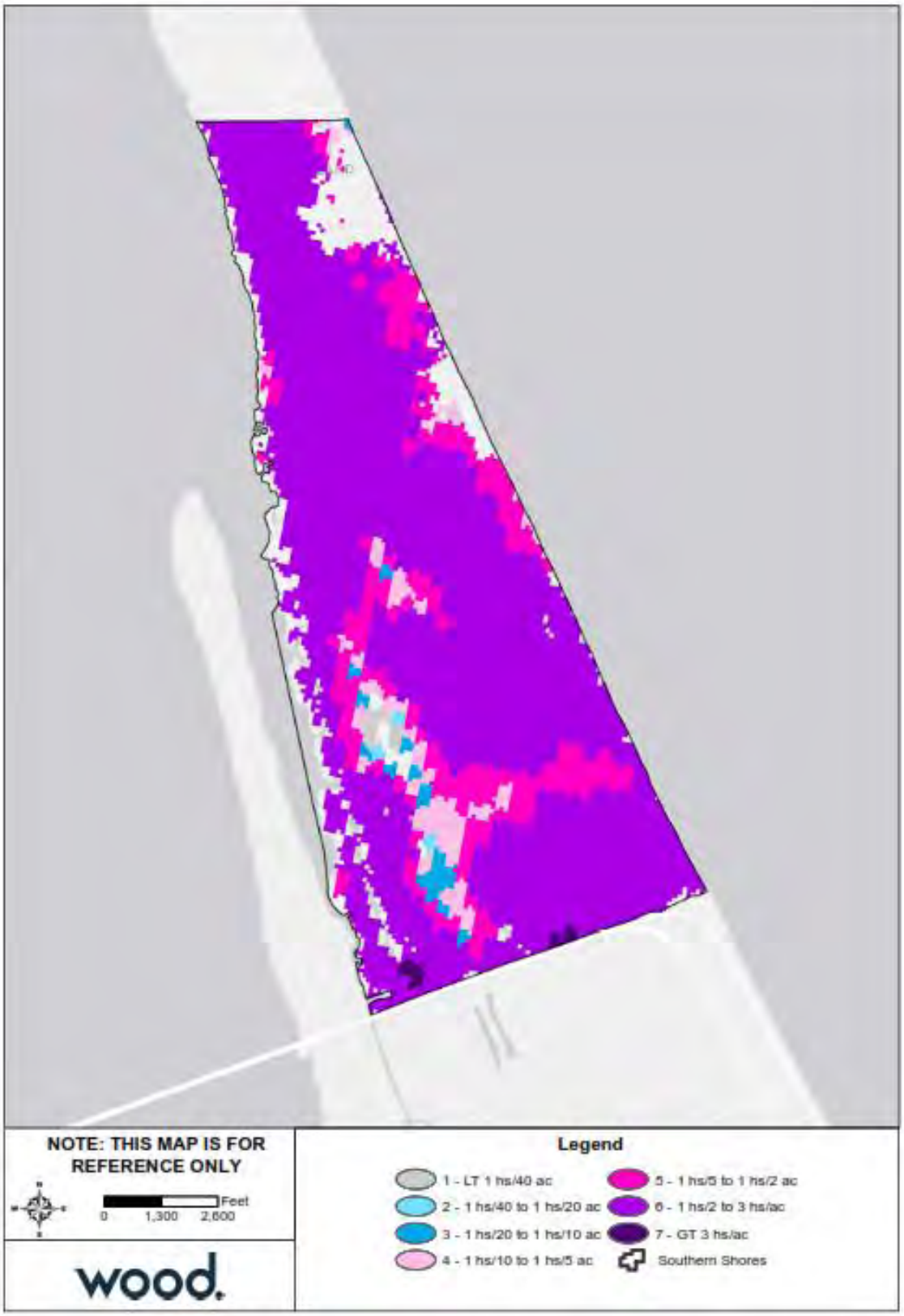
Source: NCEM Risk Management Tool

Table H.18 – High Potential Loss Properties Exposed to Wildfire, Town of Southern Shores

Category	Number of Buildings at Risk	Estimated Damages
Commercial	2	$9,905,328
Government	1	$14,623,200
Religious	1	$1,418,887
Residential	3	$3,523,800
All Categories	**7**	**$29,471,215**

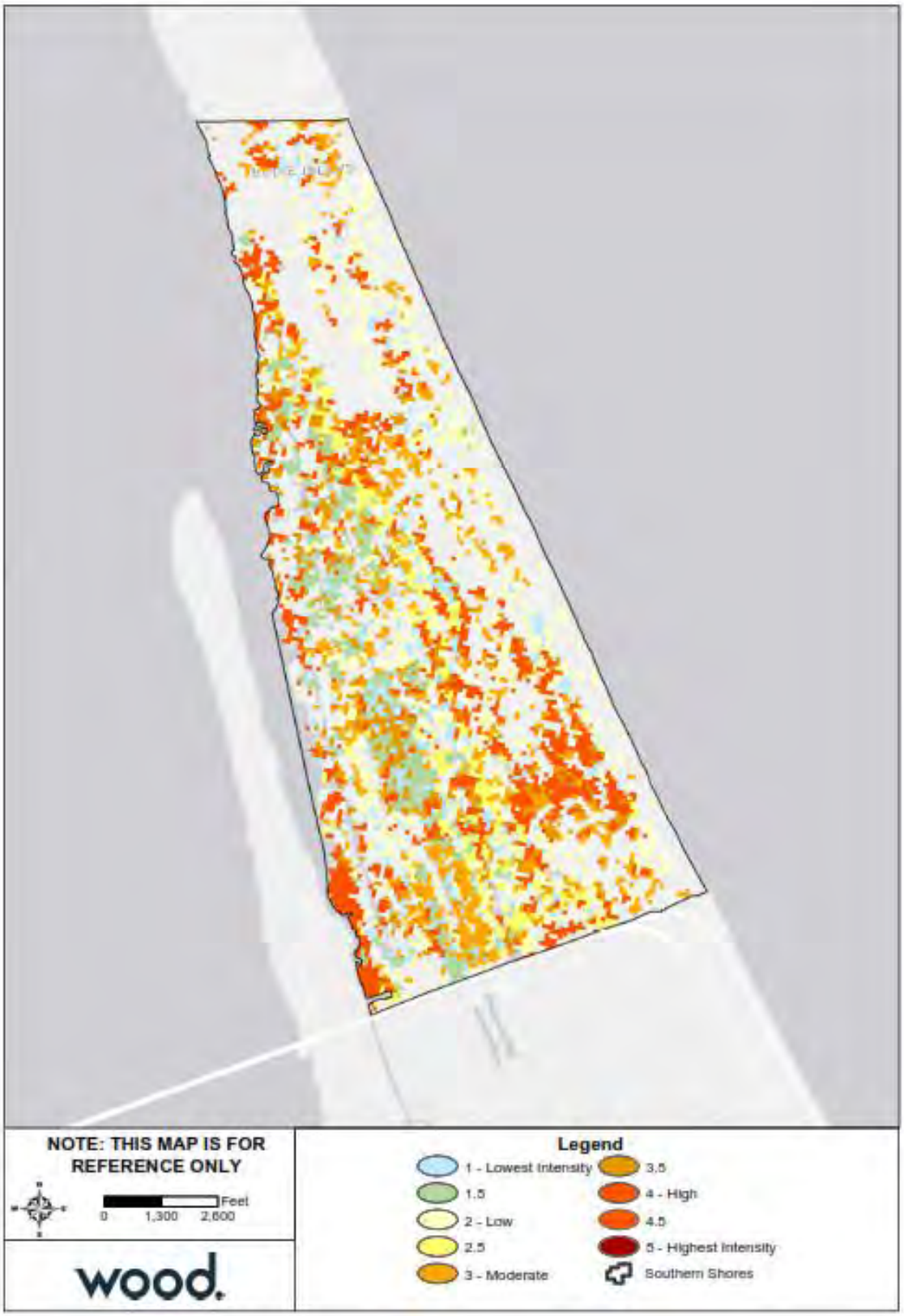
Source: NCEM Risk Management Tool

Figure H.7 – Wildland Urban Interface, Town of Southern Shores



Source: Southern Wildfire Risk Assessment

Figure H.8 – Fire Intensity Scale, Town of Southern Shores



Source: Southern Wildfire Risk Assessment

Figure H.9 – Burn Probability, Town of Southern Shores



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 Southern Shores were provided by the Town's HMPC representatives and are summarized in Section 5 Capability Assessment. Based on that information and using the scoring methodology detailed in that section, Southern Shores has an overall capability rating of High. The Town's Self-Assessment of key capability areas is summarized in Table H.19 below.

Table H.19 – Capability Self-Assessment, Southern Shores

Capability Area	Rating
Plans, Ordinances, Codes and Programs	High
Administrative and Technical Capability	High
Fiscal Capability	High
Education and Outreach Capability	High
Mitigation Capability	High
Political Capability	High
Overall Capability	High

H.4.2 Floodplain Management

The Town of Southern Shores has been a regular participant since May 1972. 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.20 – 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	984	$834,404	$293,686,000	191	$1,780,742.16
2-4 Family	17	$22,002	$4,309,800	1	$4,686.48
All Other Residential	0	$0	$0	0	$0.00
Non Residential	20	$34,513	$9,313,100	1	$5,290.70
Total	**1,021**	**$890,919**	**$307,308,900**	**193**	**$1,790,719.34**

Source: FEMA Community Information System, accessed December 2019

Table H.21 – 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	557	$324,809	$162,527,300	143	$1,190,665.52
AO Zones	92	$56,467	$26,153,900	14	$64,757.06
V01-30 & VE Zones	52	$245,784	$14,709,400	3	$3,221.05
B, C & X Zone					
Standard	103	$168,929	$30,183,400	19	$302,164.36
Preferred	216	$94,330	$73,700,000	14	$229,911.35
Total	**1,020**	**$890,319**	**$307,274,000**	**193**	**$1,790,719.34**

Source: FEMA Community Information System, accessed December 2019

Table H.22 – 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	48	$49,083	$12,513,200	10	$109,569.94
AO Zones	13	$10,263	$3,429,800	0	$0.00
V01-30 & VE Zones	8	$30,249	$2,004,500	1	$2,494.81
B, C & X Zone	35	$36,730	$11,304,900	8	$97,413.61
Standard	18	$29,769	$5,424,900	6	$31,459.87
Preferred	17	$6,961	$5,880,000	2	$65,953.74
Total	**104**	**$126,325**	**$29,252,400**	**19**	**$209,478.36**

Source: FEMA Community Information System, accessed December 2019

Table H.23 – 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	509	$275,726	$150,014,100	133	$1,081,095.58
AO Zones	79	$46,204	$22,724,100	14	$64,757.06
V01-30 & VE Zones	44	$215,535	$12,704,900	2	$726.24
B, C & X Zone	284	$226,529	$92,578,500	25	$434,662.10
Standard	85	$139,160	$24,758,500	13	$270,704.49
Preferred	199	$87,369	$67,820,000	12	$163,957.61
Total	**916**	**$763,994**	**$278,021,600**	**174**	**$1,581,240.98**

Source: FEMA Community Information System, accessed December 2019

H.5 MITIGATION STRATEGY

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
Prevention									
SOS1	Enforcement of the Zoning Ordinance as a hazard mitigation tool	All Hazards	3.1	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Planning and Code Enforcement Department continues to enforce the adopted Zoning Ordinance. Zoning Permits are issued for new development, changes in use, and new uses in order to ensure compliance.
SOS2	Identify "at risk" X Zone properties for added emphasis on flood risks and notify the responsible agencies about discrepancies between floodplain maps (FIRM vs SLOSH)	Hurricane, Tropical Storm, Severe Thunderstorm, Flood	1.2	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Planning and Code Enforcement Department continues to identify at risk properties following storm events by utilizing GIS data and in the field observations.
SOS3	Continue enforcement of the Flood Damage Prevention Ordinance	Hurricane, Tropical Storm, Severe Thunderstorm, Flood, Erosion	3.1	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Planning and Code Enforcement Department continues to enforce the Flood Damage Prevention Ordinance. Building permits are not issued unless plans demonstrate compliance with the established requirements
SOS4	Continue the enforcement of the NC State Fire Prevention Code, referenced by the Town Fire Code.	Wildfire	3.1	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Town's part-time Building Inspector enforces the NC State Fire Prevention Code and conducts required Fire Inspections to ensure compliance
SOS5	Continue enforcing the Lot Disturbance provisions of the Zoning Ordinance	Hurricane, Tropical Storm, Severe Thunderstorm, Flood, Erosion	3.1	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Planning and Code Enforcement Department continues to enforce the Lot Disturbance provisions of the Zoning Ordinance. No grading, filling, or other alteration of the topography or elevation of any unimproved lot, or demolition and clearing of improved property, nor any manmade change to any improved real estate resulting in the discharge of stormwater onto adjacent property and requiring a building permit, is undertaken without prior issuance of a lot disturbance permit
SOS6	Seek the maximum points available from the Community Rating System to keep flood insurance costs to the citizens as low as possible	Flood	3.3	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Planning and Code Enforcement Department continues to seek the maximum points available from the Community Rating System. The Town's last cycle visit was in 2015 which gave the Town a rating of Class 6 which is recertified annually until the next cycle visit in 2020. Communities with a Class 6 rating receive a 20% discount on insurance policies issued for properties in special flood hazard areas (SFHA's).
SOS7	Coordinate wildfire prevention efforts with tree preservation policies	Wildfire	3.1	Low	Planning/Code Enforcement, Fire Department	General Fund	Ongoing	Carry Forward	The Planning and Code Enforcement Department and Southern Shores Volunteer Fire Department issue permits and inspect the sites prior to any open burning.
SOS8	Continue enforcing Coastal Area Management Act (CAMA) regulations	Hurricane, Tropical Storm, Severe Thunderstorm, Flood, Erosion	3.1	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Planning and Code Enforcement Department continues to enforce the Coastal Area Management Act (CAMA) regulations. The Town's Local Permit Officers continue to review and issue Minor Permits in accordance with the Coastal Area Management Act (CAMA).
SOS9	Continue enforcing the state Erosion and Sedimentation Control regulations	Hurricane, Tropical Storm, Severe Thunderstorm, Flood, Erosion	3.2	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	When applicable, all new development must obtain a State-issued permit prior to issuance of a building/zoning permit.
SOS10	Identify factors that affect the severity of drought	Drought	3.3	High	Planning/Code Enforcement	General Fund	Ongoing	New	N/A
SOS11	Obtaining local data including tax parcels, building footprints, critical facility locations, and other information for use in risk analysis.	All Hazards	3.3	High	Planning/Code Enforcement	General Fund	Less than two years	New	N/A

Action #	Action Description	Hazard(s) Addressed	Goal & Objective Addressed	Priority	Lead Agency / Department	Potential Funding Source	Implementation Timeline	2020 Status	2020 Implementation Status Comments
SOS12	Modeling various "what-if" scenarios to estimate potential vulnerabilities in order to develop sea level rise mitigation priorities	Coastal Hazards	3.3	High	Planning/Code Enforcement	General Fund	Less than two years	New	N/A
Property Protection									
SOS13	Continue enforcement of the state building code, including wind load requirements	Hurricane, Nor'easter, Severe Thunderstorm, Winter Storms, Tornadoes, Earthquake	3.1	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Planning and Code Enforcement Department continues to enforce the state building code, including wind load requirements. All building plans must demonstrate compliance prior to issuance of a building permit. The Building Inspector continues to conduct inspections during construction and no Certificate of Occupancy is issued unless all requirements are satisfied.
SOS14	Conduct the Canal Inspection and Debris Removal program twice a year	Hurricane, Tropical Storm, Severe Thunderstorm, Flood, Erosion	2.1	High	Public Works, Southern Shores Civic Association	General Fund	Twice Per Year	Carry Forward	The Town's Public Works Dept. periodically inspects the Town's canal system and removes debris as needed. The Southern Shores Civic Association Boat Club conducts inspections of the canals every three to four weeks.
Natural Resource Protection									
SOS15	Continue implementation of the Waterways and Beaches Ordinance	Hurricane, Tropical Storm, Severe Thunderstorm, Flood, Erosion	3.2	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Planning and Code Enforcement Department continues to implement the Waterways and Beaches Ordinance. The Town Community Resource Officer and contracted lifeguard service conduct patrols of the beach to ensure compliance. All development along Town waterways is approved following demonstration of compliance. The Town continues to send Notices of Violation for canal obstructions when warranted
SOS16	Continue enforcement of the Beach and Dune Management Ordinance	Hurricane, Tropical Storm, Severe Thunderstorm, Flood, Erosion	3.2	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Police Dept., Town Community Resource Officer, and contracted lifeguard service conduct patrols of the beach to ensure compliance
Structural Projects									
SOS17	Continue to monitor plans for the Mid-Currituck Bridge to expedite evacuation	All Hazards	2.1	High	Administration, Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Town continues to monitor the NC Turnpike Authority plans for the Mid-Currituck Bridge to expedite evacuation. Lawsuits are likely to delay the project.
SOS18	Inspecting bridges and identifying if any repairs or retrofits are needed to prevent scour.	Flood		High	Administration, Public Works	NCDOT, General Fund	Annually	New	N/A
Emergency Services									
SOS19	Continue to have a standing Reconstruction Task Force	All Hazards	3.1	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	Ordinance amendment may be necessary so that appointments aren't required annually.
SOS20	Continue to provide an Emergency Operations Center	All Hazards	2.2	High	Administration	General Fund	Ongoing	Carry Forward	The Town continues to provide an Emergency Operations Center when needed for storm events and coordinates events with the Dare County Emergency Operations Center.
SOS21	Keep emergency plans current and provide staff with continuing education opportunities	All Hazards	2.2	Low	Administration	General Fund	Ongoing	Carry Forward	The Town updates its Emergency Management Plan annually and provides Town Staff with continuing education opportunities.
Public Education & Awareness									
SOS22	Educate citizens on expected impacts of hazards on daily lives	All Hazards	1.1	High	Planning/Code Enforcement	General Fund	Ongoing	Carry Forward	The Town utilizes a website, social media, and a bi-weekly newsletter to disseminate information regarding the impacts of hazards on daily lives.
SOS23	Educate citizens regarding the dangers of extreme heat and cold and the steps they can take to protect themselves when extreme temperatures occur	Extreme Heat	1.1	High	Administration, Planning/Code Enforcement	General Fund	Annually	New	N/A
SOS24	Encouraging residents in flood-prone areas to elevate homes.	Flood		High	Planning/Code Enforcement	General Fund	Ongoing	New	N/A

Appendix A Plan Review Tool

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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: **Dare County, NC and Currituck County, NC**	**Title of Plan: Outer Banks Regional Hazard Mitigation Plan**	**Date of Plan:** **March 2020**
Local Point of Contact: **David Stroud** **Title:** **Agency:**	**Address:** **4021 Stirrup Creek Drive, Suite 100** **Durham, NC 27703**	
Phone Number: **919-856-6485**	**E-Mail:** **David.stroud@woodplc.com**	

State Reviewer:	**Title:**	**Date:**

FEMA Reviewer:	**Title:**	
Date Received in FEMA Region ***(insert #)***		
Plan Not Approved		
Plan Approvable Pending Adoption		
Plan Approved		

SECTION 1:
REGULATION CHECKLIST

INSTRUCTIONS: The Regulation Checklist must be completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been 'Met' or 'Not Met.' The 'Required Revisions' summary at the bottom of each Element must be completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is 'Not Met.' Sub-elements should be referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable. Requirements for each Element and sub-element are described in detail in this *Plan Review Guide* in Section 4, Regulation Checklist.

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** (section and/or page number)	**Met**	**Not Met**
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Section 2 (p. 4-33)		
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, 15); Appendix B (p.B.93-B.94)		
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Section 2 (p. 12-14); Appendix B (p.B.35-B.92)		
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Section 2 (p. 7-8)		
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. 306)		
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. 303-306)		
ELEMENT A: REQUIRED REVISIONS			

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
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. 70-261; Hazard Description, Location, Extent, Hazard Summary by Jurisdiction), Annex A-H		
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. 70-261; Past Occurrences, Probability of Future Occurrence, Hazard Summary by Jurisdiction),		
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Section 4.5 (p. 70-261; Vulnerability Assessment, Hazard Summary by Jurisdiction), Annex A-H		
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Section 4.5.5 (p.144-146)		
ELEMENT B: REQUIRED REVISIONS			
ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Section 5 (p. 262-276)		
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. 268-269)		
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Section 6 (p.277-280)		
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. 277-280), Section 7 (p. 281-302)		
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Section 6 (p. 279-280), Section 7 (p. 281-302)		

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
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.303-306)		
ELEMENT C: REQUIRED REVISIONS			
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)			
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Section 3 (p. 34-53), Section 4 (p. 54-261; Asset Inventory, Vulnerability Assessment), Annex A-H		
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Section 2 (p. 15-33), Section 5 (p.262-276)		
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Section 6 (p. 277-280), Section 7 (p. 281-302)		
ELEMENT D: REQUIRED REVISIONS			
ELEMENT E. PLAN ADOPTION			
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))	Plan will be adopted pending APA letter from FEMA; Adoption resolutions will be added to Section 9		
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))	Plan will be adopted pending APA letter from FEMA; Adoption resolutions will be added to Section 9		
ELEMENT E: REQUIRED REVISIONS			
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)			
F1.			
F2.			

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT F: REQUIRED REVISIONS			

SECTION 2:
PLAN ASSESSMENT

INSTRUCTIONS: The purpose of the Plan Assessment is to offer the local community more comprehensive feedback to the community on the quality and utility of the plan in a narrative format. The audience for the Plan Assessment is not only the plan developer/local community planner, but also elected officials, local departments and agencies, and others involved in implementing the Local Mitigation Plan. The Plan Assessment must be completed by FEMA. The Assessment is an opportunity for FEMA to provide feedback and information to the community on: 1) suggested improvements to the Plan; 2) specific sections in the Plan where the community has gone above and beyond minimum requirements; 3) recommendations for plan implementation; and 4) ongoing partnership(s) and information on other FEMA programs, specifically RiskMAP and Hazard Mitigation Assistance programs. The Plan Assessment is divided into two sections:

1. Plan Strengths and Opportunities for Improvement
2. Resources for Implementing Your Approved Plan

Plan Strengths and Opportunities for Improvement is organized according to the plan Elements listed in the Regulation Checklist. Each Element includes a series of italicized bulleted items that are suggested topics for consideration while evaluating plans, but it is not intended to be a comprehensive list. FEMA Mitigation Planners are not required to answer each bullet item, and should use them as a guide to paraphrase their own written assessment (2-3 sentences) of each Element.

The Plan Assessment must not reiterate the required revisions from the Regulation Checklist or be regulatory in nature, and should be open-ended and to provide the community with suggestions for improvements or recommended revisions. The recommended revisions are suggestions for improvement and are not required to be made for the Plan to meet Federal regulatory requirements. The italicized text should be deleted once FEMA has added comments regarding strengths of the plan and potential improvements for future plan revisions. It is recommended that the Plan Assessment be a short synopsis of the overall strengths and weaknesses of the Plan (no longer than two pages), rather than a complete recap section by section.

Resources for Implementing Your Approved Plan provides a place for FEMA to offer information, data sources and general suggestions on the overall plan implementation and maintenance process. Information on other possible sources of assistance including, but not limited to, existing publications, grant funding or training opportunities, can be provided. States may add state and local resources, if available.

A. 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

How does the Plan go above and beyond minimum requirements to document the planning process with respect to:

- *Involvement of stakeholders (elected officials/decision makers, plan implementers, business owners, academic institutions, utility companies, water/sanitation districts, etc.);*
- *Involvement of Planning, Emergency Management, Public Works Departments or other planning agencies (i.e., regional planning councils);*
- *Diverse methods of participation (meetings, surveys, online, etc.); and*
- *Reflective of an open and inclusive public involvement process.*

Element B: Hazard Identification and Risk Assessment

In addition to the requirements listed in the Regulation Checklist, 44 CFR 201.6 Local Mitigation Plans identifies additional elements that should be included as part of a plan's risk assessment. The plan should describe vulnerability in terms of:

1) *A general description of land uses and future development trends within the community so that mitigation options can be considered in future land use decisions;*
2) *The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas; and*
3) *A description of potential dollar losses to vulnerable structures, and a description of the methodology used to prepare the estimate.*

How does the Plan go above and beyond minimum requirements to document the Hazard Identification and Risk Assessment with respect to:

- *Use of best available data (flood maps, HAZUS, flood studies) to describe significant hazards;*
- *Communication of risk on people, property, and infrastructure to the public (through tables, charts, maps, photos, etc.);*
- *Incorporation of techniques and methodologies to estimate dollar losses to vulnerable structures;*
- *Incorporation of Risk MAP products (i.e., depth grids, Flood Risk Report, Changes Since Last FIRM, Areas of Mitigation Interest, etc.); and*
- *Identification of any data gaps that can be filled as new data became available.*

Element C: Mitigation Strategy

How does the Plan go above and beyond minimum requirements to document the Mitigation Strategy with respect to:

- *Key problems identified in, and linkages to, the vulnerability assessment;*
- *Serving as a blueprint for reducing potential losses identified in the Hazard Identification and Risk Assessment;*
- *Plan content flow from the risk assessment (problem identification) to goal setting to mitigation action development;*
- *An understanding of mitigation principles (diversity of actions that include structural projects, preventative measures, outreach activities, property protection measures, post-disaster actions, etc);*
- *Specific mitigation actions for each participating jurisdictions that reflects their unique risks and capabilities;*
- *Integration of mitigation actions with existing local authorities, policies, programs, and resources; and*
- *Discussion of existing programs (including the NFIP), plans, and policies that could be used to implement mitigation, as well as document past projects.*

Element D: Plan Update, Evaluation, and Implementation (*Plan Updates Only*)

How does the Plan go above and beyond minimum requirements to document the 5-year Evaluation and Implementation measures with respect to:

- *Status of previously recommended mitigation actions;*
- *Identification of barriers or obstacles to successful implementation or completion of mitigation actions, along with possible solutions for overcoming risk;*
- *Documentation of annual reviews and committee involvement;*
- *Identification of a lead person to take ownership of, and champion the Plan;*
- *Reducing risks from natural hazards and serving as a guide for decisions makers as they commit resources to reducing the effects of natural hazards;*
- *An approach to evaluating future conditions (i.e. socio-economic, environmental, demographic, change in built environment etc.);*
- *Discussion of how changing conditions and opportunities could impact community resilience in the long term; and*
- *Discussion of how the mitigation goals and actions support the long-term community vision for increased resilience.*

B. Resources for Implementing Your Approved Plan

Ideas may be offered on moving the mitigation plan forward and continuing the relationship with key mitigation stakeholders such as the following:

- *What FEMA assistance (funding) programs are available (for example, Hazard Mitigation Assistance (HMA)) to the jurisdiction(s) to assist with implementing the mitigation actions?*
- *What other Federal programs (National Flood Insurance Program (NFIP), Community Rating System (CRS), Risk MAP, etc.) may provide assistance for mitigation activities?*
- *What publications, technical guidance or other resources are available to the jurisdiction(s) relevant to the identified mitigation actions?*
- *Are there upcoming trainings/workshops (Benefit-Cost Analysis (BCA), HMA, etc.) to assist the jurisdictions(s)?*
- *What mitigation actions can be funded by other Federal agencies (for example, U.S. Forest Service, National Oceanic and Atmospheric Administration (NOAA), Environmental Protection Agency (EPA) Smart Growth, Housing and Urban Development (HUD) Sustainable Communities, etc.) and/or state and local agencies?*

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	Currituck County	County										
2	Dare County	County										
3	Duck	Town										
4	Kill Devil Hills	Town										
5	Kitty Hawk	Town										
6	Manteo	Town										
7	Nags Head	Town										
8	Southern Shores	Town										
9												

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 (Kickoff) – Dare County Group	1) Introduction to DMA, CRS, and FMA requirements and the planning process 2) Review of HMPC responsibilities and the project schedule.	March 5, 2019	Dare County Emergency Operations Center, 370 Airport Road, Manteo
HMPC Mtg. #1 (Kickoff) – Currituck County Group		March 6, 2019	Historic Currituck County Courthouse, 2826 Caratoke Hwy, Currituck
HMPC Mtg. #2 – Currituck County Group	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	June 4, 2019	Lower Currituck Fire Department, 6323 Caratoke Hwy, Grandy
HMPC Mtg. #2 – Dare County Group		June 5, 2019	Dare County Emergency Operations Center, 370 Airport Road, Manteo
HMPC Mtg. #3	1) Review Draft Hazard Identification & Risk Assessment (HIRA) 2) Draft objectives and Mitigation Action Plans	July 24, 2019	Dare County Emergency Operations Center, 370 Airport Road, Manteo
HMPC Mtg. #4 – Currituck County Group	3) Review the Draft Hazard Mitigation Plan 4) Solicit comments and feedback	January 7, 2019	Currituck Courthouse 153 Courthouse Rd, Currituck, NC 27929
HMPC Mtg. #4 – Dare County Group		January 8, 2019	Dare County Emergency Operations Center, 370 Airport Road, Manteo

Note: All HMPC Meetings were open to the public.

HMPC Meeting Agendas, Minutes, and Sign-in Sheets

HMPC Meeting 1: March 5, 2019 & March 6, 2019

Outer Banks Regional Hazard Mitigation Plan

Meeting 1: Hazard Mitigation Planning Committee, Kick-Off Meeting

Dare County

Time & Date: Tuesday, March 5, 2019, 3:00-4:30 p.m.

Location: Dare County Emergency Operations Center, 370 Airport Road, Manteo

Currituck County

Time & Date: Wednesday, March 6, 2019, 3:00-4:30 p.m.

Location: Currituck County Courthouse, 2801 Caratoke Highway, Currituck

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. Working Groups
5. Plan Website
6. Next Steps
    a. Capability Assessment
    b. Mitigation Action Status Updates
    c. Mitigation Goals Update
7. Questions
8. Adjourn

Page **1** of **1**

Outer Banks Regional Hazard Mitigation Plan

Meeting 1: Hazard Mitigation Planning Committee Project Kick-Off Meeting – Dare
Time & Date: Tuesday, March 5, 2019, 3:00-5:00 p.m.
Location: Dare County Emergency Operations Center, 370 Airport Road, Manteo

Introductions

Drew Pearson, Dare County Emergency Management Director, welcomed everyone to the meeting, gave a brief overview of the previous plan, discussed the change to a smaller planning region of just Dare and Currituck Counties, and emphasized the importance of the hazard mitigation planning process in terms of eligibility for FEMA grant funding, preparation for emergency management, and eligibility for Community Rating System (CRS) credit. Drew then introduced David Stroud and Abby Moore, consultants from Wood, to facilitate the rest of the meeting. David began by providing the meeting agenda and had everyone in attendance introduce themselves. There were 30 attendees recorded on the sign-in sheet, including representatives from all Dare County 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. As growth and development occur, exposure to hazard events increases, particularly as the desirable locations with waterfront or water access in the region are also areas with greater 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 human-caused hazards, and trends toward more severe hazard events. There has been a continual increase in hazard expenses and an increase in the issuance of major disaster declarations. David reviewed a list of the costliest natural disasters by NOAA estimates. All of them occurred within the last 30 years, and 9 occurred within the last 20 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. Other stakeholders to involve include North Carolina Emergency Management, FEMA Region IV, NOAA, other adjoining communities, citizens, schools, businesses, and others.

Phase II: Risk Assessment entails hazard identification (what can happen here), vulnerability assessment (what will be affected or impacted), and capability assessment (how prepared we are).

David presented Wood's recommendations for which hazards to include in the plan. The HMPC's discussion on the hazard identification is summarized as follows, by hazard:

- Terrorism: The HMPC expressed concern that there are several sites with a high concentration of people as well as several large-scale events hosted in Dare County. Due to these concerns, terrorism will be profiled in the plan. Vulnerability is assessed using hypothetical scenario modeling. This will be done for two scenarios.
- Flooding: Concerns were raised about secondary hazards from contamination of waterbodies as a result of flooding, especially insofar as the impacts may affect the fishing industry. The hazard profile will discuss these concerns and the consequence analysis will specifically address impacts on the economy and the environment. The extent to which this will be included in the vulnerability assessment will depend on the availability of data. Lora Eddy from the Nature Conservancy may have some information on nutrient loading to share. We will also look into whether this issue would be eligible for FEMA mitigation funding or whether it would fall under EPA jurisdiction. On a separate issue, there was concern expressed that the FIRM and therefore the IRISK data will not fully encompass flood issues because the current FIRM does not model rainfall. To compensate for problem areas not addressed on the FIRM, we will assess localized stormwater flooding issues; this will require that all jurisdictions submit information on the location of stormwater problem areas / hot spots.
- Dam Failure: A question was raised about the impact of upstream dam releases. The NC Dam Inventory does not list any dams in Dare or Currituck counties nor in the larger Pasquotank River Basin, and the region is not listed as the direct downstream community for any upstream dams.
- Erosion: Many committee members expressed concern about estuarine and Sound-side erosion as this results in increased vulnerability to storm surge flooding from the Sound. SLOSH models do not adequately address sound-side flooding. We will attempt to show this flood potential within the assessment of sea level rise.
- Rip Current: David noted that rip currents cannot be predicted and that the hazard cannot be altered, so mitigation would be difficult other than potential for public education. FEMA will not fund life-saving efforts as mitigation. The HMPC decided that rip currents should remain in the plan because of the number of deaths they cause every year. It was decided that rip currents will be addressed under the coastal hazards section.
- Tsunami: David clarified that there is no precedent for tsunami on the east coast and little to no geological foundation to support a tsunami occurring. The HMPC felt that the hazard should still be included because there has been previous encouragement from the state for the Counties to be designated as "Tsunami Ready". The HMPC decided tsunami should be addressed within the earthquake hazard.
- Hazardous Materials Incident: There was concern about fixed facility and transportation related hazardous materials incidents, including incidents occurring on the water such as an oil spill. It was decided that this hazard will be profiled in the plan.
- Cyber Threat: David noted that information will be difficult to find at a local level for this hazard and that it was likely included in the state plan because the vulnerability and exposure is so much greater at the state level. However, the HMPC felt that because Dare County serves as the regional 911 center for 3 counties there is significant vulnerability in the region to cyber threat.
- Transportation Infrastructure Failure: This hazard was included in the previous plan as Transportation Infrastructure Impacts. A question was raised as to why this would be removed from the new plan. Abby noted that transportation infrastructure impacts will be assessed for every hazard that may impact key infrastructure. HMPC members still want to profile this as an independent hazard because of the County's significant dependence on a few key bridges and roads. An example was given of a barge hitting a bridge and damaging it. David noted that these are not predictable or repetitive events that can be measured, but the HMPC decided to profile the hazard.

- Sea Level Rise: It was confirmed that sea level rise will be addressed within the Coastal Hazards profile.

Based on this discussion, the following hazards will be profiled: Flooding, Hurricane & Coastal Hazards (Erosion, Rip Current, Nor'easter), Severe Winter Weather, Extreme Heat, Earthquake (Tsunami), Wildfire, Drought, Severe Thunderstorm, Hazardous Materials Incident, Terrorism, Cyber Threat, Transportation Infrastructure Failure. The vulnerability assessment will use NCEM IRISK data. Hazards will be prioritized using the Priority Risk Index. Each community will self-assess capability to determine ability to implement projects and where gaps exist.

Phase III: Develop Mitigation Plan involves setting planning goals, reviewing mitigation alternatives, and drafting an action plan. Typical strategies are to alter the hazard, avert the hazard, adapt to the hazard, or avoid the hazard. In addition to reviewing actions from the previous plan, the HMPC may need to develop new actions.

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. RMT integrates all available IRISK data to assist in the vulnerability assessment. Additionally, the RMT will generate and maintain a digital version of the plan, which may be useful in plan maintenance and future updates.

Project Schedule

The anticipated project schedule was presented. The process will aim for completion of a final draft document by August 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 June 2020.

Working Groups

The region will be divided into a Dare County Working Group and a Currituck County Working Group for the entirety of the planning process due to facilitate ease of attendance at planning meetings.

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.OBX-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 29th. Representatives should come to the next meeting with a status identified for all existing mitigation actions from the 2015 plan. It was noted that more substantial information than "ongoing" must be provided for continuing actions; it should be clearly noted for each action whether it's Completed, Deleted, or Carried Forward. Representatives should also be prepared to discuss revisions to the mitigation goals. The capability assessment and past actions are posted on the plan website.

Outer Banks Regional Hazard Mitigation Plan
Hazard Mitigation Planning Committee Meeting #1 – Dare County

Tuesday, March 5th, 3:00 PM

	Name	Organization	Phone	E-Mail
1.	DAVID STROUD	WOOD	919-325-6497	david.Stroud@woodplc.com
2.	Abby Moore	Wood	919-768-9927	abigail.moore@woodplc.com
3.	Donna Creef	Dare County Planning	252-475-5873	donnac@darenc.com
4.	NOAH GILLAM	DARE COUNTY PLANNING	252-475-5849	noah.gillam@darenc.com
5.	DREW PEARSON	DARE EM	252 475 5897	drew.pearson@darenc.com
6.	Jacazza Jones	NCEM	919 825 2592	jacazza.jones@ncdps.gov
7.	ROB TESTERMAN	KITTY HAWK	252-261-3552	rob.testerman@kittyhawktown.net
8.	Casey Howell	Town of Manteo	252 216 0067	howell@townofmanteo.com
9.	Meade Gwinn	Town of Nags Head	703-304-2863	MGwinn13@gmail.com
10.	Melissa Dickerson	Town of Manteo	252-216-6313	dickerson@townofmanteo.com
11.	Shane Hite	Town of Nags Head	252-441-5909	shane.hite@nagsheadnc.gov
12.	MARK BISSELL	BPG (KITTY HAWK)	252-202-1215	mark@bissellprofessionalgroup.com
13.	MIKE O'STEEN	MICHAEL DO'STEEN PE	252 423 2300	MIKEOSTEENPE@gmail.com
14.	DOUG STYONS	STYONS SURVEYING KDH	252-441-1415	dougestyons-net
15.	Meredith Guns	KDH	449 5318	meredith@kdhnc.com
16.	Cameron Ray	KDH	449-5311	Cameron@KDHNC.com
17.	Matthew Price	Duck	256-0550	Matt@WallisHoldings.com
18.	Wes Haskett	Southern Shores	261-2394	whaskett@southernshores-nc.gov
19.	Buddy Shelton	Dare Mainland	423-8659	buddyoshelton1959@gmail.com
20.	SKIP JONES	KDH FIRE/OBITEX	252-207-8338	skipjones@embarqmail.com

Outer Banks Regional Hazard Mitigation Plan
Hazard Mitigation Planning Committee Meeting #1 – Dare County

Tuesday, March 5th, 3:00 PM

21.	Jim Braithwaite	Duck	252-202-2107	JBraithwaite@AllisHoldings.com
22.	Sandy Cross	Duck	252-255-1234	scross@townofduck.com
23.	Joe Heard	"	"	jheard@townofduck.com
24.	Megan Lambert	Nags Head	252 429-1745	Megan@bootytreats.com
25.	Malcolm Fleming		252 305 8596	mfc@108bridleigh.com
26.	Andy Ward	S. Shores	252 256-0853	andyward147@gmail.com
27.	MICHAEL L. TALLEY	KITTY HAWK	757 771 8653	MIKE.TALLEY@KITTYHAWKTOWN.NET
28.	MICHAEL ZEHNER	NAGS HEAD	252 449 6041	michael.zehner@nagsheadnc.gov
29.	Holly WHITE	Nags Head	"	Holly.white@nagsheadnc.gov
30.	Lora Eddy	Dare County RI	252-441-2525	lora.eddy@tnc.org
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Outer Banks Regional Hazard Mitigation Plan

Meeting 1: Hazard Mitigation Planning Committee Project Kick-Off Meeting – Currituck
Time & Date: Wednesday, March 6, 2019, 3:00-4:00 p.m.
Location: Historic Currituck County Courthouse, Currituck

Introductions

David Stroud and Abby Moore, consultants from Wood, facilitated the meeting. David began by providing the meeting agenda and had everyone in attendance introduce themselves. David welcomed everyone to the meeting, gave a brief overview of the previous plan and discussed the change to a smaller planning region of just Dare and Currituck Counties. There were 10 attendees recorded on the sign-in sheet.

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. As growth and development occur, exposure to hazard events increases, particularly as the desirable locations with waterfront or water access in the region are also areas with greater 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 human-caused hazards, and trends toward more severe hazard events. There has been a continual increase in hazard expenses and an increase in the issuance of major disaster declarations. David reviewed a list of the costliest natural disasters by NOAA estimates. All of them occurred within the last 30 years, and 9 occurred within the last 20 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. Other stakeholders to involve include North Carolina Emergency Management, FEMA Region IV, NOAA, other adjoining communities, citizens, schools, businesses, and others.

Phase II: Risk Assessment entails hazard identification (what can happen here), vulnerability assessment (what will be affected or impacted), and capability assessment (how prepared we are).

David presented Wood's recommendations and the Dare County HMPC's additions for which hazards to include in the plan. It was noted that a portion of northern Currituck County falls within the IPZ of Surry Nuclear Plant in Virginia, therefore Radiological Incident was added to the list of hazards. Additionally, several sites and events vulnerable to a terrorism or mass casualty event were discussed. Representatives will be asked to compile a list of potentially vulnerable sites and estimate the maximum population that could be at risk.

Based on this discussion, the following hazards will be profiled: Flooding, Hurricane & Coastal Hazards (Sea Level Rise, Erosion, Rip Current, Nor'easter), Severe Winter Weather, Extreme Heat, Earthquake (Tsunami), Wildfire, Drought, Severe Thunderstorm, Hazardous Materials Incident, Radiological Incident, Terrorism, Cyber Threat, Transportation Infrastructure Failure. The vulnerability assessment will use NCEM IRISK data. Hazards will be prioritized using the Priority Risk Index. Each community will self-assess capability to determine ability to implement projects and where gaps exist.

Phase III: Develop Mitigation Plan involves setting planning goals, reviewing mitigation alternatives, and drafting an action plan. Typical strategies are to alter the hazard, avert the hazard, adapt to the hazard, or avoid the hazard. In addition to reviewing actions from the previous plan, the HMPC may need to develop new actions. David noted that in this process Wood will ensure that the Region meets the CRS requirements for considering mitigation alternatives to maximize CRS credit for the plan.

Scope of Work

The plan will meet the following criteria:

- The plan will include all required elements, as defined in the FEMA Local Mitigation Plan Review Guide.
- The plan will meet or exceed the final rule for local mitigation planning found in 44 CFR, Section 201.6, in order to be approved by FEMA.
- 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. RMT integrates all available IRISK data to assist in the vulnerability assessment. Additionally, the RMT will generate and maintain a digital version of the plan, which may be useful in plan maintenance and future updates.

Project Schedule

The anticipated project schedule was presented. The process will aim for completion of a final draft document by August 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 June 2020.

Working Groups

The region will be divided into a Dare County Working Group and a Currituck County Working Group for the entirety of the planning process due to facilitate ease of attendance at planning meetings.

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.OBX-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 29th. Representatives should come to the next meeting with a status identified for all existing mitigation actions from the 2015 plan. It was noted that more substantial information

than "ongoing" must be provided for continuing actions; it should be clearly noted for each action whether it's Completed, Deleted, or Carried Forward. Representatives should also be prepared to discuss revisions to the mitigation goals. The capability assessment and past actions are posted on the plan website.

Outer Banks Regional Hazard Mitigation Plan
Hazard Mitigation Planning Committee Meeting #1 – Currituck County

Wednesday, March 6th, 3:00 PM

	Name	Organization	Phone	E-Mail
1.	DAVID STRAUD	WOOD	919-325 6497	david.Straud@woodplc.com
2.	Abby Moore	Wood	919 - 768 - 9927	abigail.moore@woodplc.com
3.	Anthony Dickinson	NC Farm Bureau	252 232 2277	anthony.dickinson@ncfbins.com
4.	Lora Eddy	The Nature Conservancy	252-441-2525	lora.eddy@tnc.org
5.	Randall Edwards	Currituck County	252- 232- 0719	randall.edwards@currituckcountync.org
6.	MaryBeth Neuns	Currituck County	252-232-2115	mary.neuns@currituck countync.gov
7.	JASON LITTERAL	Currituck County	252-232-6052	jason.litteral@currituckcountync.gov
8.	Laurie LoCicero	Currituck County	(252)232-6028	laurie.locicero@currituck " "
9.	Jennie Turner	Currituck County	252 232-6031	jennie.turner@currituckcountync.gov
10.	Jacazza Jones	NCEM	919 825 2592	jacazza.jones@ncdps.gov
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HMPC Meeting 2: June 4, 2019 & June 5, 2019

Outer Banks Regional Hazard Mitigation Plan

Meeting 2: Hazard Mitigation Planning Committee Meeting

Currituck County
Time & Date: Tuesday, June 4, 2019, 9:30-11:30 a.m.
Location: Lower Currituck Fire Department, 6323 Caratoke Hwy, Grandy

Dare County
Time & Date: Wednesday, June 5, 2019, 1:00-3:00 p.m.
Location: Dare County Emergency Operations Center, 370 Airport Road, Manteo

Agenda

1. Goals and Objectives
    a. Review and Update Goals from the 2015 Albemarle Regional plan
    b. Create Objectives for each goal
2. Create a Vision Statement
3. Review Additional Mitigation Ideas
4. Workshop: Review Existing Mitigation Projects
    a. Reporting on Actions to be Carried Forward
5. Next Steps
6. Project Schedule Update
7. Questions
8. Adjourn

Page 1 of 1

Outer Banks Regional Hazard Mitigation Plan

Meeting 2: Hazard Mitigation Planning Committee – Currituck
Time & Date: Tuesday, June 4, 2019, 9:30-11:30 a.m.
Location: Lower Currituck Fire Department, 6323 Caratoke Hwy, Grandy

Introduction and Announcements

David Stroud and Abby Moore, consultants from Wood, who are leading the County and jurisdictions through the planning process, facilitated the meeting. David provided the meeting agenda. There were 8 people in attendance and recorded on the sign-in sheet.

Review and Update Mitigation Goals

David reviewed the goals from the 2015 Albemarle Regional 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 as well as objectives within each of the goals. The original goals are as follows:

#1	Reduce the risk of loss of life and personal injury from natural hazards.
#2	Reduce the risk and impact of future natural disasters by regulating development in known high hazard areas.
#3	Maintain critical facilities in functional order.
#4	Protect infrastructure from damage.
#5	Ensure that hazard mitigation is considered when redevelopment occurs after a natural disaster.
#6	Provide education to citizens that empowers them to protect themselves and their families from natural hazards.
#7	Fulfill Federal and State requirements for receipt of future disaster recovery and hazard mitigation assistance.
#8	Improve inter-jurisdictional cooperation and coordination, especially regarding the reduction of natural hazard impacts.

Wood's recommended revision were to make Goal #2 and Goal #6 objectives under Goal #1, to combine Goal #3 and Goal #4, and to remove Goal #7. Additional small wording changes were also made. These recommendations were presented along with proposed objectives. The HMPC discussed the proposed goals and objectives, and several additional changes were made, including addition of an objective to encourage nature-based solutions mitigation, rewording of the objective on public outreach, and removal of the word "natural" to encompass the technological and human-caused hazards that will be included in this plan. The resulting draft goals and objectives are as follows:

Goal 1: Reduce the risk of loss of life and personal injury from hazards.

- **Objective 1.1**: Provide education to citizens that encourages individual responsibility to protect themselves and their families from hazards.
- **Objective 1.2**: Reduce the risk and impact of future hazards by regulating development in known high hazard areas

Goal 2: Maintain critical facilities and infrastructure in functional order and protect them from damage.

- **Objective 2.1**: Retrofit, harden, or otherwise protect critical facilities and infrastructure.
- **Objective 2.2**: Increase redundancy of critical systems and services.

Goal 3: Ensure that hazard mitigation is considered for new development and post-disaster redevelopment.

- **Objective 3.1**: Adopt more protective development standards.
- **Objective 3.2**: Establish post-disaster redevelopment policies.
- **Objective 3.3**: Preserve and protect natural and beneficial floodplain functions and key coastal resources.

Goal 4: Improve inter-jurisdictional cooperation and coordination, especially regarding the reduction of hazard impacts.

- **Objective 4.1**: Coordinate development standards for regional consistency.
- **Objective 4.2**: Encourage and enable inter-jurisdictional communication.

These draft goals and objectives will be presented to the Dare County HMPC for further discussion, and a final draft will be sent to all HMPC members for review and approval.

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, what the Outer Banks will look like in five years, how the HMPC would like to be able to describe their communities, what the HMPC thinks their communities are doing well and what could be improved. With these guiding questions, the group developed the following list of vision concepts:

- Responsible, planned growth; balance
- Rural character / preserving current quality of life
- Saving lives and money
- Planning for resilience, preparedness, and recovery
- Public education to encourage personal responsibility
- New technology, communication
- Innovative financing
- Ensuring preparedness and safety of residents and visitors

These concepts will be presented to the Dare County HMPC in a similar exercise, and the consultant team will compile the full list of concepts into a draft vision statement to be sent to the full HMPC for review and approval.

Review Mitigation Action Ideas

David reviewed a selection of mitigation action ideas from the FEMA "Mitigation Ideas" publication. He encourages the HMPC to review the full document to find ideas for new mitigation actions. Each jurisdiction will need two actions per hazard (high and moderate priority hazards only). These actions will also need to meet the CRS requirement of two actions per mitigation category.

Existing Mitigation Projects

The HMPC must assign a status to each mitigation action in the existing plan. Currituck County completed a review of all existing mitigation actions in February 2019, which will be used to provide a status update and determine which actions are completed or will be deleted or carried forward. Abby will compile this information and provide a spreadsheet to the HMPC to make final determinations on the status for each action. Once the HMPC identifies which actions will be carried forward, supporting information and new prioritization ratings will be required for the update.

Next Steps

Abby will send out the draft goals and objectives and 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 to Abby at abigail.moore@woodplc.com by Friday, June 14th.

The next meeting will be scheduled for a date in mid- to late-July. During this meeting the consultants will review the findings of the Hazard Identification and Risk Assessment (HIRA).

Meeting Adjourned

Outer Banks Regional Hazard Mitigation Plan
Hazard Mitigation Planning Committee Meeting #2 – Currituck County

Tuesday, June 4th, 9:30 AM

	Name	Organization	Phone	E-Mail
1.	DAVID STRAUD	WOOD	919-325-6497	david.Straud@woodplc.com
2.	Anthony Dickinson	Farm Bureau, OBX Surfs Up	2522322277	anthony.dickinson@ncfbins.com
3.	Lora Eddy	The Nature Conservancy	252-774-4513	lora.eddy@tnc.org
4.	Rebecca Ray	Currituck EM	252-232-2115	rebecca.ray@currituckcountync.gov
5.	Mary Beth Newns	Currituck EM	252-232-2115	mary.newns@currituckcountync.gov
6.	WARREN DAVIS	QUIBLE & ASSOC.	252.202.8166	wdavis@quible.com
7.	Abby Moore	wood	919-768-9927	abigail.moore@woodplc.com
8.	JASON LITTERAL	Currituck County Planning	252-232-6052	jason.litteral@currituckcountync.gov
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Outer Banks Regional Hazard Mitigation Plan

Meeting 2: Hazard Mitigation Planning Committee – Dare
Time & Date: Wednesday, June 5, 2019, 1:00-3:00 p.m.
Location: Dare County Emergency Operations Center, 370 Airport Road, Manteo

Introduction and Announcements

David Stroud and Abby Moore, consultants from Wood, who are leading the County and jurisdictions through the planning process, facilitated the meeting. David provided the meeting agenda. There were 25 people in attendance and recorded on the sign-in sheet.

Review and Update Mitigation Goals

David reviewed the goals from the 2015 Albemarle Regional Hazard Mitigation Plan and 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 as well as objectives within each of the goals. The original goals are as follows:

#1	Reduce the risk of loss of life and personal injury from natural hazards.
#2	Reduce the risk and impact of future natural disasters by regulating development in known high hazard areas.
#3	Maintain critical facilities in functional order.
#4	Protect infrastructure from damage.
#5	Ensure that hazard mitigation is considered when redevelopment occurs after a natural disaster.
#6	Provide education to citizens that empowers them to protect themselves and their families from natural hazards.
#7	Fulfill Federal and State requirements for receipt of future disaster recovery and hazard mitigation assistance.
#8	Improve inter-jurisdictional cooperation and coordination, especially regarding the reduction of natural hazard impacts.

Wood's recommended revision were to make Goal #2 and Goal #6 objectives under Goal #1, to combine Goal #3 and Goal #4, and to remove Goal #7. Additional small wording changes were also made, and several objectives were proposed. The Currituck HMPC made several additional changes, including addition of an objective to encourage nature-based solutions mitigation, rewording of the objective on public outreach, and removal of the word "natural" to encompass the technological and human-caused hazards that will be included in this plan.

The Dare HMPC discussed many edits to the goals and objectives, including changes to Goals 2 and 3 and Objectives 1.1, 1.2, 2.1, 3.1, 3.2, 3.3, 4.1, and the addition of an objective. These proposed changes are incorporated into the resulting draft goals and objectives below:

Goal 1: Reduce the risk of loss of life and personal injury from hazards.

- **Objective 1.1**: Educate citizens to encourage individual responsibility to protect themselves and their families from hazards.
- **Objective 1.2**: Reduce the risk and impact of future hazards by mitigating risk of development in both known hazard areas and areas expected to face future hazard risk.

Goal 2: Maintain critical facilities and infrastructure and protect them from damage.

- **Objective 2.1**: Retrofit or otherwise protect critical facilities and infrastructure.
- **Objective 2.2**: Increase redundancy of critical systems and services.

Goal 3: Ensure that hazard mitigation is considered for both new development and post-disaster redevelopment to enhance resiliency and enable speedy recovery.

- **Objective 3.1**: Adopt protective development standards and establish post-disaster redevelopment policies.
- **Objective 3.2**: Preserve and protect natural and beneficial floodplain functions and key natural resources.
- **Objective 3.3**: Explore new pre-disaster opportunities that build community resilience.

Goal 4: Improve inter-jurisdictional cooperation and coordination, especially regarding the reduction of hazard impacts.

- **Objective 4.1**: Coordinate development standards across jurisdictions.
- **Objective 4.2**: Encourage and enable inter-jurisdictional communication.

These draft goals and objectives will be presented to the Dare County HMPC for further discussion, and a final draft will be sent to all HMPC members for review and approval.

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, what the Outer Banks will look like in five years, how the HMPC would like to be able to describe their communities, what the HMPC thinks their communities are doing well and what could be improved. With these guiding questions, the Dare HMPC developed the following list of vision concepts:

- Resiliency
- Adaptive
- Thriving – economics, health and well-being
- Quality of life and community character
- Preserve and protect
- Longevity, sustainability
- Collaboration, partnerships
- Consistency
- Safer environment
- Ready for threats
- Not surprised when threats occur, being prepared
- Recover quickly and stronger
- Respect for sense of place
- Future hazard conditions

These concepts will be combined with those developed by the Currituck HMPC, and the consultant team will compile them into a draft vision statement to be sent to the full HMPC for review and approval.

Review Mitigation Action Ideas

David reviewed a selection of mitigation action ideas from the FEMA "Mitigation Ideas" publication. He encouraged the HMPC to review the full document to find ideas for new mitigation actions. Each jurisdiction will need two actions per hazard (high and moderate priority hazards only). These actions will also need to meet the CRS requirement of two actions per mitigation category.

Existing Mitigation Projects

The HMPC representatives from each jurisdiction must assign a status to each of their jurisdiction's mitigation actions from the existing plan. Abby will compile this information and provide a spreadsheet to the HMPC to further refine and update any actions being carried forward in the plan update. Once the HMPC identifies which actions will be carried forward, supporting information and new prioritization ratings will be required for the update.

Next Steps

Abby will send out the draft goals and objectives and 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 to Abby at abigail.moore@woodplc.com by Friday, June 14th.

The next meeting will be scheduled for a date in mid- to late-July. During this meeting the consultants will review the findings of the Hazard Identification and Risk Assessment (HIRA).

Meeting Adjourned

Outer Banks Regional Hazard Mitigation Plan
Hazard Mitigation Planning Committee Meeting #2 – Dare County

Wednesday, June 5th, 1:00 PM

	Name	Organization	Phone	E-Mail
1.	Abby Moore	Wood	919-768-9927	abigail.moore@woodplc.com
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5.	John Finelli	Dar - Planning Board	252-261-8786	JLF9000@Charter.net
6.	Lora Eddy	The Nature Conservancy	252-774-4513	lora.eddy@tnc.org
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9.	Melissa Dickerson	Town of Manteo	252-473-4112	mdickerson@manteonc.org
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11.	Ed Snyder	Nags Head	804-720-6302	ed.snyder@nagsheadNC.gov
12.	Shane Hite	Nags Head	252-202-5-76	shane.hite@nagsheadnc.gov
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14.	MIKE O'STEEN	MIKE O'STEEN PE	752423-2300	MIKE-OSTEEN PE@GMAIL.COM
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16.	Casey Howell	town of Manteo	2522160067	howell@townofmanteo.com
17.	Meredith GUNS	town KDH	2524445318	meredith@KDH.nc.com
18.	MICHAEL ZEHNER	TOWN OF Nags Head	252-441-4016	michael.zehner@nagsheadncga
19.	Buddy Shelton	Dare County	252-423-8659	buddy.shelton1957@ymail.com
20.	ROB TESTERMAN	KITTY HAWK	252 261 3552	rob.testerman@kittyhawktown.net

Outer Banks Regional Hazard Mitigation Plan
Hazard Mitigation Planning Committee Meeting #2 – Dare County

Wednesday, June 5th, 1:00 PM

21.	Matt Price	Duck	252-256-0550	matt@corollishollidays.com
22.	Jim Braithwaite		252-202-2107	jbraithwaite@corollishollidays.com
23.	Sandy Cross		252-255-1234	scross@townofduck.com
24.	Joe Heard	Town of Duck	252-255-1234	jheard@townofduck.com
25.	Drew Pearson	DARE	252 475 5897	dpearson@darenc.com
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HMPC Meeting 3: July 24, 2019

Outer Banks Regional Hazard Mitigation Plan

Meeting 3: Hazard Mitigation Planning Committee Meeting

Time & Date: Wednesday, July 24, 2019, 10:00-12:00 p.m.
Location: Dare County Emergency Operations Center, 370 Airport Road, Manteo

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

Page 1 of 1

Outer Banks Regional Hazard Mitigation Plan

Meeting 3: Hazard Mitigation Planning Committee
Time & Date: Wednesday, July 24, 2019, 10:00-12:00 p.m.
Location: Dare County Emergency Operations Center, 370 Airport Road, Manteo

Introduction and Announcements

David Stroud and Abby Moore, consultants from Wood, facilitated the meeting. There were 28 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 Albemarle Regional 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:

- Coastal Hazards
- Drought
- Earthquake
- Extreme Heat
- Flood
- Hurricane & Tropical Storm
- Severe Weather (Thunderstorm, Lightning, and Hail)
- Severe Winter Storm
- Tornado
- Wildfire
- Hazardous Materials Incident
- Cyber Threat
- Radiological Incident
- Terrorism
- Transportation Infrastructure Failure

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:

- The Region received a disaster declaration for Hurricane Michael that should be added to the list.
- There were many concerns regarding the age of the IRISK data. Wood is unable to alter the IRISK data but can compile a summary of development that has occurred since the date of the IRISK building data to put loss estimates in current context. Wood will need local parcel data to accomplish this task. It was noted that exposure and loss estimates will not impact post-disaster aid.
- Critical facilities are also provided by IRISK and may need to be updated. The HMPC can review existing maps to see if any new facilities should be added. If a GIS layer of critical facilities exists, Wood can use this to identify new facilities.
- There is no compiled database on rates of sound side erosion. Wood can incorporate anecdotal evidence but cannot compile individual records of erosion over time to estimate erosion rates as this would be a significant effort requiring substantial time investment. This could be a good mitigation project from some jurisdictions to pursue.
- It was noted that the erosion maps should read "Ocean Shoreline".

- It was noted that rip current records from NCEI did not capture all past fatalities. An additional data source compiled by NOAA will be added to this section.
- There was question on whether the IRISK data reflects Currituck's old or current effective FIRM. Updates will be made accordingly to specify.
- NCEI records of flood damages are low and underplay the severity of flood in the Region. Property damage records will be withheld in the profile and a qualifying statement will be added expressing the HMPC's concern that the data is inaccurate.
- The issue with historical flood incidents was discussed as a gap identification issue. As a mitigation project the Region could work to improve reporting to NWS to ensure that records of flooding are more accurate in the future.
- Details are needed for any specific incidents or vulnerabilities that should be listed related to the Transportation Infrastructure Failure hazard. One issue mentioned was the unpredictable closing of the Alligator River bridge.

In summary, the high priority hazards are: hurricane & tropical storm, extreme heat, flood, coastal hazards, severe winter storm, terrorism, severe weather, tornado, and wildfire. The moderate priority hazards are: transportation infrastructure failure, drought, radiological emergency, cyber attack, hazardous materials incident. Earthquake is a low priority hazard and does not need to be prioritized for mitigation.

Public Survey Results

There were 853 responses to the public survey. The highest priority hazards according to the public are: hurricane, flood, erosion, 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 Goals & Objectives

The final plan goals and objectives are provided for 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. Emergency Services actions do not count toward this requirement but do count toward CRS requirements. Each jurisdiction must also have actions in at least 5 of the 6 mitigation categories for CRS; every jurisdiction must have a Structural Project.

Next Steps

The draft HIRA is posted on the plan website. The HMPC can review the HIRA and submit comments until Friday, August 9th. 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 23rd.

Meeting Adjourned

Outer Banks Regional Hazard Mitigation Plan
Hazard Mitigation Planning Committee Meeting #3 – Currituck & Dare Counties

Wednesday, July 24th, 10:00 AM

	Name	Organization	Phone	E-Mail
1.	Abby Moore	Wood	919-768-9927	abigail.moore@woodplc.com
2.	DREW PEARSON	DARE	252 475 5897	drew.pearson@darenc.com
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4.	MATTHEW PRICE		252-256-0550	matt@gilliSHoldings.com
5.	Jim Braithwaite	Duck	252-202-2407	JBd ALHiS Holdings.com
6.	ROB TESTERMAN	KITTY HAWK	252-261-3552	rob.testerman@kittyhawktown.net
7.	Holly B White	Nags Head	252 449 6041	holly.white@nagsheadnc.gov
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9.	Ed Snyder	Nags Head	252-449-6046	ed.snyder@nagsheadNC.gov
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14.	Wes Haskett	Southern Shores	261-2394	wheskett@SouthernShoresNC.gov
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18.	Megan Lambert	Nags Head	252-489-1745	Megan@boothtreats.com
19.	Meade Gwinn	Nags Head	703-304-2863	MGW.NH13@gmail.com
20.	Melissa Dickerson	Manteo	252-216-6313	mdickerson@manteonc.gov

Outer Banks Regional Hazard Mitigation Plan
Hazard Mitigation Planning Committee Meeting #3 – Currituck & Dare Counties

Wednesday, July 24th, 10:00 AM

21.	Meredith Guns	KDH	252.449-5318	meredith@kdhnc.com
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HMPC Meeting 4: January 7, 2020 & January 8, 2020

Outer Banks Regional Hazard Mitigation Plan

Meeting 4: Hazard Mitigation Planning Committee Meeting

Currituck County
Time & Date: Tuesday, January 7, 2020, 1 p.m.
Location: Currituck Courthouse, 153 Courthouse Road, Currituck

Dare County
Time & Date: Wednesday, January 8, 2020, 1 p.m.
Location: Dare County Emergency Operations Center, 370 Airport Road, Manteo

Agenda

1. Planning Process Review
2. Structure of the Plan Document
3. Review of Key Plan Components
    a. Hazards & Priority Risk Index
    b. Goals & Objectives
    c. Mitigation Actions
4. Plan Implementation and Maintenance
    a. Integration with Other Plans
5. Next Steps
6. Questions
7. Adjourn

Page 1 of 1

Outer Banks Regional Hazard Mitigation Plan

Meeting 4: Hazard Mitigation Planning Committee - Currituck
Time & Date: Tuesday, January 7, 1:00 p.m.
Location: Currituck County Courthouse Conference Room, 153 Courthouse Road, Currituck

There were 11 attendees recorded on the meeting sign-in sheet.

Planning Process Update

David Stroud and Abby Moore, consultants from Wood leading the plan update, facilitated the meeting. David began the meeting with a review of the planning process. The process is now in Step 7 (Review Possible Activities) and Step 8 (Draft an Action Plan). Once the plan is fully drafted and approved, all communities will adopt the plan (Step 9) and then implement, evaluate, and revise the plan (Step 10) over the next five years until the next update cycle begins.

David provided a review of the planning process and listed the ways in which the planning process was augmented to maximize CRS credit.

Structure of the Plan

To prepare the HMPC to review and comment on the draft plan, David presented the structure of the plan, discussing each of the nine sections as well as the appendices and annexes to the plan. This summary of each plan section as well as annex content can be found in the presentation slides.

Additionally, David clarified where and how data on development not included in IRISK was added to the HIRA and annexes to address concerns from the review of the HIRA. This data on recent development provides a good indication of growth in each participating jurisdiction and puts the IRISK data presented in the HIRA into context. This data was also assessed in terms of flood risk, by comparing parcels to floodplains in the 2006 FIRM in order to estimate additional exposure to flooding. The 2006 FIRM was used in order to provide a like-for-like comparison to the IRISK data.

David also reviewed a few answers from the public survey in order to discuss potential new mitigation actions that could stem from public input.

Review of Key Plan Components

Abby reviewed the major components of the plan as follows:

- Hazards Profiled: listed the hazards assessed in this plan, which includes natural hazards as well as technological and human-caused hazards.
- Risk Assessment Summary & PRI Results: presented the Priority Risk Index scores for each hazard, demonstrating how hazards were classified as high, moderate, or low risk. Only natural hazards with a high or moderate risk rating need to be targeted for mitigation.
- Goals & Objectives: Presented the goals and objectives, discussed at the second HMPC meeting, for reference. All mitigation actions must nest under one of these goals and objectives.
- Mitigation Action Plans: a set of example actions were shown. The HMPC then reviewed the Currituck County Action Plan and brainstormed new actions. Several new actions were added, including targeted outreach and critical facility protection. Additionally, several natural resource protection actions were revised. Abby will send these updates to the HMPC for final revision by January 15th.

Plan Implementation & Maintenance

Abby reviewed the HMPC's responsibilities for implementing and maintaining the plan once it is adopted. The Disaster Mitigation Act of 2000 (DMA) requires that the HMPC conduct annual reviews of the plan to discuss implementation progress and any needed revisions; however, in order to maximize credit Wood recommends conducting quarterly reviews. The HMPC should document each meeting and make that documentation publicly available in order to enable continued public involvement in the plan. More regular meetings will also help the

committee make progress on implementation. During quarterly reviews, the HMPC can revise and/or add mitigation projects to the County's action plan by completing a form required by NCEM.

The committee also discussed ways that the 2015 plan has been integrated and ways that this plan update will be integrated into other planning efforts moving forward. The County's Land Use Plan update is currently underway – the previous plan was integrated through analysis of hazard areas in the land suitability analysis. As the Land Use Plan is in draft stage, this update can be referenced for any updates as necessary before the plan is final. This plan may also be integrated into policy updates, including the possibility of new ordinances such as a dune protection ordinance, which was previously under consideration by the County.

Moving forward, the final components of the plan will be compiled into a complete draft, which will be posted for review on the plan website. Committee members and the public will have until January 30th to review the draft. Comments and feedback will be compiled into a final draft plan, which will be sent to the State to review. Once the State has approved the plan, it will be sent to FEMA for review. After FEMA sends the Approval Pending Adoption (APA) letter, all communities must adopt the plan. The rough timeline for plan reviews will be 30 days for State review and 45 days for FEMA review.

John also mentioned that the State will work with communities to amend the plan and add new projects if needed, such as if a community wants to apply for HMGP funding for a project that is not currently listed in the plan.

Next Steps

HMPC representatives should try to submit any mitigation action revisions by Wednesday, January 15th. HMPC members also have until Thursday, January 30th to review the draft plan. Comments and feedback on the plan can be sent to Abby at abigail.moore@woodplc.com.

Meeting Adjourned

Outer Banks Regional Hazard Mitigation Plan
Hazard Mitigation Planning Committee Meeting #4 – Currituck

Tuesday, January 7th, 1 PM

	Name	Organization	Phone	E-Mail
1.	Abby Moore	Wood.	919-708-9927	abigail.moore@woodplc.com
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3.	Lora Eddy	The Nature Conservancy	252-774-4513	lora.eddy@tnc.org
4.	Steven Pyle	Currituck County	252-232-2115	steven.pyle@currituckcountync.gov
5.	Anthony Dickinson	North Carolina Farm Bureau	252-599-0005	anthony.dickinson@ncfbins.com
6.	Randall Edwards	Currituck County	252-232-0719	randall.edwards@currituckcountync.gov
7.	Jennie Turner	Currituck County	252-232-6031	jennie.turner@currituckcountync.gov
8.	Chandler Sawyer	Currituck County	252-232-6068	chandler.sawyer@currituckcountync.gov
9.	ERIC WEATHERLY	CURRITUCK COUNTY	252.232-6055	eric.weatherly@currituckcountync.gov
10.	JASON LITTERAL	Currituck county	252-232-6052	jason.litteral@currituckcountync.gov.
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Outer Banks Regional Hazard Mitigation Plan

Meeting 4: Hazard Mitigation Planning Committee - Dare
Time & Date: Wednesday, January 8, 1:00 p.m.
Location: Dare County Emergency Operations Center, 370 Airport Road, Manteo

There were 24 attendees recorded on the meeting sign-in sheet.

Planning Process Update

David Stroud and Abby Moore, consultants from Wood leading the plan update, facilitated the meeting. David began the meeting with a review of the planning process. The process is now in Step 7 (Review Possible Activities) and Step 8 (Draft an Action Plan). Once the plan is fully drafted and approved, all communities will adopt the plan (Step 9) and then implement, evaluate, and revise the plan (Step 10) over the next five years until the next update cycle begins.

David provided a review of the planning process and listed the ways in which the planning process was augmented to maximize CRS credit, including through a more robust planning process and a review of mitigation alternatives, both documented in the appendices. David requested that representatives share information about the draft plan on their local websites and social media accounts and share those posts with Abby in order to ensure these final public outreach efforts are documented in the plan.

Structure of the Plan

To prepare the HMPC to review and comment on the draft plan, David presented the structure of the plan, discussing each of the nine sections as well as the appendices and annexes to the plan. This summary of each plan section as well as annex content can be found in the presentation slides.

Additionally, David clarified where and how data on development not included in IRISK was added to the HIRA and annexes. This was done to address concerns from the review of the HIRA. This data on recent development provides a good indication of growth in each participating jurisdiction and puts the IRISK data presented in the HIRA into context. This data was also assessed in terms of flood risk, by comparing parcels to floodplains in the current effective (2006) FIRM in order to estimate additional exposure to flooding.

David also reviewed a few answers from the public survey in order to discuss potential new mitigation actions that could stem from public input. There was a discussion of preparedness and knowledge of evacuation areas; however, because there are no evacuation centers in the county, inland evacuation centers are determined on a case by case basis, and many residents shelter in place, it was determined that the survey question should be rephrased in the future.

Review of Key Plan Components

Abby reviewed the major components of the plan as follows:

- Hazards Profiled: listed the hazards assessed in this plan, which includes natural hazards as well as technological and human-caused hazards.
- Risk Assessment Summary & PRI Results: presented the Priority Risk Index scores for each hazard, demonstrating how hazards were classified as high, moderate, or low risk. Only natural hazards with a high or moderate risk rating need to be targeted for mitigation. Earthquake is the only natural hazard not necessarily targeted for mitigation.
- Goals & Objectives: Presented the goals and objectives, discussed at the second HMPC meeting, for reference. All mitigation actions must nest under one of these goals and objectives.
- Mitigation Action Plans: a set of example actions were shown. Some details are still needed from several jurisdictions; however all jurisdictions are currently meeting the DMA requirements and maximizing CRS credits with the action plans as they currently stand.

Plan Implementation & Maintenance

Abby reviewed the HMPC's responsibilities for implementing and maintaining the plan once it is adopted. The Disaster Mitigation Act of 2000 (DMA) requires that the HMPC conduct annual reviews of the plan to discuss implementation progress and any needed revisions; however, in order to maximize CRS credit Wood recommends conducting quarterly reviews. The HMPC should document each meeting and make that documentation publicly available in order to enable continued public involvement in the plan and document these meetings. More regular meetings will also help the committee make progress on implementation.

The committee also discussed ways that the 2015 plan has been integrated and ways that this plan update will be integrated into other planning efforts moving forward. This plan update has already been incorporated into the update to the Dare County Emergency Operations Plan, which is currently underway. It was confirmed that this hazard mitigation plan update includes a consequence analysis for each hazard according to the requirements of the Emergency Management Accreditation Program (EMAP) in order to ensure integration with emergency management efforts.

Moving forward, the final components of the plan will be compiled into a complete draft, which will be posted for review on the plan website. Committee members and the public will have until January 30th to review the draft. Comments and feedback will be compiled into a final draft plan, which will be sent to the State to review. Once the State has approved the plan, it will be sent to FEMA for review. After FEMA sends the Approval Pending Adoption (APA) letter, all communities must adopt the plan. The rough timeline for plan reviews will be 30 days for State review and 45 days for FEMA review.

Next Steps

HMPC representatives should try to submit any mitigation action revisions by Wednesday, January 15th. HMPC members also have until Thursday, January 30th to review the draft plan. Comments and feedback on the plan can be sent to Abby at abigail.moore@woodplc.com.

Mitigation Action Plan Workshop

Before closing the meeting, time was set aside for each jurisdiction to review their mitigation action plans and discuss any additional details where needed. It was clarified that although a specific cost estimate is not required, a potential funding source must be provided in order to meet CRS reporting requirements. Example sources may include general fund, staff time, HMGP grant, other state or federal funding, etc. Those communities whose action plans are not yet complete were asked to provide any missing details by January 15th so that Wood can review the information and ensure all requirements are met.

Meeting Adjourned

Outer Banks Regional Hazard Mitigation Plan
Hazard Mitigation Planning Committee Meeting #4 – Dare

Wednesday, January 8th, 1 PM

	Name	Organization	Phone	E-Mail
1.	DREW PEARSON	DARE COUNTY GIS	252 475 5897	drew.pearson@darenc.com
2.	EDWARDINE MARRONE	FEMA	404 433 3968	EDWARDINE.MARRONE@FEMA.DHS.GOV
3.	Jacazza Jones	NCEM - Mitigation	919 825 2592	jacazza.jones@ncdps.gov
4.	DAVID STRAUD	WOOD	919 325 6197	david.straud@woodplc.com
5.	Abby Moore	Wood	919 768 9927	abigail.moore@woodplc.com
6.	John Finelli	Dare Co. Planning	252-261-8786	JCF5000@charter.net
7.	Donna Creef	Dare Planning	252-475-5873	donnac@darenc.com
8.	Mesde Gwinn	TONH	703-304-2663	mgwinn13@gmail.com
9.	Casey Howell	TOM	252-473-2133	chowell@manteonc.gov
10.	Wes Haskett	Southern Shores	252-261-2394	whaskett@southernshores-nc.gov
11.	Jim Braithwaite	Duck	252 202-2107	jba@allisholdings.com
12.	Matt Price	Duck	252-256-0550	matt@allisholdings.com
13.	James Wootten	Dare Co EM	475-5894	james.wootten@gmail.com
14.	Kevin Zorc	Manteo	252-256-0726	kzorc@manteonc.gov
15.	Melissa Dickerson	Manteo	252-473-4112	mdickerson@manteonc.gov
16.	Doug Styons	KDH	252-305-1415	doug@styons.net
17.	Holly B White	Nags Head	252-~~449~~-6041	holly.white@nagsheadnc.gov
18.	Joe Heard	Town of Duck	252-255-1234	jheard@townofduck.com
19.	MIKE TALLEY	KITTY HAWK	757 771 8053	mike.talley@kittyhawktown.net
20.	Sandy Cross	Duck	252-~~384~~-3024 255-1234	scross@townofduck.com

Outer Banks Regional Hazard Mitigation Plan
Hazard Mitigation Planning Committee Meeting #4 – Dare

Wednesday, January 8th, 1 PM

21.	~~42.~~	Lora Eddy	The Nature Conservancy Dare SWCD	lora.eddy@tnc.org	
22.	~~43.~~	Meredith Guns	Town of KDH	meredith@kdhnc.com	
23.	~~44.~~	Casey Howell	Town of Manteo	chowell@manteonc.gov	
24.	~~45.~~	Jim Braithwaite	DUCK	JBraithwaite@allisholdings.com	
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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 (Kick-Off) – Dare County	1) Introduction to DMA, CRS, and FMA requirements and the planning process 2) Review of HMPC responsibilities and the project schedule. 3) Review of Hazard Identification 4) Explanation of Mitigation Categories	March 5, 2019	Dare County Admin Building, 954 Marshall C. Collins Drive, Room 168, Manteo
Public Meeting #1 (Kick-Off) – Currituck County		March 6, 2019	Currituck County Senior Center, 130 Community Way, Barco
Public Meeting #2 – Currituck County	1) Introduction to DMA, CRS, and FMA requirements and the planning process 2) Review of HMPC responsibilities and the project schedule. 3) Review of Hazard Identification 4) Explanation of Mitigation Categories	June 4, 2019	Wildlife Center, 1160 Village Lane, Corolla, NC 27927
Public Meeting #2 – Dare County		June 5, 2019	Fessenden Center Annex, 47017 Buxton Back Road, Buxton, NC 27920
Public Meeting #2 – Dare County		June 6, 2019	102 Town Hall Drive, Commissioners Meeting Room, Kill Devil Hills, NC 27948
Public Meeting #3 – Currituck County	1) Review "Draft" Hazard Mitigation Plan 2) Solicit comments and feedback	January 7, 2020	Currituck Courthouse 153 Courthouse Rd, Currituck, NC 27929
Public Meeting #3 – Dare County		January 8, 2020	Fessenden Center 47017 Buxton Back Road, Buxton, NC 27920
Public Meeting #3 – Dare County		January 9, 2020	Jockey's Ride State Park Auditorium 300 W. Carolista Drive, Nags Head, NC 27959

Public Meeting Agendas, Minutes, Sign-in Sheets, and Announcements

Public Meeting 1: March 5, 2019 and March 6, 2019

Outer Banks Regional Hazard Mitigation Plan

Public Meeting 1: Public Kick-Off Meeting

Dare County

Time & Date: Tuesday, March 5, 2019, 6-7 p.m.

Location: Dare County Admin Building, 954 Marshall C. Collins Drive, Room 168, Manteo

Currituck County

Time & Date: Wednesday, March 6, 2019, 6-7 p.m.

Location: Currituck County Senior Center, 130 Community Way, Barco

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
    a. Public Survey
5. Questions
6. Adjourn

Page 1 of 1

Outer Banks Regional Hazard Mitigation Plan

Meeting 1: Public Kick-Off Meeting – Dare
Time & Date: Tuesday, March 5, 2019, 6:00-7:00 p.m.
Location: Dare County Admin Building, 954 Marshall C. Collins Drive, Room 168, Manteo

Introductions

David Stroud and Abby Moore, consultants from Wood, facilitated the meeting. There were 8 attendees recorded on the sign-in sheet, including several HMPC representatives and stakeholders from The Coastland Times and NC Coastal Federation.

Presentation Highlights

David discussed trends in disaster response and recovery and explained reasons to plan. He also 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 consultant team at Wood blends this with the process of the Community Rating System (CRS) Floodplain Management Planning. This completed Hazard Mitigation Plan (HMP) will meet the requirements of all three FEMA programs.

The consultant team and the Hazard Mitigation Planning Committee (HMPC) decided on a list of hazards to profile in the plan based on past plans, historical occurrences, and local knowledge. Based on this discussion, the following hazards will be profiled: Flooding, Hurricane & Coastal Hazards (Erosion, Rip Current, Nor'easter), Severe Winter Weather, Extreme Heat, Earthquake (Tsunami), Wildfire, Drought, Severe Thunderstorm, Hazardous Materials Incident, Terrorism, Cyber Threat, Transportation Infrastructure Failure, and Radiological Incident.

Project Schedule

The anticipated project schedule was presented. The process will include five more public meetings: this Kickoff information will be presented at three public meetings expected to be scheduled for April. The final draft plan will be presented at two public meetings at the end of the process, expected to be scheduled for July.

Plan Website

Abby introduced the website for the planning process, which will be a tool for public outreach with information on throughout the planning process. The website is www.OBX-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 members of the public are encouraged to take the public survey.

Discussion and Adjournment

Following the formal presentation, time was given for a question and answer period.

Outer Banks Regional Hazard Mitigation Plan
Public Meeting #1 – Dare County

Tuesday, March 5th, 6:00 PM

	Name	Organization (resident)	Phone	E-Mail
1.	DAVID STROUD	WOOD	919-325-6499	david.Stroud@woodplc.com
2.	Abby Moore	Wood	919-768-9927	abigail.moore@woodplc.com
3.	DREW PEARSON	DARE EM	252 475 5897	drew.pearson@darenc.com
4.	Donna Creef	Dare Planning	252-475-5873	donnac@darenc.com
5.	Jacazza Jones	NCEM	919 825 2592	jacazza.jones@ncdps.gov
6.	MHGoodlow-Murphy	The Coastland Times	252-987-2656	atmmhgm@aol.com
7.	Casey Howell	Town of Manteo	252 216 0067	howell@townofmanteo.com
8.	Michael Flynn	NC Coastal Federation	252-473-1607	michaelf@nccoast.org
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Outer Banks Regional Hazard Mitigation Plan

Meeting 1: Public Kick-Off Meeting – Currituck
Time & Date: Wednesday, March 6, 2019, 6:00-7:00 p.m.
Location: Currituck County Senior Center, Barco

Introductions

David Stroud and Abby Moore, consultants from Wood, facilitated the meeting. There were 5 attendees recorded on the sign-in sheet, including an HMPC representative and a stakeholder from the Pine Island Audubon Sanctuary.

Presentation Highlights

David discussed trends in disaster response and recovery and explained reasons to plan. He also 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 consultant team at Wood blends this with the process of the Community Rating System (CRS) Floodplain Management Planning. This completed Hazard Mitigation Plan (HMP) will meet the requirements of all three FEMA programs.

The consultant team and the Hazard Mitigation Planning Committee (HMPC) decided on a list of hazards to profile in the plan based on past plans, historical occurrences, and local knowledge. Based on this discussion, the following hazards will be profiled: Flooding, Hurricane & Coastal Hazards (Erosion, Rip Current, Nor'easter), Severe Winter Weather, Extreme Heat, Earthquake (Tsunami), Wildfire, Drought, Severe Thunderstorm, Hazardous Materials Incident, Terrorism, Cyber Threat, Transportation Infrastructure Failure, and Radiological Incident.

Project Schedule

The anticipated project schedule was presented. The process will include five more public meetings: this Kickoff information will be presented at three public meetings expected to be scheduled for April. The final draft plan will be presented at two public meetings at the end of the process, expected to be scheduled for July.

Plan Website

Abby introduced the website for the planning process, which will be a tool for public outreach with information on throughout the planning process. The website is www.OBX-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 members of the public are encouraged to take the public survey.

Discussion and Adjournment

Following the formal presentation, time was given for a question and answer period.

Outer Banks Regional Hazard Mitigation Plan
Public Meeting #1 – Currituck County

Wednesday, March 6th, 6:00 PM

	Name	Organization (resident)	Phone	E-Mail
1.	david. Straud	WOOD	919 325 6497	David. Straud@woodpc.com
2.	Robert Fearn	Pine Island audubon Sanctuary	252 453-0603	RFEARN@audubon.org
3.	Abby Moore	wood	919 708 9927	abigail. moore@woodplc.com
4.	Jacazza Jones	NCEM	919 825 2592	jacazza. jones@ncdps.gov
5.	MaryBeth Newns	Currituck Co.	252-232-2115	mary. newns@currituckcountync.gov
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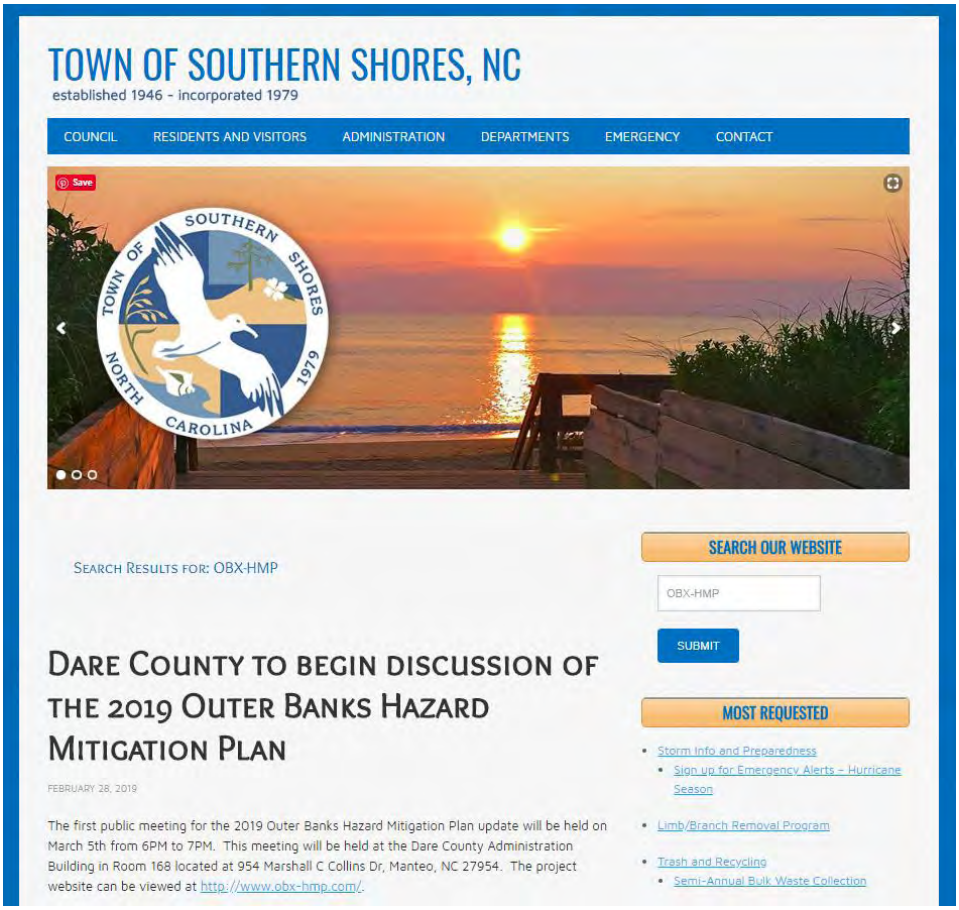
CURRITUCK COUNTY
1668
GOVERNMENT
RESIDENT
DEPARTMENTS
SEARCH
NEWS
PUBLIC MEETING TO DISCUSS REGIONAL HAZARD MITIGATION PLAN
MARCH 1, 2019
RANDALL EDWARDS
A public meeting will be held on March 6, 2019 for the development of the Outer Banks Regional Hazard Mitigation Plan. This meeting will take place at the Currituck County Senior Center, at 6:00 p.m. – 7:00 p.m.
Currituck County is working with Dare County and other partners to develop this regional plan. It will identify and assess the community's natural hazard risks and determine how to best minimize or manage those risks. Public participation is a valuable component of this process and any citizen interested in learning more about the mitigation plan is encouraged to attend.
For more information, contact Currituck County Emergency Management at 252-232-2115.


TOWN OF SOUTHERN SHORES, NC
established 1946 - incorporated 1979
COUNCIL
RESIDENTS AND VISITORS
ADMINISTRATION
DEPARTMENTS
EMERGENCY
CONTACT
SOUTHERN SHORES
TOWN OF
NORTH CAROLINA
1979
SEARCH RESULTS FOR: OBX-HMP
DARE COUNTY TO BEGIN DISCUSSION OF THE 2019 OUTER BANKS HAZARD MITIGATION PLAN
FEBRUARY 28, 2019
The first public meeting for the 2019 Outer Banks Hazard Mitigation Plan update will be held on March 5th from 6PM to 7PM. This meeting will be held at the Dare County Administration Building in Room 168 located at 954 Marshall C Collins Dr, Manteo, NC 27954. The project website can be viewed at http://www.obx-hmp.com/.
SEARCH OUR WEBSITE
OBX-HMP
SUBMIT
MOST REQUESTED
Storm Info and Preparedness
Sign up for Emergency Alerts – Hurricane Season
Limb/Branch Removal Program
Trash and Recycling
Semi-Annual Bulk Waste Collection



TOWN of DUCK
NORTH CAROLINA

? HOW DO I... RESIDENTS VISITORS BUSINESSES EVENTS GOVT REGROUP

Home / News / Kick Off Meeting Scheduled for Updating the Dare County-Currituck County Hazard Mitigation Plan

KICK OFF MEETING SCHEDULED FOR UPDATING THE DARE COUNTY-CURRITUCK COUNTY HAZARD MITIGATION PLAN

MARCH 1 2019 / BETSY TRIMBLE / NEWS

Dare County will host a public meeting on Tuesday, March 5 to kick off the update process for the Dare County-Currituck County Hazard Mitigation Plan. A similar public meeting will be held on Wednesday, March 6 in Currituck County.

Local governments are required to prepare and update hazard mitigation plans in order to be eligible for FEMA disaster relief assistance. Dare County and Currituck County have joined efforts on this latest update. The Towns of Manteo, Nags Head, Kitty Hawk, Kill Devil Hills, Southern Shores and Duck will also be part of the 2020 Hazard Mitigation Update.

One component of the process is the solicitation of public input on hazards that affect our area and appropriate responses to these hazards. The public meeting for Dare County is being held on Tuesday March 5 from 6:00 p.m. to 7:00 p.m. at the Dare County Administration Building, 954 Marshall Collins Drive on Roanoke Island. The Currituck County meeting is being held on Wednesday, March 6 from 6:00 p.m. to 7:00 p.m. at the Currituck County Senior Center located at 130 Community Way in Barco. Citizens and interested parties are invited to attend.

The update process typically takes twelve to eighteen months to complete. Questions about the Dare County Hazard Mitigation process can be directed to Drew Pearson, Dare County Emergency Management Director at 252-475-5897.

Upcoming Events

TUE 03 — ROTATING ART SHOW: "PEOPLE, PETS, AND PLACES" WATERCOLOR BY MARY EDWARDS
March 3 @ 9:00 am - 4:00 pm
Town of Duck First Floor Conf. Room

WED 04 — ROTATING ART SHOW: "PEOPLE, PETS, AND PLACES" WATERCOLOR BY MARY EDWARDS
March 4 @ 9:00 am - 4:00 pm
Town of Duck First Floor Conf. Room

WED 04 — TOWN COUNCIL MEETING
March 4 @ 7:00 pm - 10:00 pm
Paul F. Keller Meeting Hall

THU 05 — ROTATING ART SHOW: "PEOPLE, PETS, AND PLACES" WATERCOLOR BY MARY EDWARDS
March 5 @ 9:00 am - 4:00 pm
Town of Duck First Floor Conf. Room

View More...

How Do I...



Town of Duck
@DuckOBX

Kick off meeting scheduled for updating the Dare County Hazard Mitigation Plan

Kick Off Meeting Scheduled for Updating the Dare County-Cu...
Dare County will host a public meeting on Tuesday, March 5 to kick off the update process for the Dare County-Currituck ...
townofduck.com

10:28 AM · Mar 1, 2019 · Twitter for iPhone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Share
Town of Duck
@townofduck
Home
About
Posts
Events
Photos
YouTube
Videos
E-Newsletter Signup
Reviews
Community
Groups
Create a Page
Town of Duck
March 1, 2019
Local governments are required to prepare and update hazard mitigation plans in order to be eligible for FEMA disaster relief assistance.
One component of the process is the solicitation of public input on hazards that affect our area and appropriate responses to these hazards. The public meeting for Dare County is being held on Tuesday March 5 from 6:00 p.m. to 7:00 p.m. at the Dare County Administration Building, 954 Marshall Collins Drive on Roanoke Island.
For more information please see the Town website below.
TOWN of DUCK
NORTH CAROLINA
TOWNOFDUCK.COM
Kick Off Meeting Scheduled for Updating the Dare County-Currituck County Hazard Mitigation Plan | Town of Duck, No...
5
Like
Comment
Share


Like
Follow
Share
Town of Duck
@townofduck
Home
About
Posts
Events
Photos
YouTube
Videos
E-Newsletter Signup
Reviews
Community
Groups
Create a Page
Town of Duck
March 5, 2019
Tonight is the night! The public meeting for Dare County is being held on Tuesday March 5 from 6:00 p.m. to 7:00 p.m. at the Dare County Administration Building, 954 Marshall Collins Drive on Roanoke Island.
Local governments are required to prepare and update hazard mitigation plans in order to be eligible for FEMA disaster relief assistance.One component of the process is the solicitation of public input on hazards that affect our area and appropriate responses to these hazards.
For more information please see the Town website below.
TOWN of DUCK
NORTH CAROLINA
TOWNOFDUCK.COM
Kick Off Meeting Scheduled for Updating the Dare County-Currituck County Hazard Mitigation Plan | Town of Duck, No...
8
Like
Comment
Share



Town of Duck News
March 4, 2019

Town Council Meeting

The Town Council will hold its regular meeting on Wednesday, March 6, 2019, at 7:00 p.m. in the Paul F. Keller Meeting Hall. This meeting is open to the public and all interested parties are welcome to attend. To view the agenda with links click here. To view without links click here.

Hazard Mitigation Plan Meeting

Dare County will host a public meeting on Tuesday, March 5 from 6:00 - 7:00 p.m.at the Dare County Administrative Building to kick off the update process for the Dare County-Currituck County Hazard Mitigation Plan.

Local governments are required to prepare and update hazard mitigation plans in order to be eligible for FEMA disaster relief assistance. One component of the process is the solicitation of public input on hazards that affect our area and appropriate responses to these hazards.

For more information on this meeting click here.

MEETINGS & EVENTS

Town Council Meeting
Wednesday
7:00 p.m.
March 6, 2019
Learn More

Brown Bag Lunch with Chief Cueto
Tuesday
12:00 p.m.
March 12, 2019
Learn More

Planning Board Meeting
Wednesday
6:30 p.m.
March 13, 2019
Learn More

Rotating Art Show: Photography by Eve Turek and Jeff Lewis
Monday - Friday
9:00 a.m. - 4:00 p.m.
February 1, 2019 - April 24, 2019
Learn More

Brown Bag Lunch With Chief Cueto

Public Meeting 2: June 4, 2019; June 5, 2019; and June 6, 2019

Outer Banks Regional Hazard Mitigation Plan

Public Meeting 2

Dare County

Time & Date: Wednesday, June 5, 2019, 6-7 p.m.
Location: Fessenden Center Annex, 47017 Buxton Back Road, Buxton, NC 27920

Time & Date: Thursday, June 6, 2019, 1-2 p.m.
Location: 102 Town Hall Drive, Commissioners Meeting Room, Kill Devil Hills, NC 27948

Currituck County

Time & Date: Tuesday, June 4, 2019, 1-3 p.m.
Location: Wildlife Center, 1160 Village Lane, Corolla, NC 27927

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. Risk Management Tool
3. Project Schedule
4. Plan Website
    a. Public Survey
5. Questions
6. Adjourn

Page 1 of 1

Outer Banks Regional Hazard Mitigation Plan

Meeting 2: Public Meeting – Currituck
Time & Date: Tuesday, June 4, 2019, 1:00 p.m.
Location: Outer Banks Wildlife Center, Corolla

Introductions

David Stroud and Abby Moore, consultants from Wood, facilitated the meeting. There were 8 attendees recorded on the sign-in sheet.

Presentation Highlights

David discussed trends in disaster response and recovery and explained reasons to plan. He also 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 consultant team at Wood blends this with the process of the Community Rating System (CRS) Floodplain Management Planning. This completed Hazard Mitigation Plan (HMP) will meet the requirements of all three FEMA programs.

The consultant team and the Hazard Mitigation Planning Committee (HMPC) decided on a list of hazards to profile in the plan based on past plans, historical occurrences, and local knowledge. Based on this discussion, the following hazards will be profiled: Flooding, Hurricane and Tropical Storm, Coastal Hazards (Erosion, Rip Current, Nor'easter, Sea Level Rise), Severe Winter Weather, Extreme Heat, Earthquake (Tsunami), Wildfire, Drought, Severe Thunderstorm, Hazardous Materials Incident, Terrorism, Cyber Threat, Transportation Infrastructure Failure, and Radiological Incident.

Project Schedule

The anticipated project schedule was presented. The draft Hazard Identification and Risk Assessment will be presented to the planning committee and posted online for committee and public review in late July. The final draft plan will be presented in September, and additional public meetings will be held to gather public feedback.

Plan Website

Abby introduced the website for the planning process, which will be a tool for public outreach with information on throughout the planning process. The website is www.OBX-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 members of the public are encouraged to take the public survey, which will close on June 14th.

Discussion and Adjournment

Following the presentation, a question was raised regarding the inclusion of emergency management and evacuation procedures in the plan. It was noted that this plan seeks to address hazards in the pre-event phase as opposed to response, but that the planning committee may develop some mitigation actions related to emergency services.

Outer Banks Regional Hazard Mitigation Plan
Public Meeting #2 – Currituck County

Tuesday, June 4th, 1:00 PM

	Name	Organization (resident)	Phone	E-Mail
1.	E.T. SMITH	RESIDENT	703-505-4100	ET2537@ICLOUD.COM
2.	TIM KESLER	DOMINION ENERGY	804.920.4387	tim.kesler@dominionenergy.com
3.	JENNIE TURNER	CURRITUCK CO.	252-232-6031	jennie.turner@currituckcountync.gov
4.	David Pergerson	Caroline Designs Realty	252. 261. 3934	david.pergerson@carolinadesigns.com
5.	KIMBERLY ENDLE	Resort Realty	252-202 3696	Kimberly.endle@gmail.com
6.	DAVID STROUD	WOOD	919-325-6497	david.stroud@woodpc.com
7.	Rebecca Ray	Currituck County EM	252-232-2115	rebecca.ray@currituckcountync.gov
8.	Mary Beth Newns	Currituck County EM	252-232-2115	mary-beth.newns@currituckcountync.gov
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Outer Banks Regional Hazard Mitigation Plan

Meeting 2: Public Meeting – Dare, Buxton
Time & Date: Wednesday, June 5, 2019, 6:00 p.m.
Location: Fessenden Center Annex, Buxton

Introductions

Drew Pearson, Dare County Emergency Management Director, kicked off the meeting with a brief introduction and a discussion of the importance of hazard mitigation planning. David Stroud and Abby Moore, consultants from Wood, facilitated the rest of the meeting. There were 14 attendees recorded on the sign-in sheet.

Presentation Highlights

David discussed trends in disaster response and recovery and explained reasons to plan. He also 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 consultant team at Wood blends this with the process of the Community Rating System (CRS) Floodplain Management Planning. This completed Hazard Mitigation Plan (HMP) will meet the requirements of all three FEMA programs.

The consultant team and the Hazard Mitigation Planning Committee (HMPC) decided on a list of hazards to profile in the plan based on past plans, historical occurrences, and local knowledge. Based on this discussion, the following hazards will be profiled: Flooding, Hurricane and Tropical Storm, Coastal Hazards (Erosion, Rip Current, Nor'easter, Sea Level Rise), Severe Winter Weather, Extreme Heat, Earthquake (Tsunami), Wildfire, Drought, Severe Thunderstorm, Hazardous Materials Incident, Terrorism, Cyber Threat, Transportation Infrastructure Failure, and Radiological Incident.

Project Schedule

The anticipated project schedule was presented. The draft Hazard Identification and Risk Assessment will be presented to the planning committee and posted online for committee and public review in late July. The final draft plan will be presented in September, and additional public meetings will be held to gather public feedback.

Plan Website

Abby introduced the website for the planning process, which will be a tool for public outreach with information on throughout the planning process. The website is www.OBX-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 members of the public are encouraged to take the public survey, which will close on June 14th.

Discussion and Adjournment

- Someone asked whether mosquitos were considered as a hazard for inclusion in the plan, related to infectious disease from the State plan. David noted that many local health departments address this hazard and that it's difficult to handle through mitigation, as any amount of standing water can allow mosquito breeding. Drew noted that drainage issues would be addressed relative to the flood hazard and that aside from drainage improvements, little mitigation can be done.
- Another public health concern was raised related to septic systems.
- Someone expressed concern that large developments were being approved that would cause runoff and negatively impact drainage issues.
- There was discussion regarding concerns that a major hurricane will cut off Buxton and Frisco from the rest of the island. Someone asked whether the HMPC or emergency management have considered this issue and what can be done, such as provision of ferry docks for emergency evacuation or supplies. Drew responded that this issue is regularly discussed by emergency management but that the water is too shallow for ferry access. He stressed the importance of heeding evacuation orders because it may be a long time before resources can be provided to the area following a major event.

Outer Banks Regional Hazard Mitigation Plan
Public Meeting #2 – Dare County

Wednesday, June 5th, 6:00 PM

	Name	Organization (resident)	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.	Millie Griffin	Wood	252 995 0135	milliegriffin@yahoo.com
4.	Judy SWARTWOOD	HICERT	252 305 1508	manicblackcat@yahoo.com
5.	LARRY Ogden	HICERT	252 995 2034	larrybeach@yahoo.com
6.	Joy Crist	Island Free Press	252 995 6959	joy@islandfreepress.org
7.	Chip Hammack	Cape Hatteras Electric	252-995-5616	chiph@chec.coop
8.	Donna Creef	DC Planning	252-475-5873	donnac@dcnc.com
9.	Drew Pearsom	DC Emer. Mgr	252-475-5897	drew.pearsm@dcnc.com
10.	Elizabeth B. Fox	HICERT	252-995-5020	liz23@hiwr.us
11.	WILLIE MATHIS	HI CERT	404 317 8186	warmat@embarqmail.com
12.	Lou BROWNING	Radio Hatteras	252-475-4217	LouB@HIWR.US
13.	Misty Gidlikin	HI Cert	757-575-2172	obxmisty1@gmail.com
14.	KEVIN Toohey	HI CERT	252 489 6313	KTATTHEBEACH@GMAIL.COM
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Outer Banks Regional Hazard Mitigation Plan

Meeting 2: Public Meeting – Dare, Kill Devil Hills
Time & Date: Thursday, June 6, 2019, 1:00 p.m.
Location: Kill Devil Hills Town Hall Meeting Room

Introductions

Drew Pearson, Dare County Emergency Management Director, kicked off the meeting with a brief introduction and a discussion of the importance of hazard mitigation planning. David Stroud and Abby Moore, consultants from Wood, facilitated the rest of the meeting. There were 22 attendees recorded on the sign-in sheet.

Presentation Highlights

David discussed trends in disaster response and recovery and explained reasons to plan. He also 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 consultant team at Wood blends this with the process of the Community Rating System (CRS) Floodplain Management Planning. This completed Hazard Mitigation Plan (HMP) will meet the requirements of all three FEMA programs.

The consultant team and the Hazard Mitigation Planning Committee (HMPC) decided on a list of hazards to profile in the plan based on past plans, historical occurrences, and local knowledge. Based on this discussion, the following hazards will be profiled: Flooding, Hurricane and Tropical Storm, Coastal Hazards (Erosion, Rip Current, Nor'easter, Sea Level Rise), Severe Winter Weather, Extreme Heat, Earthquake (Tsunami), Wildfire, Drought, Severe Thunderstorm, Hazardous Materials Incident, Terrorism, Cyber Threat, Transportation Infrastructure Failure, and Radiological Incident.

Project Schedule

The anticipated project schedule was presented. The draft Hazard Identification and Risk Assessment will be presented to the planning committee and posted online for committee and public review in late July. The final draft plan will be presented in September, and additional public meetings will be held to gather public feedback.

Plan Website

Abby introduced the website for the planning process, which will be a tool for public outreach with information on throughout the planning process. The website is www.OBX-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 members of the public are encouraged to take the public survey, which will close on June 14th.

Discussion and Adjournment

- There was a question on disaster costs and discussion on the additional costs that are not accounted for in these numbers. (The costs in the presentation were stated to be FEMA relief costs, however the presented numbers actually show total estimated costs including federal, state, local, and individual costs as well as economic impacts. However, these estimates are still likely an underestimate of actual estimated impacts.)
- In reviewing data sources for the risk assessment, it was noted that many costs are not accounted for in insurance estimates. For example, damages to piers and docks are generally not reported or covered by insurance but occur frequently and can be substantial The group discussed that permits may be a source of data on the cost to rebuild piers/docks but that gathering and analyzing this data may be outside the scope of this assessment. However, the planning team can use this public input to supplement quantitative data on losses and provide a more complete picture of estimated losses.

Outer Banks Regional Hazard Mitigation Plan Update
Dare HMPC Meeting 2 – Kill Devil Hills

Page **1** of **1**

Outer Banks Regional Hazard Mitigation Plan
Public Meeting #2 – Dare County

Thursday, June 6th, 1:00 PM

	Name	Organization (resident)	Phone	E-Mail
1.	Joe Wilson	Resident	276 245 6757	josephlwatt@aol.com
2.	Linda Wilson	OBWC	276 245-6752	lmww@aol.com
3.	DAVID STROUD	WOOD	919 325 6497	david.Stroud@woodpgc.com
4.	Donna Creef	DC Planning	252-475-5873	donnac@darenc.com
5.	NOAH GILLAM	DC PLANNING	252-475-5849	noah.gillam@darenc.com
6.	Ed Snyder	Nags Head	804-720-6302	ed.snyder@nagsheadnc.gov
7.	Colleen Kakretz	The Outer Banks Hospital	252 449-5813	ckakretz@theobh.com
8.	J.M KRANDA	OBRA	7036242927	JKRANDA@GMAIL.COM
9.	George Bery	OBRA-SS	703-473-0528	georgeatobx@gmail.com
10.	BRET DOMAN	FMC HEALTH	252-675-1846	BRETDOMAN06@MAIL.com
11.	RICHARD JONES	KDH RETIRED	757-344-0658	rmaj73@gmail.com
12.	DENNIS POTTL	KDH	540-395-9812	ILAANDDEN8@GMAIL.COM
13.	TIM KESLER	DOMINION ENERGY	804 920 4387	tim.kesler@dominionenergy.com
14.	Tommy Irving	Dominion ENERGY	757-647-9954	Thomas.L.Irving@DominionEnergy.com
15.	Michael Flynn	NC Coastal Federation	252-473-1607	michaelf@nccoast.org
16.	Duane Tuberville	OBRA	252-489-8078	N1PLV@aol.com
17.	KEN DAIDONE	OBRA	252-423-5000	KDAIDONE7@GMAIL.COM
18.	Meredith Gums	Town KDH	252 449-5318	
19.	Colleen Shriver	OBAR	252-305-4585	Colleen@sunandsea.com
20.	Steve Kovac	Dare Co. EM/FM	252-475-5750	steve.kovac@darenc.com

Outer Banks Regional Hazard Mitigation Plan
Public Meeting #2 – Dare County

Thursday, June 6th, 1:00 PM

	Name	Organization	Phone	E-Mail
21.	Drew Pearson	Dare Co	—	—
22.	Abby Moore	Wood	919-768-9927	abigail.moore@woodplc.com
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Kill Devil Hills
North Carolina
Search...
Government
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Feature Links
Chapter 151. Flood Damage Prevention Ordinance
Community Rating System
Construction
FEMA Issued Flood Maps
FEMA Flood Resources
FEMA Flood Insurance Information
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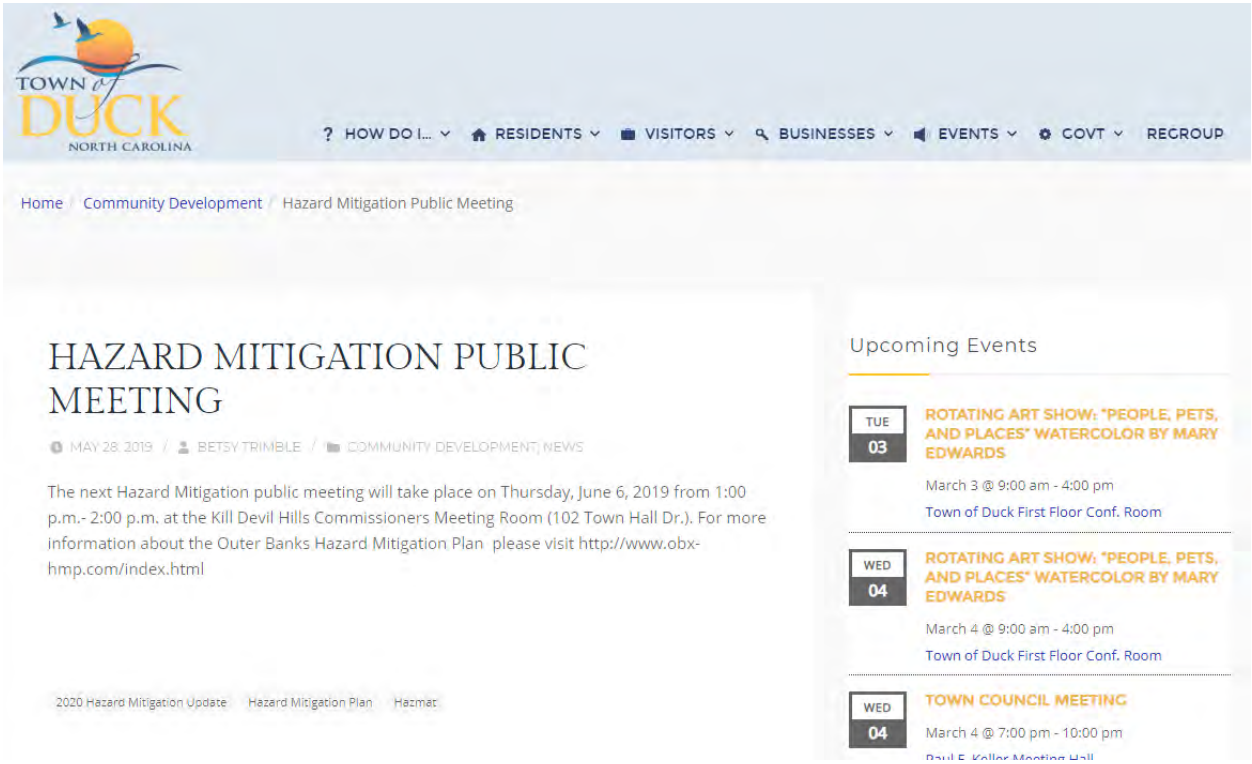
Flood Issues - Board of Commissioners Meetings
Personal Preparedness and Protection
Turn Around, Don't Drown!
Home › Feature Links › Flood Prevention Information & Maps
Flood Prevention, Protection, Maps & Other Flood-Related Information
HAZARD MITIGATION ACTION PLAN
Local governments are required to prepare and update hazard mitigation plans in order to be eligible for FEMA disaster relief assistance.
The next Hazard Mitigation public meeting will take place on Thursday, June 6, 2019 from 1:00 p.m.- 2:00 p.m. at the Kill Devil Hills Commissioners Meeting Room (102 Town Hall Dr.). For more information about the Outer Banks Hazard Mitigation Plan, please visit: http://www.obx-hmp.com/index.html


TOWN of DUCK
NORTH CAROLINA
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RESIDENTS
VISITORS
BUSINESSES
EVENTS
GOVT
REGROUP
Home / Community Development / Hazard Mitigation Public Meeting
HAZARD MITIGATION PUBLIC MEETING
MAY 28, 2019 / BETSY TRIMBLE / COMMUNITY DEVELOPMENT, NEWS
The next Hazard Mitigation public meeting will take place on Thursday, June 6, 2019 from 1:00 p.m.- 2:00 p.m. at the Kill Devil Hills Commissioners Meeting Room (102 Town Hall Dr.). For more information about the Outer Banks Hazard Mitigation Plan please visit http://www.obx-hmp.com/index.html
2020 Hazard Mitigation Update
Hazard Mitigation Plan
Hazmat
Upcoming Events
TUE 03
ROTATING ART SHOW: "PEOPLE, PETS, AND PLACES" WATERCOLOR BY MARY EDWARDS
March 3 @ 9:00 am - 4:00 pm
Town of Duck First Floor Conf. Room
WED 04
ROTATING ART SHOW: "PEOPLE, PETS, AND PLACES" WATERCOLOR BY MARY EDWARDS
March 4 @ 9:00 am - 4:00 pm
Town of Duck First Floor Conf. Room
WED 04
TOWN COUNCIL MEETING
March 4 @ 7:00 pm - 10:00 pm

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Town of Duck
May 28, 2019 ·

Local governments are required to prepare and update hazard mitigation plans in order to be eligible for FEMA disaster relief assistance.

The next Hazard Mitigation public meeting will take place on Thursday, June 6, 2019 from 1:00 p.m.- 2:00 p.m. at the Kill Devil Hills Commissioners Meeting Room (102 Town Hall Dr.). For more information about the Outer Banks Hazard Mitigation Plan see below.



OBX-HMP.COM
Outer Banks Regional Hazard Mitigation Plan
Welcome to the website for the 2019 Outer Banks Hazard Mitigation Plan...

Town of Duck News
June 3, 2019

Town Council Meeting

The Town Council will hold its regular meeting on Wednesday, June 5 at 7:00 p.m. in the Paul F. Keller Meeting Hall. This meeting is open to the public and all interested parties are welcome to attend. To view the agenda with links click here. To view without links click here.

Duck Beach FAQs

With many recent questions about beach access in Duck, a list of FAQs has been placed on the homepage of the website: townofduck.com.

Hazard Mitigation Public Meeting

The next Hazard Mitigation public meeting will take place on Thursday, June 6, 2019 from 1:00 p.m.- 2:00 p.m. at the Kill Devil Hills Commissioners Meeting Room (102 Town Hall Dr.). For more information about the Outer Banks Hazard Mitigation Plan click here.

MEETINGS & EVENTS

Town Council Meeting
Wednesday
7:00 p.m.
June 5, 2019
Learn More

Hazard Mitigation Public Meeting
Thursday
1:00 p.m.
June 6, 2019
Learn More

Yoga on the Green
Tuesday
7:30 a.m.
June 11, 2019
Learn More

Movies on the Green-
The Sword in the Stone
Tuesday
8:30 p.m.
June 11, 2019
Learn More

Dynamic Flow on the Green
Wednesday
7:30 a.m.
June 12, 2019
Learn More



DARE COUNTY HAZARD MITIGATION PLAN PUBLIC MEETING

MAY 31, 2019 (EDIT)

The next Dare County Hazard Mitigation public meeting will take place on Thursday, June 6, 2019 from 1:00 p.m.- 2:00 p.m. at the Kill Devil Hills Commissioners Meeting Room (102 Town Hall Dr.). For more information about the Outer Banks Hazard Mitigation Plan please visit http://www.obx-hmp.com/index.html.

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- Storm Info and Preparedness
  - Sign up for Emergency Alerts – Hurricane Season
  - APPLY FOR A REENTRY PERMIT
- Limb/Branch Removal Program



OUTER BANKS REGIONAL HAZARD MITIGATION PLAN UPDATE MEETINGS FOR PUBLIC

MAY 31, 2019 (EDIT)

Outer Banks Regional Hazard Mitigation Plan Update Meetings for Public

FILED UNDER: NEWS, PUBLIC NOTICES ARCHIVE

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SUBMIT

MOST REQUESTED

- Storm Info and Preparedness
  - Sign up for Emergency Alerts – Hurricane Season
  - APPLY FOR A REENTRY PERMIT
- Limb/Branch Removal Program

Public Meeting 3: January 7, 2020; January 8, 2020; and January 9, 2020

Outer Banks Regional Hazard Mitigation Plan

Public Meeting 3

Currituck County

Time & Date: Tuesday, January 7, 2020, 5 p.m.
Location: Currituck Courthouse Commissioners' Meeting Room, 153 Courthouse Road, Currituck, NC 27929

Dare County

Time & Date: Wednesday, January 8, 2020, 5 p.m.
Location: Fessenden Center Annex, 47017 Buxton Back Road, Buxton, NC 27920

Time & Date: Thursday, January 9, 2020, 10 a.m.
Location: Jockey's Ridge State Park Auditorium, located at 300 W. Carolista Drive, Nags Head, NC 27959

Agenda

1. Planning Process Review
2. Structure of the Plan Document
3. Review of Key Plan Components
    a. Hazards & Priority Risk Index
    b. Goals & Objectives
    c. Mitigation Actions
4. Plan Implementation and Maintenance
5. Next Steps
6. Questions
7. Adjourn

Page 1 of 1

Outer Banks Regional Hazard Mitigation Plan
Public Meeting #3 – Currituck County

Tuesday, January 7th, 5:00 PM

	Name	Organization (resident)	Phone	E-Mail
1.	DAVID STROUD	WOOD	919-325-6497	david.stroud@woodplc.com
2.	Abby MOORE	Wood	919-768-9927	abigail.moore@woodplc.com
3.	JASON LITTERAL	Currituck County	252-232-6052	jason.litteral@currituckcountync.gov.
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Outer Banks Regional Hazard Mitigation Plan
Public Meeting #3 – Dare County

Wednesday, January 8th, 5:00 PM

	Name	Organization (resident)	Phone	E-Mail
1.	Abby Moore	Wood	919 768 9927	abigail.moore@woodplc.com
2.	Drew Pearson	Dare County EM	252 475 5897	drew.pearson@dare.co
3.	Donna Creef	Dare County		
4.	M H Goodlee-Murphy	The Coastland Times	252-987-1303	atmmhgm@aol.com
5.	Sarah Rich	Island Free Press	540-406-0592	rich.sarah@gmail.com
6.	Elaine Whitaker	NC 12 Realty	252-475-0642	elaine@nc12realty.com
7.	Sue West	Resident	410-708-5498	dougdwest@gmail.com
8.	Doug West	resident	"	"
9.	KAREN Scroggin	resident	252-995-3094	hkscroggin@gmail
10.	JAYSON COLLIER	RESIDENT	252-565-7200	JAYSON@HT-CALIBER.COM
11.	Brooks Wadsworth	NCEM		
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Outer Banks Regional Hazard Mitigation Plan
Public Meeting #3 – Dare County

Thursday, January 9th, 10:00 AM

	Name	Organization (resident)	Phone	E-Mail
1.	Abby Moore	Wood	919 768 9927	abigail.moore@woodplc.com
2.	JB Heal		252-473-7832	jbheadiii@gmail.com
3.	DAVID STRAUD	WOOD	919 325 6497	david.Straud@woodplc.com
4.	Danielle Puleo	Coastland Times	484 809 5622	danielle.puleo@thecoastlandtimes.com
5.	Michael Flynn	NC Coastal Federation	252-473-1607	michaelf@nccoast.org
6.	James Wooten	DC EM	475-5894	james.wooten@gmail.com
7.	Jim Bailey	Ham Radio	252-480-3065	N4ACT@earthlink.net
8.	Lorelei Costa	OBX Community Fdn	261-8839	LCOSTA@obcf.org
9.	MATT WALKER	MILEPOST	202-603	r.matt.walker@gmail.com
10.	Donna Creef	DC Planning	252-475-5873	donnac@darenc.com
11.	Holly White	Town of Nags Head	252 449 6041	holly.white@nagsheadnc.gov
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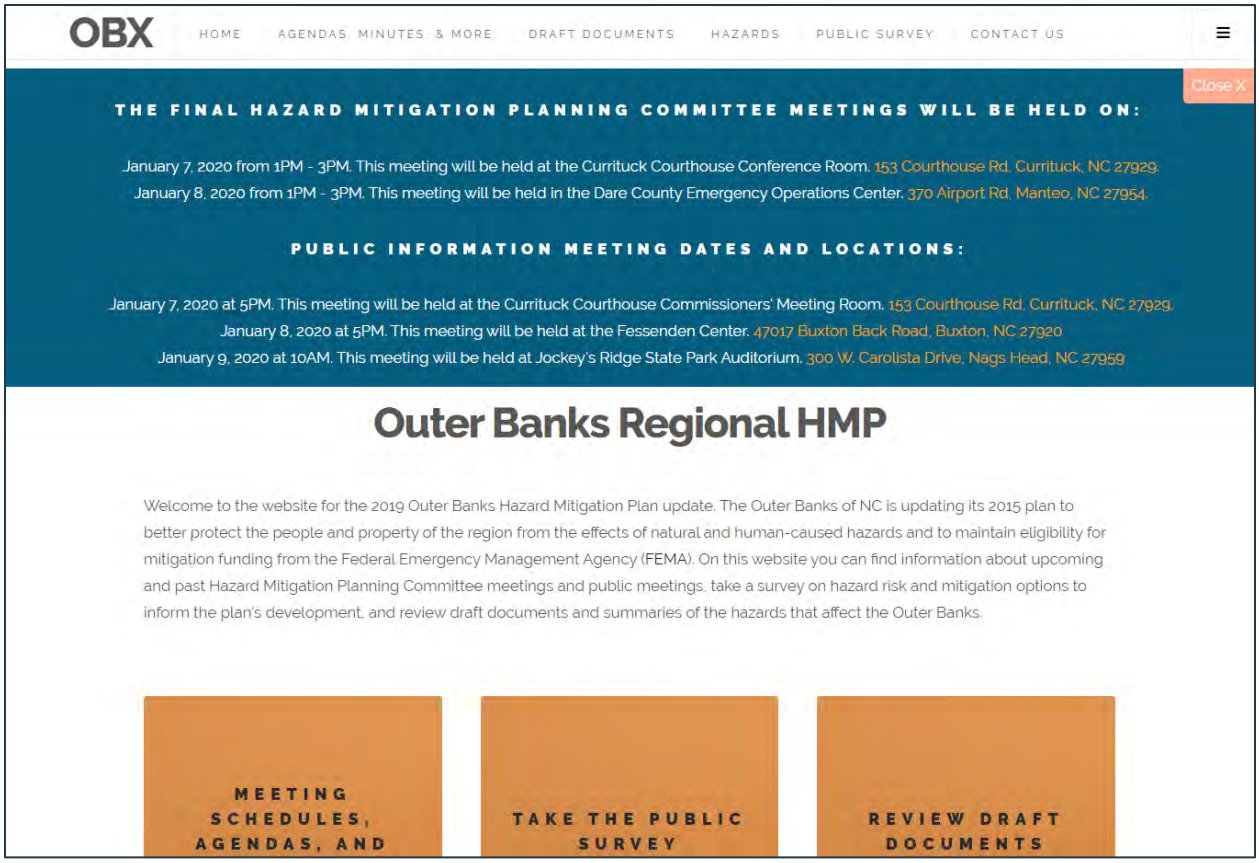
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PUBLIC SURVEY
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THE FINAL HAZARD MITIGATION PLANNING COMMITTEE MEETINGS WILL BE HELD ON:
January 7, 2020 from 1PM - 3PM. This meeting will be held at the Currituck Courthouse Conference Room. 153 Courthouse Rd, Currituck, NC 27929.
January 8, 2020 from 1PM - 3PM. This meeting will be held in the Dare County Emergency Operations Center. 370 Airport Rd, Manteo, NC 27954.
PUBLIC INFORMATION MEETING DATES AND LOCATIONS:
January 7, 2020 at 5PM. This meeting will be held at the Currituck Courthouse Commissioners' Meeting Room. 153 Courthouse Rd, Currituck, NC 27929.
January 8, 2020 at 5PM. This meeting will be held at the Fessenden Center. 47017 Buxton Back Road, Buxton, NC 27920
January 9, 2020 at 10AM. This meeting will be held at Jockey's Ridge State Park Auditorium. 300 W. Carolista Drive, Nags Head, NC 27959
Outer Banks Regional HMP
Welcome to the website for the 2019 Outer Banks Hazard Mitigation Plan update. The Outer Banks of NC is updating its 2015 plan to better protect the people and property of the region from the effects of natural and human-caused hazards and to maintain eligibility for mitigation funding from the Federal Emergency Management Agency (FEMA). On this website you can find information about upcoming and past Hazard Mitigation Planning Committee meetings and public meetings, take a survey on hazard risk and mitigation options to inform the plan's development, and review draft documents and summaries of the hazards that affect the Outer Banks.
MEETING SCHEDULES, AGENDAS, AND
TAKE THE PUBLIC SURVEY
REVIEW DRAFT DOCUMENTS


OUTER BANKS HAZARD MITIGATION PLAN FINAL PUBLIC MEETING DATES
JANUARY 2, 2020 (EDIT)
OUTER BANKS HAZARD MITIGATION PLAN FINAL PUBLIC MEETING DATES
DARE AND CURRITUCK COUNTIES ARE HOLDING THREE FINAL MEETINGS TO DISCUSS THE FINAL DRAFT PLAN.
Dare and Currituck Counties are nearing the final stages of updating the Outer Banks Regional Hazard Mitigation Plan. The Counties' participation is required in order to maintain eligibility for future pre and post-disaster grant funding from FEMA. The planning effort has helped both Counties and incorporated communities identify hazard risks, understand vulnerability, and develop ways to proactively mitigate this risk. Past public meetings were held in March and June. Those meeting shared information on the planning process, the identified hazards, and provided opportunities for the public to be involved and provide feedback.
The final public meetings will be held as follows:
Tuesday, January 7 at 5 p.m. at the Currituck Courthouse Commissioners' Meeting Room, located at 153 Courthouse Road, Currituck, NC 27929
Wednesday, January 8 at 5 p.m. at the Fessenden Center Annex, located at 47017 Buxton Back Road, Buxton, NC 27920
Thursday, January 9 at 10 a.m. at Jockey's Ridge State Park Auditorium, located at 300 W. Carolista Drive, Nags Head, NC 27959
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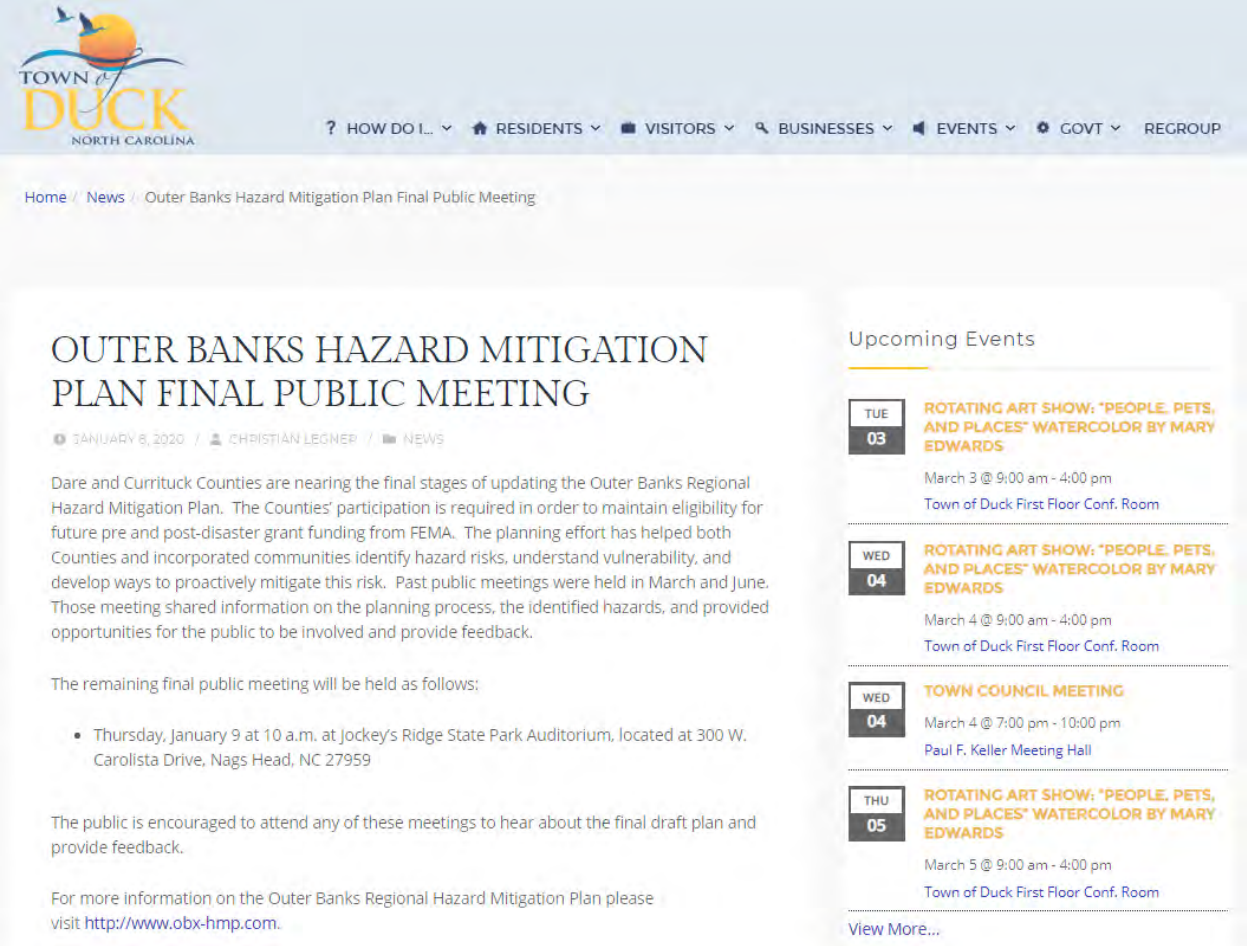
Storm Info and Preparedness
Sign up for Emergency Alerts – Hurricane Season
APPLY FOR A REENTRY PERMIT
Limb/Branch Removal Program
Trash and Recycling
Semi-Annual Bulk Waste Collection
Public Works Project Information
Pothole?
Beach Access Parking
Financial Documents
Council Meeting Schedule
Minutes, Resolutions & Ordinances (Council and Committees)



TOWN of DUCK
NORTH CAROLINA

? HOW DO I... RESIDENTS VISITORS BUSINESSES EVENTS GOVT REGROUP

Home / News / Outer Banks Hazard Mitigation Plan Final Public Meeting

OUTER BANKS HAZARD MITIGATION PLAN FINAL PUBLIC MEETING

JANUARY 8, 2020 / CHRISTIAN LEGNER / NEWS

Dare and Currituck Counties are nearing the final stages of updating the Outer Banks Regional Hazard Mitigation Plan. The Counties' participation is required in order to maintain eligibility for future pre and post-disaster grant funding from FEMA. The planning effort has helped both Counties and incorporated communities identify hazard risks, understand vulnerability, and develop ways to proactively mitigate this risk. Past public meetings were held in March and June. Those meeting shared information on the planning process, the identified hazards, and provided opportunities for the public to be involved and provide feedback.

The remaining final public meeting will be held as follows:

- Thursday, January 9 at 10 a.m. at Jockey's Ridge State Park Auditorium, located at 300 W. Carolista Drive, Nags Head, NC 27959

The public is encouraged to attend any of these meetings to hear about the final draft plan and provide feedback.

For more information on the Outer Banks Regional Hazard Mitigation Plan please visit http://www.obx-hmp.com.

Upcoming Events

TUE 03 — ROTATING ART SHOW: "PEOPLE, PETS, AND PLACES" WATERCOLOR BY MARY EDWARDS
March 3 @ 9:00 am - 4:00 pm
Town of Duck First Floor Conf. Room

WED 04 — ROTATING ART SHOW: "PEOPLE, PETS, AND PLACES" WATERCOLOR BY MARY EDWARDS
March 4 @ 9:00 am - 4:00 pm
Town of Duck First Floor Conf. Room

WED 04 — TOWN COUNCIL MEETING
March 4 @ 7:00 pm - 10:00 pm
Paul F. Keller Meeting Hall

THU 05 — ROTATING ART SHOW: "PEOPLE, PETS, AND PLACES" WATERCOLOR BY MARY EDWARDS
March 5 @ 9:00 am - 4:00 pm
Town of Duck First Floor Conf. Room

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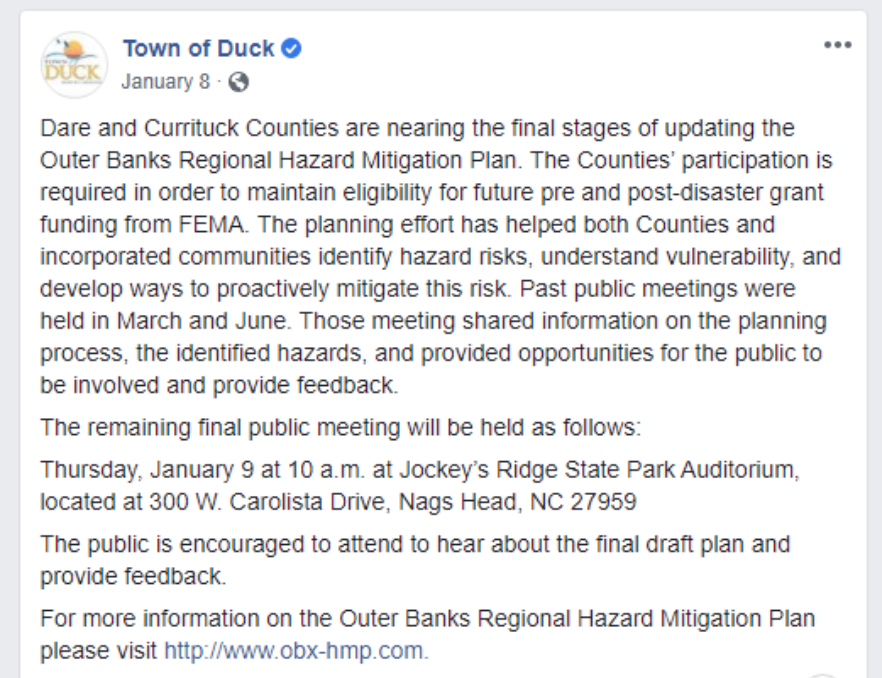

Town of Duck
January 8 ·

Dare and Currituck Counties are nearing the final stages of updating the Outer Banks Regional Hazard Mitigation Plan. The Counties' participation is required in order to maintain eligibility for future pre and post-disaster grant funding from FEMA. The planning effort has helped both Counties and incorporated communities identify hazard risks, understand vulnerability, and develop ways to proactively mitigate this risk. Past public meetings were held in March and June. Those meeting shared information on the planning process, the identified hazards, and provided opportunities for the public to be involved and provide feedback.

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For more information on the Outer Banks Regional Hazard Mitigation Plan please visit http://www.obx-hmp.com.

Official E-Newsletter of the Town of Duck View this email in your browser



TOWN of DUCK
NORTH CAROLINA

Town of Duck News
January 6, 2020

Hazard Mitigation Plan Public Meeting Dates

Dare and Currituck Counties are nearing the final stages of updating the Outer Banks Regional Hazard Mitigation Plan. The Counties' participation is required in order to maintain eligibility for future pre and post-disaster grant funding from FEMA. The public is encouraged to attend any of the meetings to hear about the final draft plan and provide feedback.

For more information, click here.

Tuesday, January 7, 5 p.m.
Currituck Courthouse

Wednesday, January 8, 5 p.m.
Fessenden Center Annex, Buxton

Thursday, January 9, 10 a.m.
Jockey's Ridge State Park

Draft Plan Outreach

(https://islandfreepress.org/)

Hazard Mitigation Plan Draft Calls for Locals' Feedback

January 10, 2020 (/2020/01/) | Local News (https://islandfreepress.org/./outer-banks-news/) | By: Sarah Rich (https://islandfreepress.org/author/sarah-allman/)

Resiliency planners with Wood, a company which offers contract-based solutions in energy and environmental markets, convened a public Hazard Mitigation Plan meeting on Wednesday night, January 8, in Buxton to encourage feedback from locals on the plan's current draft.



Photo by Don Bowers

For the past year, both Dare and Currituck counties have made moves to create a Hazard Mitigation plan which meets both FEMA's code of federal regulations and the needs of local citizens.

Created and approved by a Hazard Mitigation Plan Committee (HMPC), the draft covers the weather events likely to occur in Dare County, the impact they might have, and the steps to be taken to diminish their effects.

In order to create such a plan, Wood representatives Abby Moore and David Stroud collected extensive data on factors such as geography and environment, population and demographics, and housing and employment, which they hope will give an accurate picture of life in Dare County. While data from Currituck is included in the plan, the information is broken down by jurisdiction, with Hatteras Island included under the umbrella of unincorporated Dare County.

FEMA requires that each region update its Hazard Mitigation Plan every five years in order to qualify for federal assistance in the event of a disaster.

Some of the mitigation strategies included in the plan are a continuance of the old plan, such as allocating more funds to improve stormwater drainage and preparations for flooding. Others, like reducing dune erosion with the implementation of natural barriers, are new and could have a greater effect on life on the Outer Banks.

In order to finalize the draft of Dare County's hazard mitigation plan, Moore and Stroud are continuing to ask for public comments and feedback via email.

Moore and Stroud have already divulged some of the public's thought via a 10-question survey, located on the HMP website, Moore and Stroud sought an understanding of locals' main concerns regarding weather-related devastation, and the results of the survey can still be reviewed online at www.obx-hmp.com (http://www.obx-hmp.com).

Moore and Stroud's survey received a total of 853 responses. Hurricanes were, of course, considered the greatest risk of living in Dare County, followed by flooding, tornadoes, high winds, and erosion. In the write-in section of the survey, some of the most frequently mentioned issues were sea level rise and flooding. 92% of the responses were found to have been from Dare County residents. Although the survey has closed, Moore, Stroud, and Dare County officials want to encourage the public to continue submitting their comments in order to further the draft to public needs.

"If we don't know what you think, we can't make the right decisions," Dare County Emergency Management Director Drew Pearson said.

Once Moore and Stroud get this information, they will include it in the plan's final draft which they will then submit to the state government. The state then submits it for FEMA approval. Once FEMA approves, the plan is adopted and each jurisdiction takes measures to implement it. The implementation of a new Hazard Mitigation Plan not only promises to lower flood insurance rates and increase assistance from FEMA, but also protect locals from future hazards.

"We hope to reduce lives lost not only during storms, but year round," Pearson said.

To read the full draft of the Hazard Mitigation Plan go to www.obx-hmp.com (http://www.obx-hmp.com). Although the survey has closed, the public is encouraged to continue submitting their comments and suggestions up until January 30, 2020. To do so, utilize the email link on the main survey page at http://www.obx-hmp.com/Survey.html (http://www.obx-hmp.com/Survey.html).

To receive individual assistance for damage incurred from Hurricane Dorian, call the state government at 919-825-2378.

Draft hazard mitigation plan out for review



(https://www.thecoastlandtimes.com/author/maryhelengoodloemurphy/)
By Mary Helen Goodloe-Murphy (https://www.thecoastlandtimes.com/author/maryhelengoodloemurphy/)
Email the author (mailto:maryhelengoodloemurphy@thecoastlandtimes.com)

Published 1:57 pm Monday, January 27, 2020

A draft of the 2020 Hazardous Mitigation Plan for Dare and Currituck counties is now out for review and public comment.

The plan includes the incorporated towns in Dare County.

"This planning process is required to remain eligible for FEMA disaster funding and to help the Outer Banks region to become more disaster-resistant through implementation of sound mitigation projects," states a media release from Dare County.

The plan is rewritten every five years.

Public comment on the plan is due by Jan. 31, 2020 to www.obx-hmp.com (http://www.obx-hmp.com/).

In Section 7 of the plan, mitigation action plans by county are detailed. For Dare County, 31 actions and for Currituck, 29 actions are listed for implementation during the ensuing five years.

For Dare's incorporated towns, Duck lists 27 actions; Kill Devil Hills 27; Kitty Hawk 15, Manteo 22, Nags Head 25 and Southern Shores 24.

The actions are divided into five sectors: Prevention, Property Protection, Natural Resource Protection, Structural Projects and Public Education and Awareness.

Each action is designated by Hazard Addressed, Goal Addressed, Priority, Lead Agency/Department, Potential Funding Source, Implementation Timeline, 2020 Status and Comments. Some actions are carried over from the previous plan.

Under Priority, the actions are in three categories:

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. For Dare County, 21 actions are considered high priority; for Currituck, 16 are high priority.

Medium Risk – Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster. Seven actions are rated medium in Dare's list; 13 are rated moderate priority in Currituck's.

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

In the Dare plan, three low priority actions are included. The Currituck plan has no low priority actions.

As to funding actions for Dare County, the General Fund would be tapped for 15 actions, grants would fund seven actions and a combination of grants and general fund monies would address nine actions.

For Currituck County, the General Fund would pay for 19 actions, a combination of grant and general fund monies would address four actions and a grant would fund one. Other sources would be occupancy tax, NCDOT and Turnpike Authority.

The action plan assigns lead agencies for addressing each action. For Dare County, the planning department is the lead department on 13 actions and emergency management on nine actions. Other departments involved are the Dare County Sheriff's Office, information technology, fire marshal, Soil and Water Conservation Board, water department. Outside agencies with assignment include National Park Service, U.S. Fish and Wildlife Service, N.C. Forestry Service, NCDOT and National Weather Service.

For Currituck County, the planning department is the lead agency on 16 actions; emergency management on six; public safety agencies on three; and fire marshal, social services, public works and engineering on one each.

For a copy of the draft plan and to make comment, go to http://www.obx.hmp.com (http://www.obx.hmp.com/).

Comments are due at the close of business Jan. 31, 2020.

Dare County High Priorities:

- Identify funding to improve stormwater drainage and land management preparation for flooding.
- Update Dare County's 2001 comprehensive stormwater management plan.
- Prioritize and fund critical drainage projects that improve stormwater drainage and land management preparation for flooding.
- Take action on the results of the Moffit-Nicholas/NCDOT Northern Roanoke Island drainage study.

- Work with all landowners including federal, state and private to ensure proper maintenance and use of existing drainage systems to minimize impacts and reduce standing water on all property.
- Grow Local Emergency Planning Committee membership by expanding industry participation while fully implementing community right to know reporting requirements to enhance knowledge of hazardous material risk across the region.
- Utilize existing post-storm information and GIS mapping to identify the most vulnerable structures in the county.
- Become a FIREWISE Community that is able to protect people, property and natural resources from wildland fire.
- Maintain or increase the number of flood insurance policies in place across Dare County when new flood hazard maps become effective and many properties are reclassified as Shaded X and/or X zone no longer requiring flood insurance associated with a federally insured mortgage.
- Pursue the installation of flood gauges at all towns and villages. Have those gauges tied into the county alert and notification system allowing users to be alerted to changing conditions as they occur.
- Complete a cybersecurity risk assessment from an external subject matter expert. Based on risk assessment outcomes, develop and require all employees, volunteers and elected officials to complete cybersecurity awareness training before being given access to county information technology systems. Develop and offer cybersecurity awareness training for citizens. Develop and conduct cybersecurity exercises.
- Protect transportation routes and improve traffic flow along NC 12. Improve NC 12 to a two-lane road and coordinate traffic signals.
- Advocate the replacement of the Lindsey Warren (Alligator River) Bridge.
- Improve water supply and delivery systems to save water and reduce drought impacts by eliminating breaks and leaks. Encourage drought-tolerant landscape design to reduce dependence on irrigation. Encourage permeable driveways and surfaces to reduce runoff and promote groundwater recharge.
- Acquire generators or other forms of redundant power supply to ensure that critical facilities and infrastructure remain operational where normal power supply is not available.
- Study and identify all key secondary roadways used by workforce that flood routinely and develop plans to mitigate flood hazards. These are transit corridors that support year-round resident populations like Colington Road, NC 345 and Kitty Hawk Road.
- Expand hazardous weather awareness to include tornados and winter storms by expanding NWS partnership opportunities to include SKYWARN training and community forums.
- Increase the use of the NWS alert feature of the county mass notification system so that residents and visitors have direct access to all issued weather alerts.
- Expand the "Love The Beach Respect The Ocean" beach safety campaign by expanding participation with the Chamber of Commerce, property managers, as well as hotel, restaurant and beach equipment rental companies.
- Take actions needed to ensure equipment and personnel are readily available to implement the Dare County Emergency Pumping Plan at multiple locations simultaneously.

Dare County Medium Actions

- Expand the number of lifeguarded beaches in unincorporated Dare to bring lifeguards to all villages in addition to ocean rescue response personnel.
- Expand involvement with the North Carolina Information Sharing and Analysis Center to ensure actionable intelligence on immediate and emerging threats to the region are identified and shared with first responders, private sector, emergency management, local law enforcement and other partner agencies in a timely manner.
- Encourage the use of natural barriers over hard structure to control shoreline erosion and protect built infrastructure.
- Protect natural floodplain function and resilient areas as open space to provide flood and coastal hazard risk reduction and potentially increase CRS 420 open space credit.
- Establish secondary water supplies/points for fire protection efforts.
- Coordinate with NC Floodplain Mapping on public dissemination of updated floodplain maps.
- Lobby state legislators to require Realtors to disclose flood zones.

Dare County Low Priorities

- Complete commodity flow study to identify hazardous materials routinely transported across region.
- Study and document soundside erosion rates and water level changes.
- Complete physical security assessment of public facilities and large crowd (500+) gathering venues and events. Based on results, make physical security improvements and/or implement measures to protect lives from likely threats.

Currituck County High Priorities

- Establish appropriate buffers/setbacks between critical facilities and other uses that may be incompatible.
- Direct development away from high-risk and vulnerable areas and establish redevelopment standards that decrease hazard risk.
- Evaluate allocating a portion of occupancy tax toward the dune protection program and shoreline restoration.
- Identify bridges for retrofitting.
- Secure funding, design and construct an EOC/Public Safety Facility. Public Safety Center slated for completion late 2020.
- Maintain and work to improve radio communications and technology throughout public safety programs.
- Provide continuous training and information for first responders in hazard response.
- Coordinate response to bridge incidents for the Wright Memorial Bridge.
- Educate the public and inform them of the benefits of participation in the FIREWISE program.
- Develop a joint public outreach document that addresses all hazards (published by the planning and emergency management departments).
- Evaluate effectiveness of Currituck's warning systems.
- Educate and assist vulnerable populations in developing personal preparedness plans.
- Partner with other county departments, state, local agencies to educate and inform vulnerable populations about special needs registry with Social Services through community outreach (survey, website, social media, water bill).
- Create curriculums for all hazards preparedness to better educate the public.
- Continue to educate elected officials and the public on the need for and benefits of sustained shoreline management strategies.
- Develop outreach materials and offer training on Low Impact Development (LID) best management practices that can be distributed to the public and engineering communities.

Currituck Moderate Priorities

- Maintain partnerships with adjacent counties and municipalities to leverage and share resources.
- Encourage clustering of residential lots outside of hazard areas in subdivision design/review and discourage development intensity and infrastructure improvements in known hazard areas.
- Preserve natural environmental features to naturally absorb water run-off and serve as wind buffers.
- Retain vegetation and require buffers in areas adjacent to wetlands, water bodies and maritime forests.
- Work in conjunction with the Division of Coastal Management and the GIS coordinator to track the extent of local beach erosion and annually produce a "State of the Beach" report.
- Create maps reflecting the historical migration of the marsh to track erosion.
- Seek funding for public hazard mitigation projects.
- Continue to support efforts for planning, design and construction of the mid-county bridge project.
- Educate homeowners and builders on the benefits of sprinkler systems in residential structures.
- Increase public awareness and understanding of the locations and proper way to dispose of hazardous waste.
- Periodically survey the public to evaluate if public outreach efforts are effective in identifying potential flood hazards, public concern and ways to mitigate against hazards.
- Educate property owners on the natural and beneficial functions of floodplains, watersheds and other natural/coastal areas.
- Educate the development and agricultural communities as well as the public on the impacts of turbidity on floodplain/natural areas and mitigating best management practices

READ ABOUT MORE NEWS AND EVENTS HERE. (https://www.thecoastlandtimes.com/category/news/)





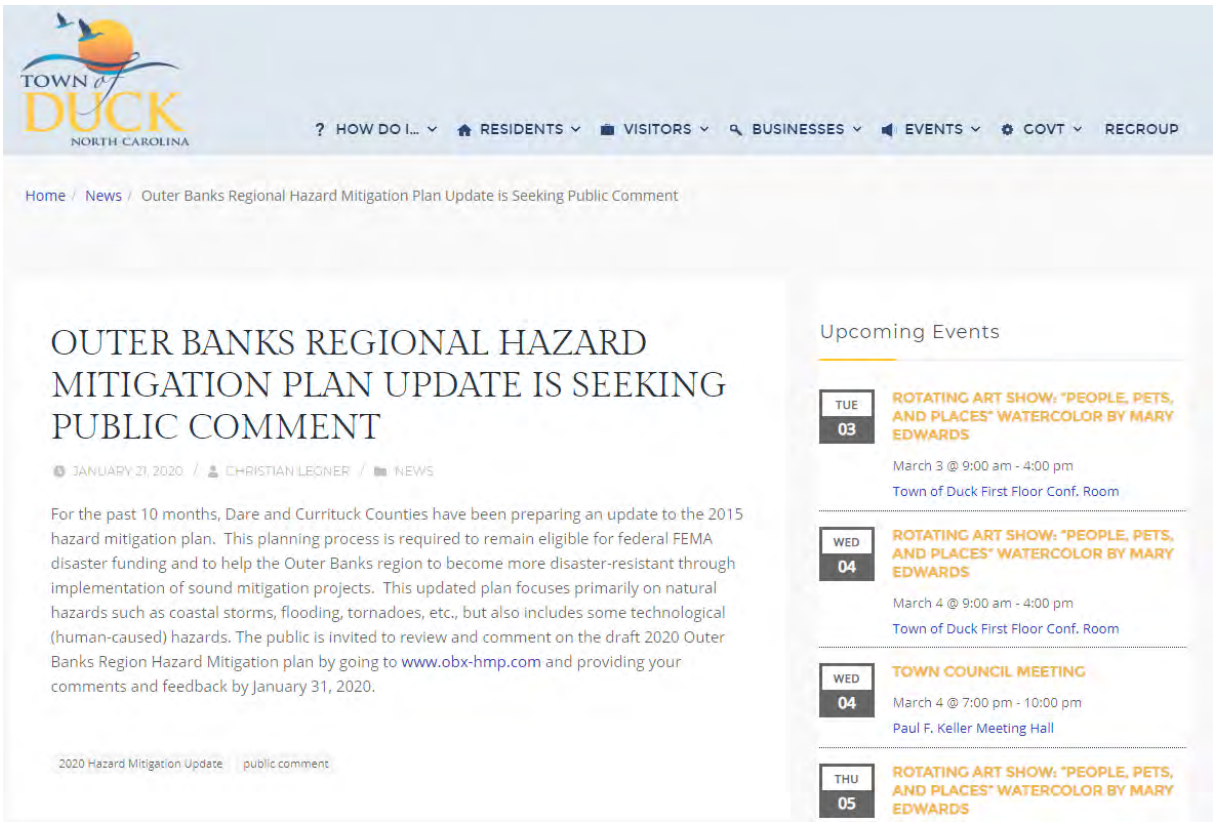


Public Comment Sought on Outer Banks Regional Hazard Mitigation Plan

We need your help! For the past 10 months, Dare and Currituck Counties have been preparing an update to the 2015 hazard mitigation plan. This planning process is required to remain eligible for federal FEMA disaster funding and to help the Outer Banks region to become more disaster-resistant through implementation of sound mitigation projects.

This updated plan focuses primarily on natural hazards such as coastal storms, flooding, tornadoes, etc., but also includes some technological (human-caused) hazards.

The public is invited to review and comment on the draft 2020 Outer Banks Region Hazard Mitigation plan by going to www.obx-hmp.com and providing your comments and feedback by January 31, 2020.



TOWN of DUCK NORTH CAROLINA

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Home / News / Outer Banks Regional Hazard Mitigation Plan Update is Seeking Public Comment

OUTER BANKS REGIONAL HAZARD MITIGATION PLAN UPDATE IS SEEKING PUBLIC COMMENT

JANUARY 21, 2020 / CHRISTIAN LEGNER / NEWS

For the past 10 months, Dare and Currituck Counties have been preparing an update to the 2015 hazard mitigation plan. This planning process is required to remain eligible for federal FEMA disaster funding and to help the Outer Banks region to become more disaster-resistant through implementation of sound mitigation projects. This updated plan focuses primarily on natural hazards such as coastal storms, flooding, tornadoes, etc., but also includes some technological (human-caused) hazards. The public is invited to review and comment on the draft 2020 Outer Banks Region Hazard Mitigation plan by going to www.obx-hmp.com and providing your comments and feedback by January 31, 2020.

2020 Hazard Mitigation Update public comment

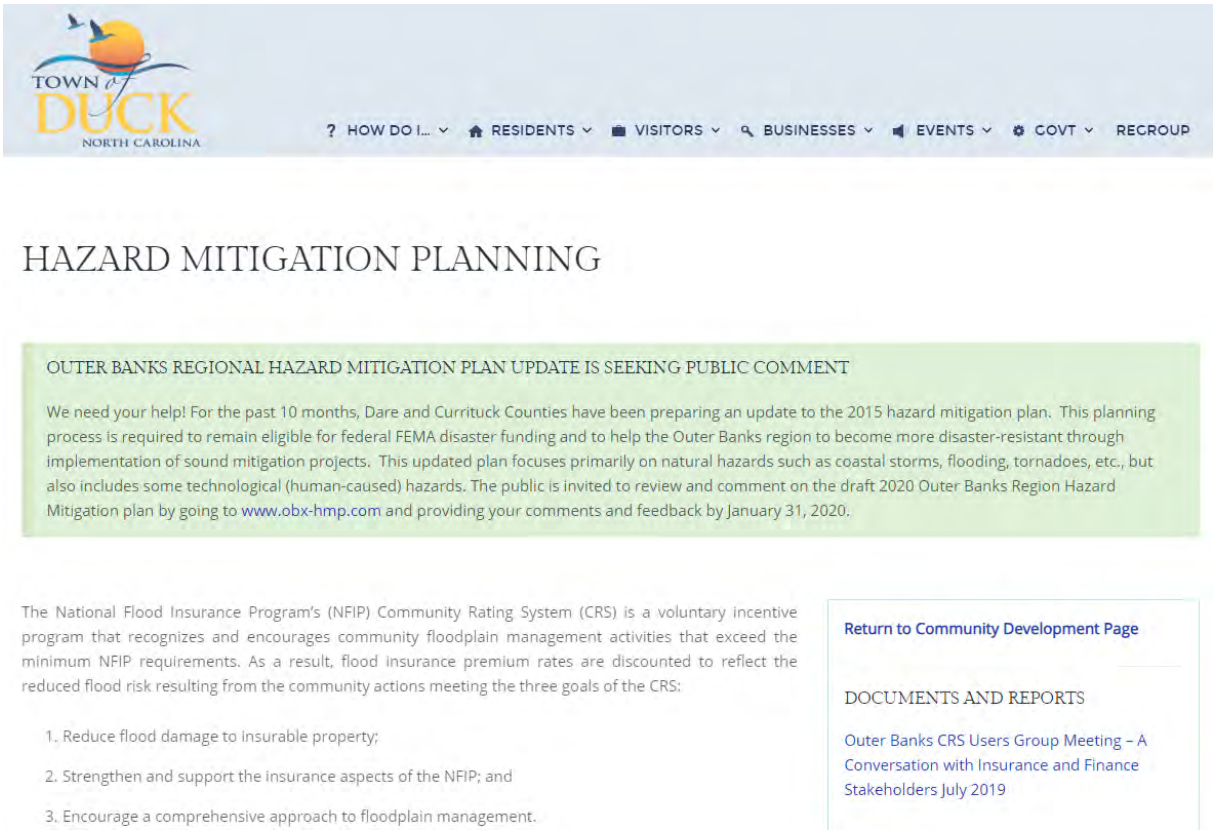
Upcoming Events

TUE 03 — ROTATING ART SHOW: "PEOPLE, PETS, AND PLACES" WATERCOLOR BY MARY EDWARDS
March 3 @ 9:00 am - 4:00 pm
Town of Duck First Floor Conf. Room

WED 04 — ROTATING ART SHOW: "PEOPLE, PETS, AND PLACES" WATERCOLOR BY MARY EDWARDS
March 4 @ 9:00 am - 4:00 pm
Town of Duck First Floor Conf. Room

WED 04 — TOWN COUNCIL MEETING
March 4 @ 7:00 pm - 10:00 pm
Paul F. Keller Meeting Hall

THU 05 — ROTATING ART SHOW: "PEOPLE, PETS, AND PLACES" WATERCOLOR BY MARY EDWARDS



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HAZARD MITIGATION PLANNING

OUTER BANKS REGIONAL HAZARD MITIGATION PLAN UPDATE IS SEEKING PUBLIC COMMENT

We need your help! For the past 10 months, Dare and Currituck Counties have been preparing an update to the 2015 hazard mitigation plan. This planning process is required to remain eligible for federal FEMA disaster funding and to help the Outer Banks region to become more disaster-resistant through implementation of sound mitigation projects. This updated plan focuses primarily on natural hazards such as coastal storms, flooding, tornadoes, etc., but also includes some technological (human-caused) hazards. The public is invited to review and comment on the draft 2020 Outer Banks Region Hazard Mitigation plan by going to www.obx-hmp.com and providing your comments and feedback by January 31, 2020.

The National Flood Insurance Program's (NFIP) Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS:

1. Reduce flood damage to insurable property;
2. Strengthen and support the insurance aspects of the NFIP; and
3. Encourage a comprehensive approach to floodplain management.

Return to Community Development Page

DOCUMENTS AND REPORTS

Outer Banks CRS Users Group Meeting – A Conversation with Insurance and Finance Stakeholders July 2019


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Outer Banks Regional Hazard Mitigation Plan Update is Seeking Public Comment: Provide comments and feedback on the Final Draft Plan by January 31, 2020.
We need your help! For the past 10 months, Dare and Currituck Counties have been preparing an update to the 2015 hazard mitigation plan. This planning process is required to remain eligible for federal FEMA disaster funding and to help the Outer Banks region to become more disaster-resistant through implementation of sound m... See More
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Outer Banks Regional Hazard Mitigation Plan
Welcome to the website for the 2019 Outer Banks Hazard Mitigation Plan update. The Outer Banks of NC is updating its 2015 plan to better protect the...
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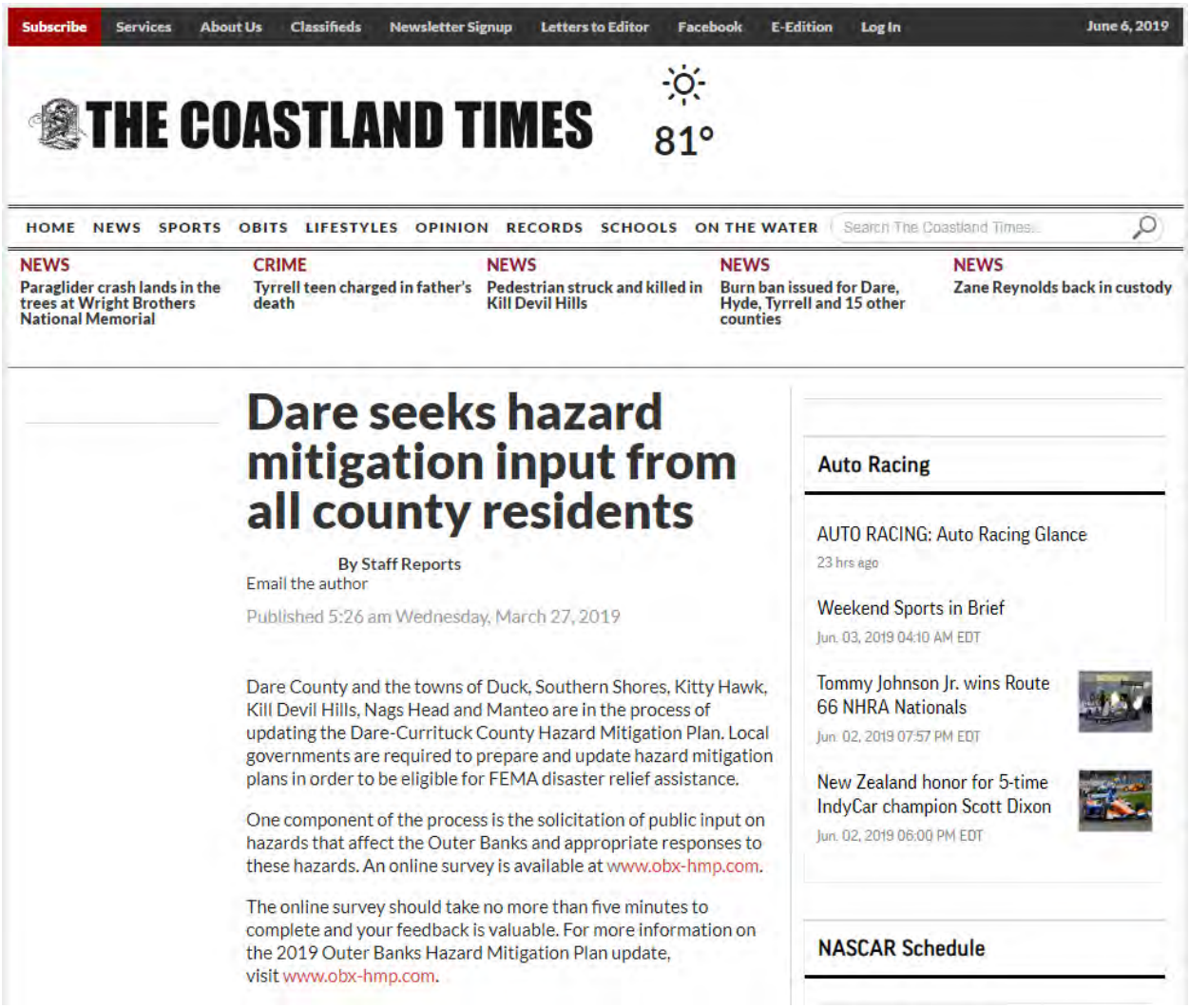
Plan Website & Survey Outreach



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Paraglider crash lands in the trees at Wright Brothers National Memorial

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Tyrrell teen charged in father's death

NEWS
Pedestrian struck and killed in Kill Devil Hills

NEWS
Burn ban issued for Dare, Hyde, Tyrrell and 15 other counties

NEWS
Zane Reynolds back in custody

Dare seeks hazard mitigation input from all county residents

By Staff Reports
Email the author

Published 5:26 am Wednesday, March 27, 2019

Dare County and the towns of Duck, Southern Shores, Kitty Hawk, Kill Devil Hills, Nags Head and Manteo are in the process of updating the Dare-Currituck County Hazard Mitigation Plan. Local governments are required to prepare and update hazard mitigation plans in order to be eligible for FEMA disaster relief assistance.

One component of the process is the solicitation of public input on hazards that affect the Outer Banks and appropriate responses to these hazards. An online survey is available at www.obx-hmp.com.

The online survey should take no more than five minutes to complete and your feedback is valuable. For more information on the 2019 Outer Banks Hazard Mitigation Plan update, visit www.obx-hmp.com.

Auto Racing

AUTO RACING: Auto Racing Glance
23 hrs ago

Weekend Sports in Brief
Jun. 03, 2019 04:10 AM EDT

Tommy Johnson Jr. wins Route 66 NHRA Nationals
Jun. 02, 2019 07:57 PM EDT

New Zealand honor for 5-time IndyCar champion Scott Dixon
Jun. 02, 2019 06:00 PM EDT

NASCAR Schedule


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Dare County and our municipalities are updating our Hazard Mitigation Plan to better protect the people and property of the region from the effects of natural and human-caused hazards and to maintain eligibility for mitigation funding from the Federal Emergency Management Agency.
Details on the update process can be found by visiting the Outer Banks Hazard Mitigation Plan Update website. On this site you can find information about upcoming and past Hazard Mitigation Planning Committee meetings and public meetings, take a survey on hazard risk and mitigation options to inform the plan's development, and review draft documents and summaries of the hazards that affect the Outer Banks.
Citizen input is a critical part of the plan update process. We encourage everyone to visit the website to learn about the effort, complete the Public Survey, and participate in public meetings. Use this link Public Survey if you just want to provide input.
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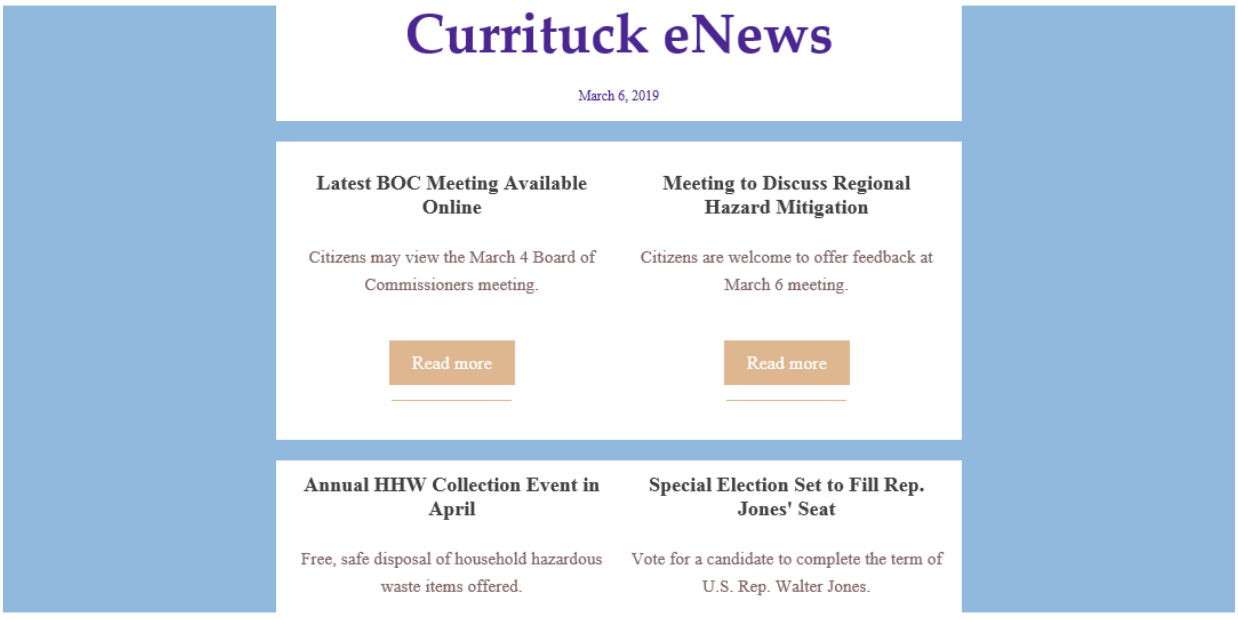
Currituck eNews
March 6, 2019
Latest BOC Meeting Available Online
Citizens may view the March 4 Board of Commissioners meeting.
Read more
Meeting to Discuss Regional Hazard Mitigation
Citizens are welcome to offer feedback at March 6 meeting.
Read more
Annual HHW Collection Event in April
Free, safe disposal of household hazardous waste items offered.
Special Election Set to Fill Rep. Jones' Seat
Vote for a candidate to complete the term of U.S. Rep. Walter Jones.


Currituck County Government
March 7 at 10:17 AM
Currituck County is working to develop a new regional hazard mitigation plan. Please take a few minutes to complete a brief, online survey and give us your opinion on natural hazards facing our community.
To learn more about the Outer Banks Regional Hazard Mitigation Plan, check out the project website or contact Currituck Emergency Management at 252-232-2115.
CO.CURRITUCK.NC.US
Feedback sought for hazard mitigation plan update – Currituck County
News Feedback sought for hazard mitigation plan update March 7, 2019 Randall Edwards Currituck County is working with Dare County and other...
1,535
People Reached
76
Engagements
Boost Post
Susan Michaud, Pat Ricks and 5 others
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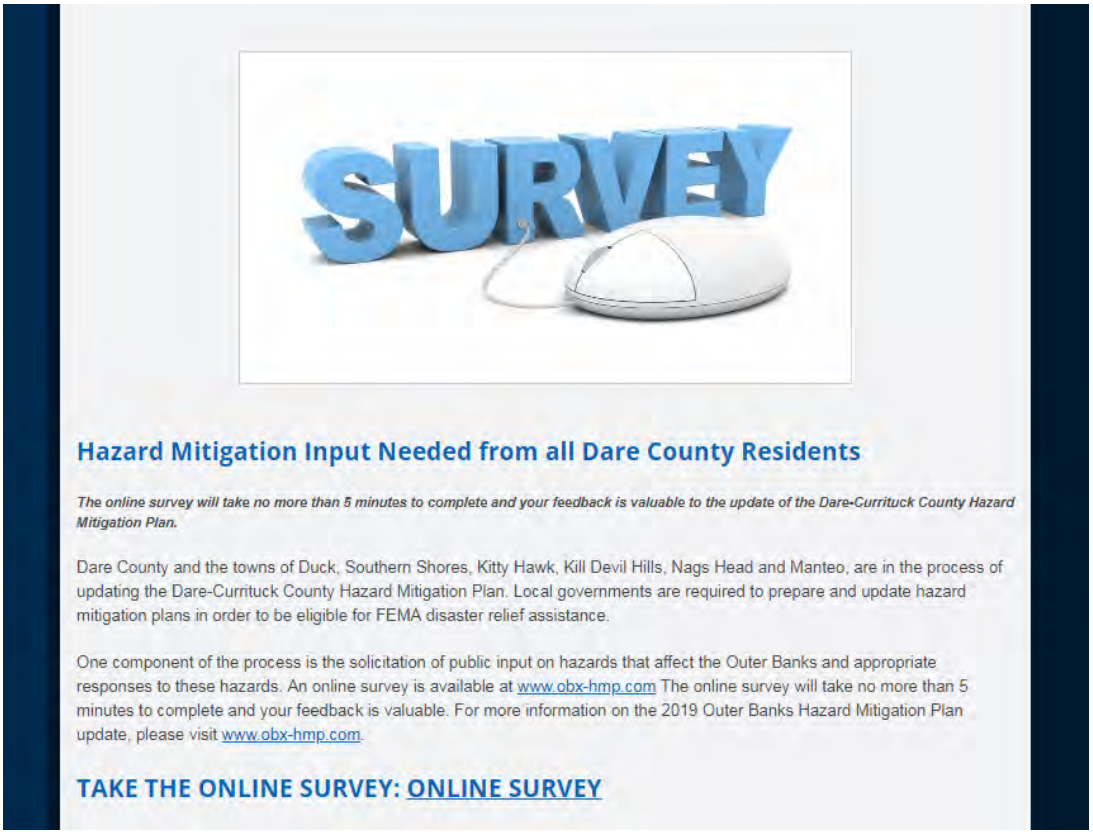
SURVEY
Hazard Mitigation Input Needed from all Dare County Residents
The online survey will take no more than 5 minutes to complete and your feedback is valuable to the update of the Dare-Currituck County Hazard Mitigation Plan.
Dare County and the towns of Duck, Southern Shores, Kitty Hawk, Kill Devil Hills, Nags Head and Manteo, are in the process of updating the Dare-Currituck County Hazard Mitigation Plan. Local governments are required to prepare and update hazard mitigation plans in order to be eligible for FEMA disaster relief assistance.
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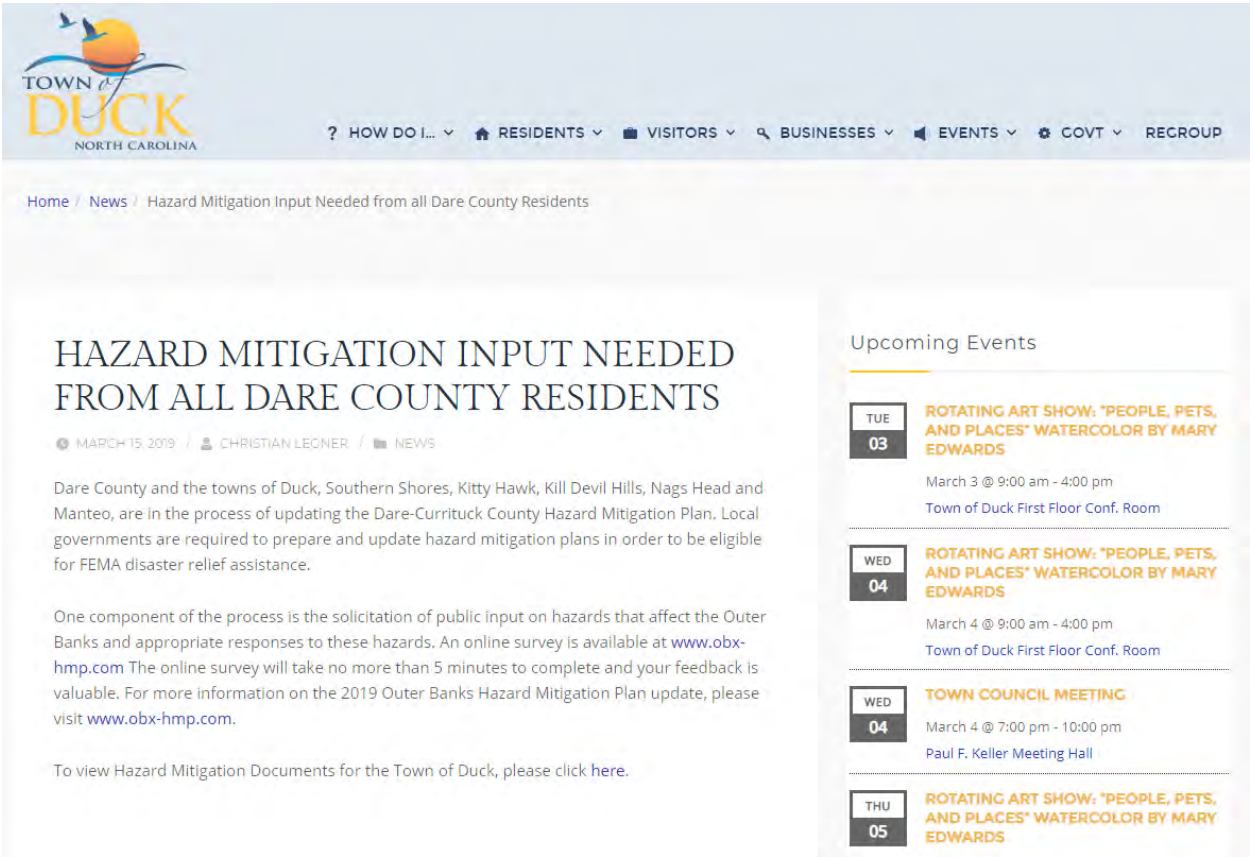
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Home / News / Hazard Mitigation Input Needed from all Dare County Residents
HAZARD MITIGATION INPUT NEEDED FROM ALL DARE COUNTY RESIDENTS
MARCH 15, 2019 / CHRISTIAN LEGNER / NEWS
Dare County and the towns of Duck, Southern Shores, Kitty Hawk, Kill Devil Hills, Nags Head and Manteo, are in the process of updating the Dare-Currituck County Hazard Mitigation Plan. Local governments are required to prepare and update hazard mitigation plans in order to be eligible for FEMA disaster relief assistance.
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To view Hazard Mitigation Documents for the Town of Duck, please click here.
Upcoming Events
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March 3 @ 9:00 am - 4:00 pm
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THU 05
ROTATING ART SHOW: "PEOPLE, PETS, AND PLACES" WATERCOLOR BY MARY EDWARDS


Town of Duck
@DuckOBX
Towns in Dare County are in the process of updating the Dare-Currituck County Hazard Mitigation Plan.
A survey is available at obx-hmp.com. The online survey will take no more than 5 minutes to complete and your feedback is valuable.
9:28 AM · Mar 15, 2019 · Hootsuite Inc.
2 Retweets 3 Likes

Town of Duck News
March 18, 2019

Town Council Mid-Month Meeting

The Town Council will hold a mid-month meeting on Wednesday, March 20 at 1:00 p.m. in the Paul F. Keller Meeting Hall. This meeting is open to the public and all interested parties are welcome to attend. To view the agenda with links click here. To view without links click here.

Pedestrian Plan Phase II Update

Over the past week, RPC Contracting poured the dumpster pad at Osprey Landing shopping center and began driveway improvements at the southern driveway to the Soundfront Shoppes. They also backfilled landscape areas adjoining the sidewalks to improve safety and appearance in the project area. A minimal amount of construction is anticipated during the upcoming week of March 18th.

Find more project information here.

Corolla Civic Association Request for Input

The Corolla Civic Association is spearheading planning for a north

MEETINGS & EVENTS

Town Council Mid-Month Meeting
Wednesday
1:00 p.m.
March 20, 2019
Learn More

Rotating Art Show: Photography by Eve Turek and Jeff Lewis
Monday - Friday
9:00 a.m. - 4:00 p.m.
February 1, 2019 - April 24, 2019
Learn More

Input Needed for Hazard Mitigation Plan

Dare County is in the process of updating the Dare-Currituck County Hazard Mitigation Plan. Local governments are required to prepare and update these plans in order to be eligible for FEMA disaster relief assistance.

Public input is needed on hazards that affect the Outer Banks and appropriate responses to these hazards. All public feedback is appreciated and a 5 minute online survey is available here. To view Hazard Mitigation Documents for the Town of Duck, please click here.


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March 15, 2019
Make your voice heard!
Dare County and the towns of Duck, Southern Shores, Kitty Hawk, Kill Devil Hills, Nags Head and Manteo, are in the process of updating the Dare-Currituck County Hazard Mitigation Plan. Local governments are required to prepare and update hazard mitigation plans in order to be eligible for FEMA disaster relief assistance.
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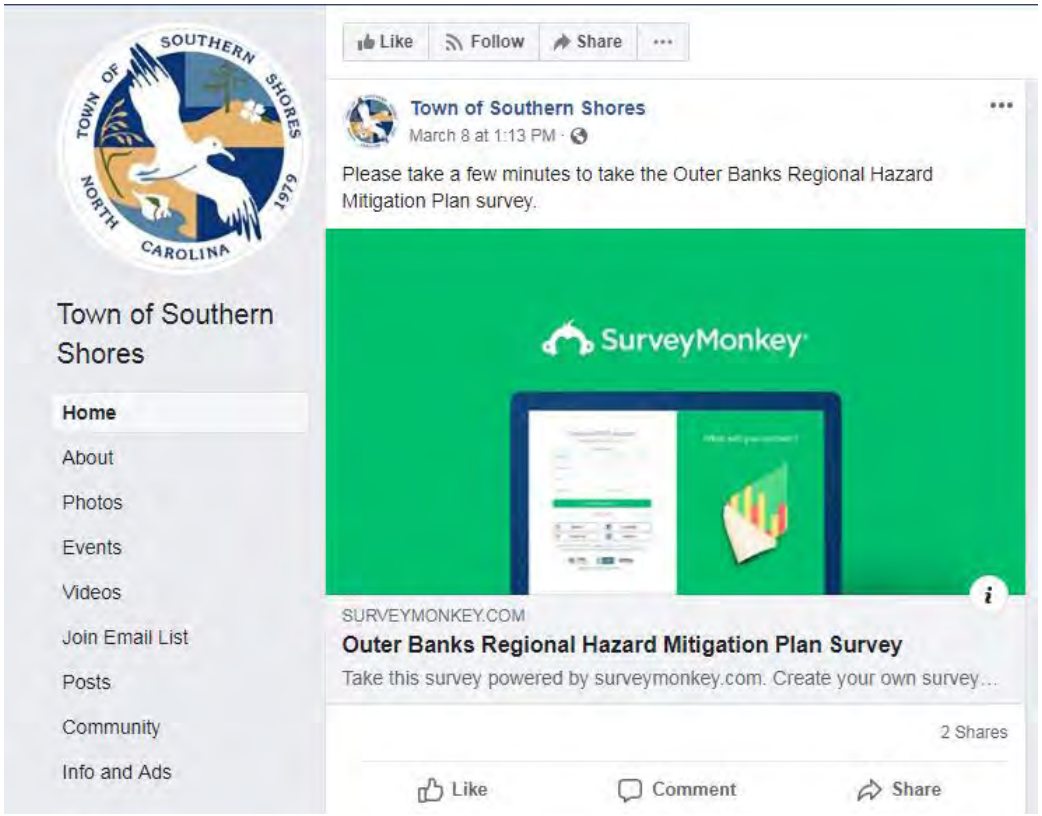
To see Town of Duck Hazard Mitigation information, please visit https://www.townofduck.com/comm.../hazard-mitigation-planning/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Town of Southern Shores
March 8 at 1:13 PM
Please take a few minutes to take the Outer Banks Regional Hazard Mitigation Plan survey.
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OUTER BANKS REGIONAL 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 needs your input on the types of hazards that are your priority concern and your opinion on ways to prevent or lessen the impacts of hazards.

Phase 1
1. Organize Planning Team
2. Plan for Public Involvement
3. Coordinate with Other Agencies

Phase 2
4. Identify the Hazards
5. Estimate Losses

Phase 3
6. Identify Goals & Objectives
7. Develop Potential Mitigation Actions
8. Draft the Mitigation Plan

Phase 4
9. Adopt the Plan
10. Implement and Maintain the Plan

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 identified the following hazards for inclusion in the Outer Banks Regional Hazard Mitigation Plan:

- Coastal Hazards (Erosion, Rip Current)
- Drought
- Extreme Heat
- Earthquake and Tsunami
- Flood
- Hurricane and Tropical Storm
- Severe Winter Storm
- Wildfire
- Hazardous Materials Incident
- Cyber Threat
- Transportation Infrastructure Failure
- Radiological Emergency

What Can I Do to Participate?

Visit the website. Get more information and follow the planning process at www.OBX-HMP.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, a public survey, and more.

Take the survey. A public outreach survey is available on the plan website, at www.surveymonkey.com/r/OBX-HMP, or in hard copy format. Please complete a survey to ensure your opinion is captured!

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.

Public Survey

The Region distributed a public survey, shown below, that requested public input into the Hazard Mitigation Plan 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, made available in hard copy format, provided via a link on participating jurisdictions web and social media accounts, and made available online on the plan website.

Outer Banks Regional Hazard Mitigation Plan
Public Survey

Online version can be found at: https://www.surveymonkey.com/r/OBX-HMP

Currituck and Dare Counties, along with Dare County local jurisdictions, are developing a Regional 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 Region and how to best mitigate or reduce the impacts of these hazards. **Please help us by completing this survey by Friday, June 14th 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/OBX-HMP

If you have any questions about this survey or want to learn about more ways to participate in the Outer Banks Regional Hazard Mitigation Plan update, please contact the planning consultant for the project, David Stroud with Wood, at 919-765-9986 or by email at david.stroud@woodplc.com. You can also visit the project website at www.OBX-HMP.com.

BACKGROUND INFORMATION

1. Where do you live?
   - ☐ Unincorporated Currituck County
   - ☐ Unincorporated Dare County
   - ☐ Duck
   - ☐ Kill Devil Hills
   - ☐ Kitty Hawk
   - ☐ Manteo
   - ☐ Nags Head
   - ☐ Southern Shores
   - ☐ 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.

____ Coastal Hazards (Erosion, Rip Current, Sea Level Rise)	____ Tornado
____ Drought	____ Wildfire
____ Earthquake (& Tsunami)	____ Hazardous Materials Incident
____ Extreme Heat	____ Radiological Emergency
____ Flood	____ Terrorism
____ Hurricane & Tropical Storm	____ Cyber Threat
____ Severe Weather (Thunderstorm/Lightning/Hail)	____ Infrastructure Failure
____ Severe Winter Storm	____ Other _____

8. Describe specific hazard issues/problem areas that you would like the planning committee to consider.

9. Describe any actions you have taken to mitigate hazard risk for your family, home, or neighborhood.

10. Which categories of mitigation actions do you feel would be most effective?

- ☐ Preventive activities (e.g. planning and zoning, building codes)
- ☐ Property protection (e.g. retrofitting, insurance, flood prone property buyout)
- ☐ Natural resource protection (e.g. wetlands protection, erosion control, forest health protection)
- ☐ Emergency services (e.g. hazard threat recognition, hazard warning systems, critical facilities protection)
- ☐ Structural projects (e.g. storm drain improvements, hazardous tree removal,
- ☐ Public information (e.g. outreach projects, environmental education, public education)

11. What is the best way for you to receive information about how to make your family, home, or neighborhood more resilient to hazards? Please check all that apply.

☐ Television News/Advertisements	☐ County/Town website
☐ Radio News/Advertisements	☐ County/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.

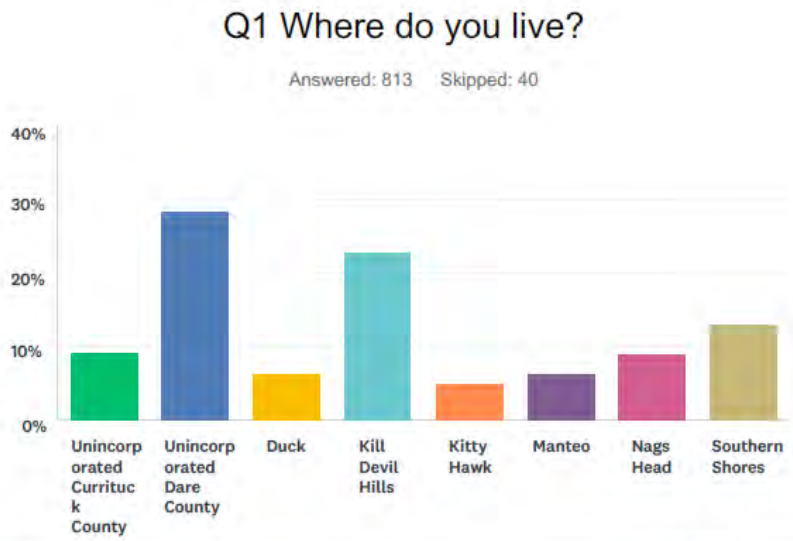
Name: _____ Email: _____

2

The County received 853 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.

- Over 92% of respondents own their home, which indicates ability of those engaged in the mitigation process to implement mitigation on their own properties.
- Only 8% of respondents say they feel not at all prepared for a hazard event; 63.4% feel somewhat prepared and 28.6% feel very prepared.
- 56.8% of respondents do not know where evacuation centers or storm shelters are located; however, 96.6% of respondents say they are able to evacuate or take shelter if necessary, which indicates that most people manage evacuating or taking shelter through their own resources. It is possible that these results skew toward those with more awareness of hazard risk and resources to respond.
- One quarter of respondents do not know where to get more information on hazard risk and preparedness.
- Hurricane was rated the most significant hazard, followed by flood, tornado, severe weather, and erosion. Earthquake was rated the least significant hazard, followed by drought.
- Many respondents who reported having taken steps to mitigate risk at home reported preparedness actions such as generators, evacuation plans, and emergency kits and supplies as well as home maintenance actions such as removing yard debris and trimming trees. Fewer respondents also noted prevention or property protection actions such as installing storm shutters, addressing localized drainage issues, or even elevating their homes; these may be important ideas to promote in outreach.
- Respondents favored structural projects and emergency services for mitigation; the mitigation category with the least support was property protection. Continued outreach on the importance of individual property protection may be beneficial.

Figure B.1 – Survey Response, Place of Residence



ANSWER CHOICES	RESPONSES	
Unincorporated Currituck County	9.10%	74
Unincorporated Dare County	28.41%	231
Duck	6.40%	52
Kill Devil Hills	22.76%	185
Kitty Hawk	4.92%	40
Manteo	6.40%	52
Nags Head	8.98%	73
Southern Shores	13.04%	106
TOTAL		813

Figure B.2 – Survey Response, Home Ownership

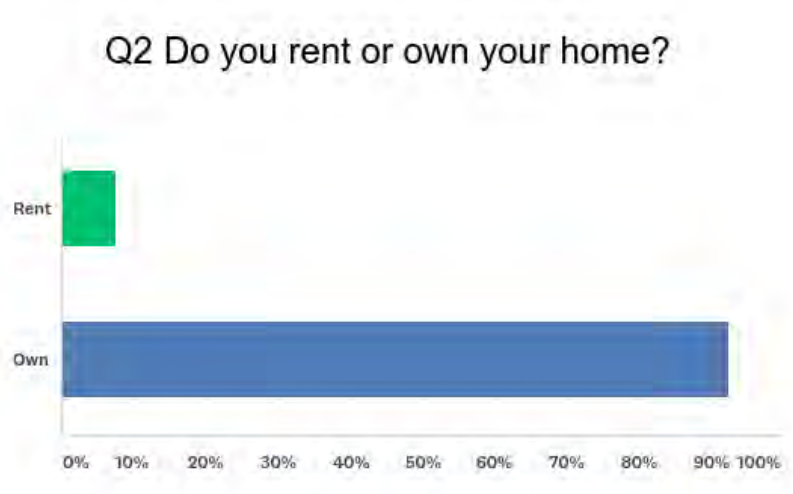
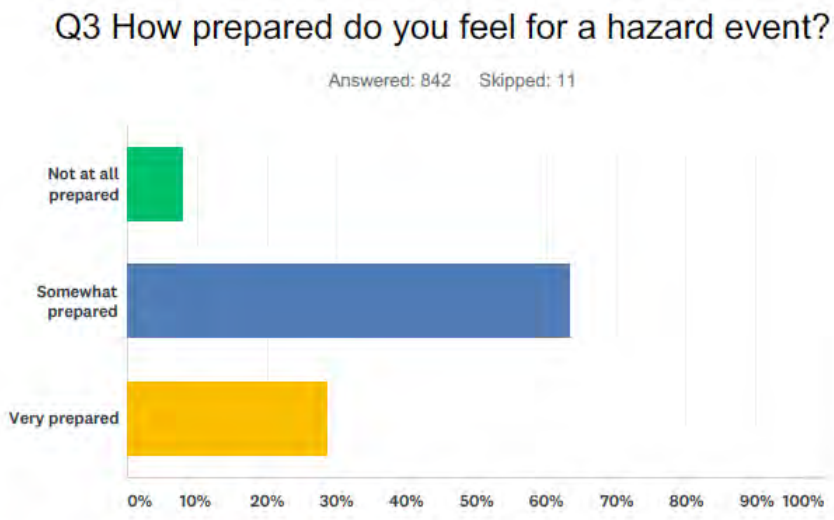
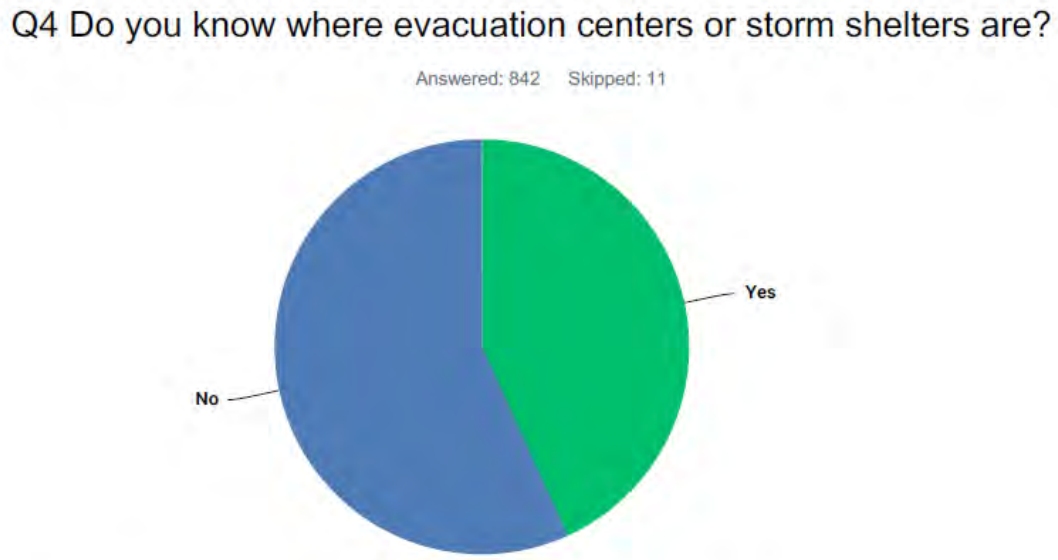


Figure B.3 – Survey Response, Preparedness



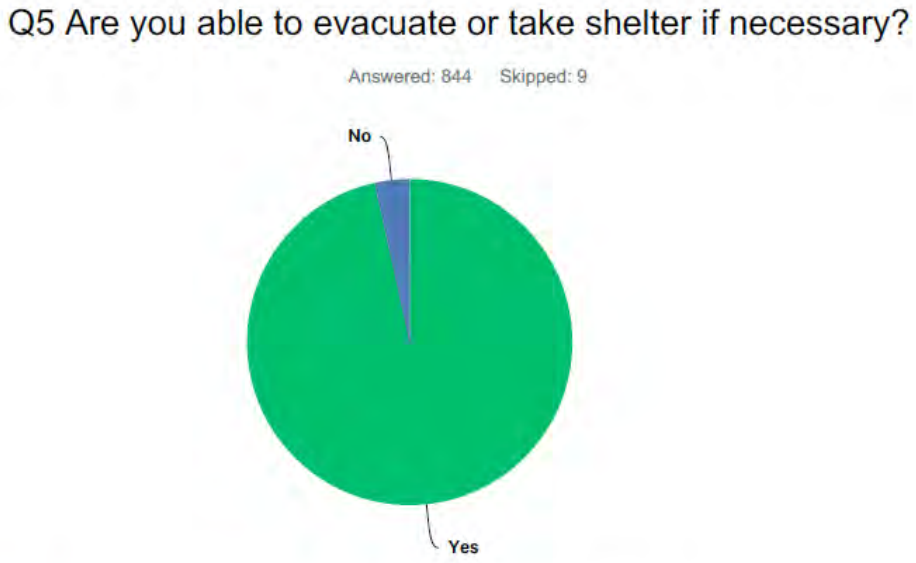
ANSWER CHOICES	RESPONSES	
Not at all prepared	7.96%	67
Somewhat prepared	63.42%	534
Very prepared	28.62%	241
TOTAL		842

Figure B.4 – Survey Response, Evacuation Center/Shelter Awareness



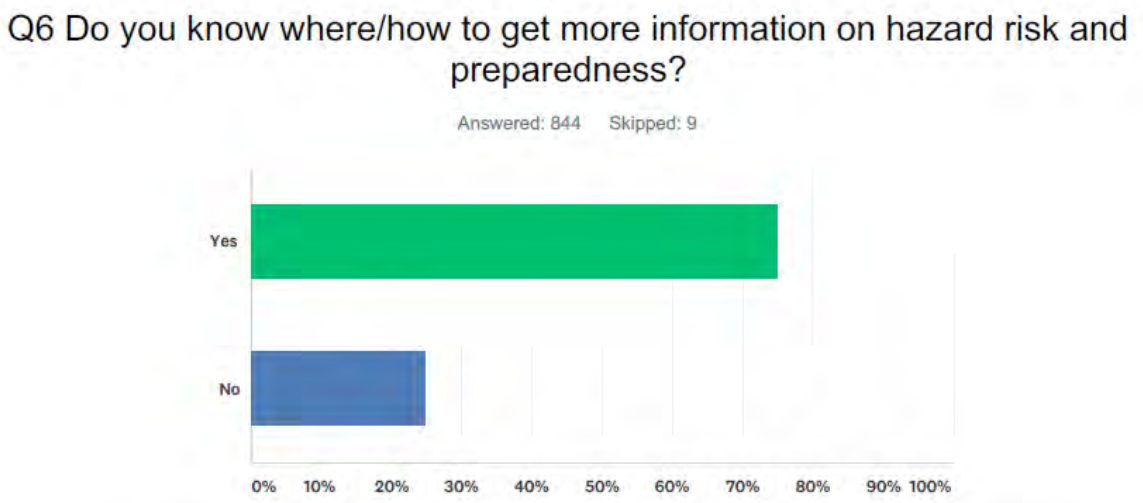
ANSWER CHOICES	RESPONSES	
Yes	43.23%	364
No	56.77%	478
TOTAL		842

Figure B.5 – Survey Response, Ability to Evacuate/Take Shelter



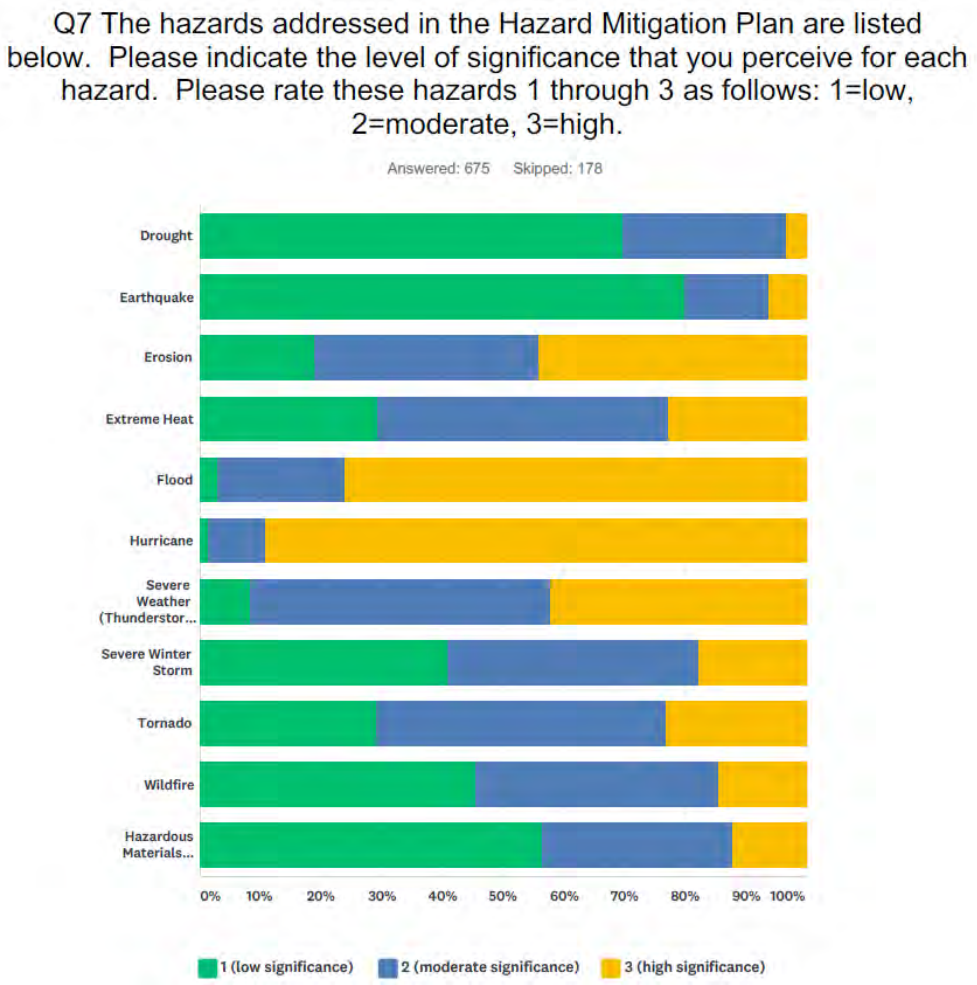
ANSWER CHOICES	RESPONSES	
Yes	96.56%	815
No	3.44%	29
TOTAL		844

Figure B.6 – Survey Response, Knowledge of Where to Find Hazard Information



ANSWER CHOICES	RESPONSES	
Yes	75.12%	634
No	24.88%	210
TOTAL		844

Figure B.7 – Survey Response, Hazard Significance Ratings



	1 (LOW SIGNIFICANCE)	2 (MODERATE SIGNIFICANCE)	3 (HIGH SIGNIFICANCE)	TOTAL	WEIGHTED AVERAGE
Drought	69.71% 458	26.94% 177	3.35% 22	657	1.34
Earthquake	79.94% 526	13.83% 91	6.23% 41	658	1.26
Erosion	18.93% 124	36.79% 241	44.27% 290	655	2.25
Extreme Heat	29.38% 193	47.79% 314	22.83% 150	657	1.93
Flood	2.86% 19	21.08% 140	76.05% 505	664	2.73
Hurricane	1.50% 10	9.32% 62	89.17% 593	665	2.88
Severe Weather (Thunderstorm/Lightning/Hail)	8.18% 54	49.70% 328	42.12% 278	660	2.34
Severe Winter Storm	40.79% 270	41.39% 274	17.82% 118	662	1.77
Tornado	29.03% 191	47.87% 315	23.10% 152	658	1.94
Wildfire	45.37% 299	40.21% 265	14.42% 95	659	1.69
Hazardous Materials Incident	56.36% 368	31.39% 205	12.25% 80	653	1.56

Figure B.8 – Survey Response, Key Hazard Issues/Concerns

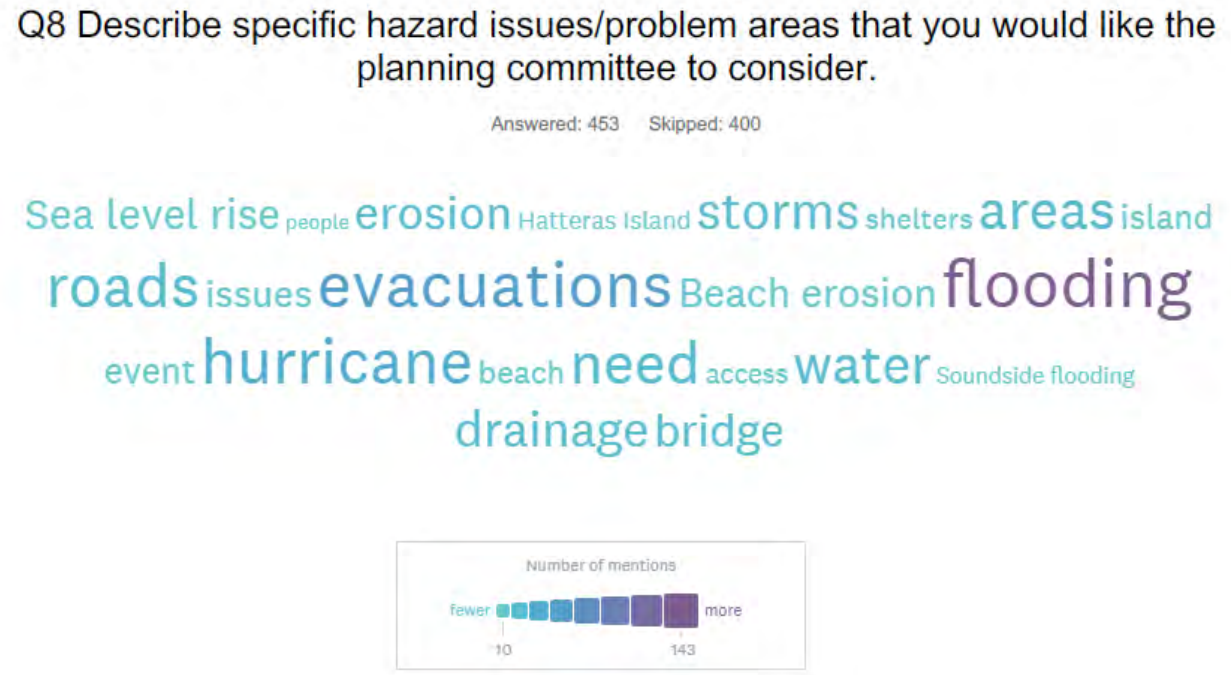


Figure B.9 – Survey Response, Personal Actions Taken for Mitigation

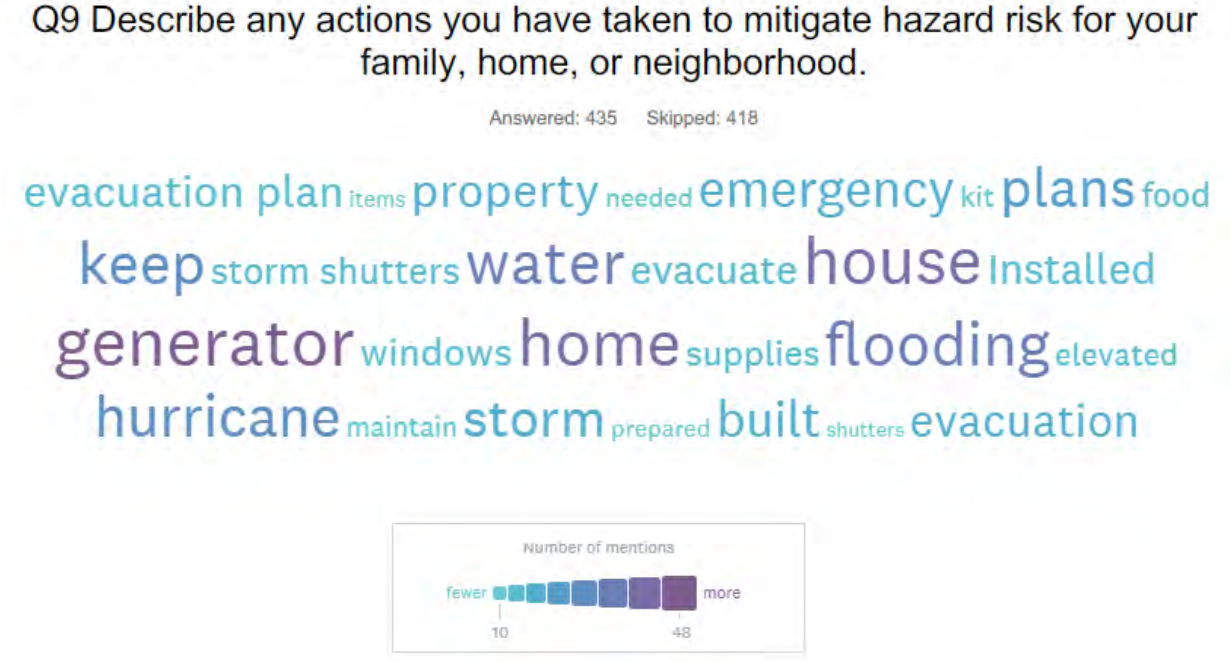
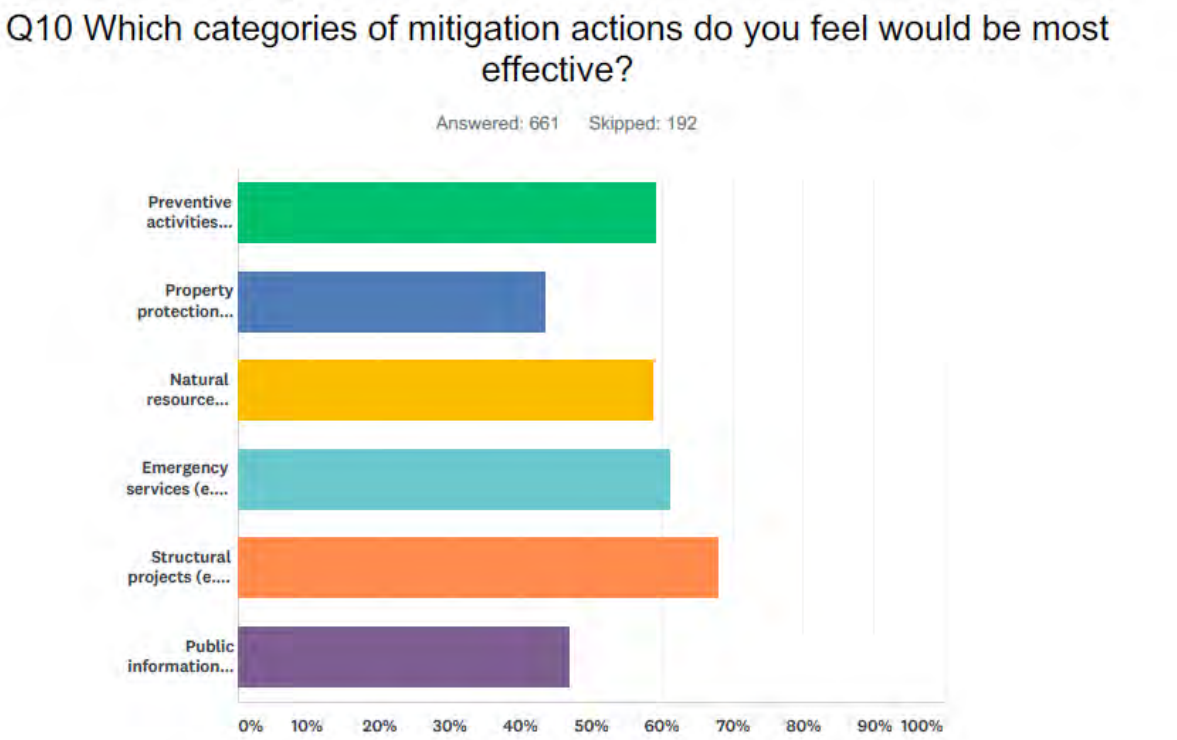
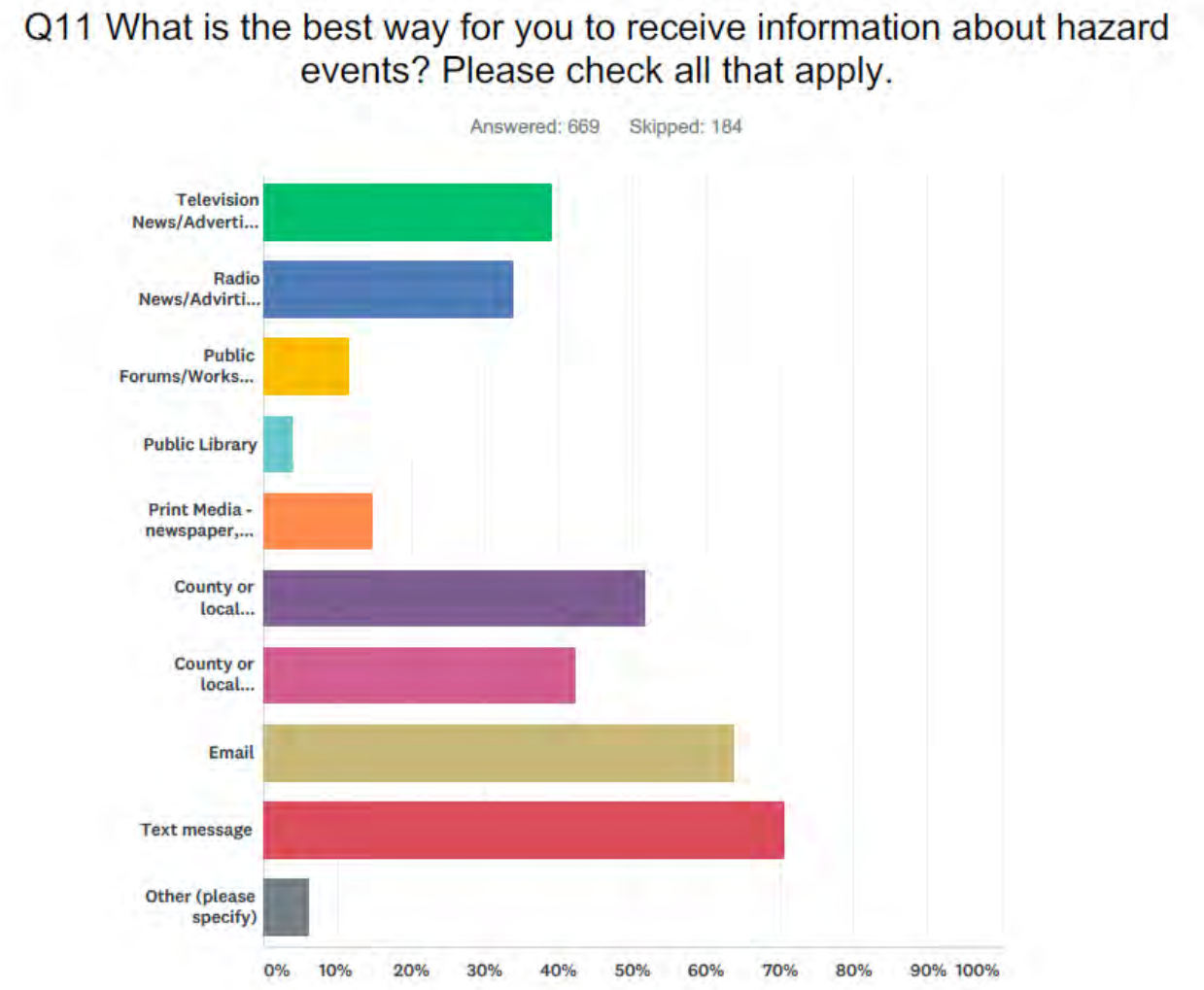


Figure B.10 – Survey Response, Preferred Mitigation Categories



ANSWER CHOICES	RESPONSES	
Preventive activities (e.g. planning and zoning, building codes)	59.15%	391
Property protection (e.g. retrofitting, insurance, flood prone property buyout)	43.42%	287
Natural resource protection (e.g. wetlands protection, erosion control, forest health protection)	58.70%	388
Emergency services (e.g. hazard threat recognition, hazard warning systems, critical facilities protection)	61.27%	405
Structural projects (e.g. storm drain improvements, hazardous tree removal,	67.93%	449
Public information (e.g. outreach projects, environmental education, public education)	46.90%	310
Total Respondents: 661		

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. To incorporate stakeholder input into the plan, a variety of stakeholders were identified 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 the stakeholders who were contacted is provided in Table B.3.

Stakeholders were also involved through specific requests for data to support the development of the plan as well as through participation on the HMPC.

From: Moore, Abigail
Sent: Tuesday, December 31, 2019 10:07 AM
To: LCosta@obcf.org; obcinc252@gmail.com; erinf@nccoast.org; director@interfaithoutreach.com; farrellyjo@daretolearn.org; mstefanik@currituck.k12.nc.us; robert_wynegar02@albemarle.edu; wilbert_harris@albemarle.edu; Corbett, D. Reide; saundersc@co.pasquotank.nc.us; justin.gibbs@hydecountyems.co; weshopkins@tyrrellcounty.net; rhondamoney@perquimanscountync.gov; public@cityofchesapeake.net; eesutton@vbgov.com; roy.mcclure@fema.dhs.gov; Marrone, Edwardine; ktodd@ISO.com; jbratcher@iso.com; sharper@iso.com; ewstrom@usgs.gov; Brubaker, Dan; jcrew@ncem.org; john.holley@ncdenr.gov; linda.culpepper@ncdenr.gov; tim.baumgartner@ncdenr.gov; Thompson, Hannah; kbrown@outerbankschamber.com; neel@obsentinel.com; info@outerbanksvoice.com; jbbass05@gmail.com; atmmhgm@aol.com; rfearn@audubon.org; tim.kesler@dominionenergy.com; michaelf@nccoast.org; ckakretz@theobh.com
Cc: Stroud, David A; Drew Pearson; Mary Newns
Subject: Outer Banks Regional Hazard Mitigation Plan - Stakeholder Input Needed!

Good morning!

Currituck and Dare Counties are in the process of developing the Outer Banks Regional Hazard Mitigation Plan, and to assist with this process, the Counties and the Hazard Mitigation Planning Committee are seeking your input and expertise to support the planning effort and provide feedback on the draft plan.

We invite you to attend one of the following public information meetings on the draft plan:

- Tuesday, January 7th at 5 p.m. at the Currituck Courthouse Commissioners' Meeting Room located at 153 Courthouse Road, Currituck, NC 27929
- Wednesday, January 8th at 5 p.m. at the Fessenden Center, located at 47017 Buxton Back Road, Buxton, NC 27920
- Thursday, January 9th at 10 a.m. at Jockey's Ridge State Park Auditorium, located at 300 W. Carolista Drive, Nags Head, NC 27959

Additionally, following these meetings we will be releasing the full draft of the plan for review. The draft will be posted on the plan website, here: http://www.obx-hmp.com/draftDocuments.html. The website already contains information on the risk assessment findings and the planning process, which we encourage you to review. We appreciate any input you may wish to share! Please feel free to share this information with anyone else who may be interested in reviewing the plan, and please email any comments or feedback on the draft plan to me at abigail.moore@woodplc.com.

Thank you for your assistance in this important effort to make our communities safer and more resilient to hazards!

Abby Moore, CFM
Hazard Mitigation & Resiliency Planner
Direct: +1 (919) 768 9927
www.woodplc.com

Table B.3 – Stakeholder List

First Name	Last Name	Organization
Non-Profit Organizations		
Lorelei	Costa	Outer Banks Community Foundation, Executive Director
William	Parker	Outer Banks Conservationists
Robert	Fearn	Pine Island Audubon Sanctuary
Michael	Flynn	NC Coastal Federation
Jennifer	Albanese	Interfaith Community Outreach
Educational Institutions		
Dr. John	Farrelly	Dare County Schools, Superintendent
Mark	Stefanik	Currituck County Schools, Superintendent
Dr. Robert	Wynegar	College of the Albemarle, President
Don	Harris	College of the Albemarle, Security Supervisor
Reide	Corbett	Coastal Studies Institute, Executive Director
Surrounding Municipalities		
Christy	Saunders	Pasquotank-Camden-Elizabeth City Emergency Management, Coordinator
Justin	Gibbs	Hyde County Emergency Services Director
Wesley	Hopkins	Tyrrell County Emergency Management Coordinator
Rhonda	Money	Perquimans Planning and Zoning
Robert	Gelormine	Chesapeake, VA Emergency Management, Senior Planner
Erin	Sutton	Virginia Beach, VA Deputy Emergency Service Coordinator
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		
Dan	Brubaker	State NFIP Coordinator
Chris	Crew	State Hazard Mitigation Officer
John	Holley	NCDENR - Land Quality Section Regional Office
Linda	Culpepper	DEQ Division of Water Resources, Director
Tim	Baumgartner	DEQ Division of Mitigation Services, Director
Hannah	Thompson-Welch	NC Forest Service, Wildfire Mitigation Specialist
Business Community		
Karen	Brown	The Outer Banks Chamber of Commerce, President & CEO
Neel	Keller	Outer Banks Sentinel, News Editor
Rob	Morris	Outer Banks Voice, Editor
Mary Helen	Goodloe-Murphy	The Coastland Times
Tim	Kesler	Dominion Energy
Josh	Bass	Currituck County Chamber of Commerce, President

Appendix C Mitigation Alternatives

44 CFR Subsection D §201.6(c)(3)(ii): [The mitigation strategy section shall include] a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new buildings and infrastructure. All plans approved by FEMA after October 1, 2008, must also address the jurisdiction's participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.

As part of the process of developing the mitigation action plans found in Section 7, the HMPC reviewed and considered a comprehensive range of mitigation options before selecting the actions identified for implementation. This section summarizes the full range of mitigation measures evaluated and considered by the HMPC, including a review of the categories of mitigation measures outlined in the 2017 CRS Coordinator's Manual, a discussion of current local implementation and CRS credits earned for those measures, and a list of the specific mitigation projects considered and recommended for implementation.

Mitigation alternatives identified for implementation by the HMPC were evaluated and prioritized using the criteria discussed in Section 6 of this plan.

C.1 CATEGORIES OF MITIGATION MEASURES CONSIDERED

Once it was determined which flood hazards warranted the development of specific mitigation actions, the HMPC analyzed viable mitigation options that supported the identified goals and objectives. The HMPC was provided with the following list of mitigation categories which are utilized as part of the CRS planning process.

- Prevention
- Property Protection
- Natural Resource Protection
- Structural Projects
- Emergency Services
- Public Information and Outreach

C.2 ALTERNATIVE MITIGATION MEASURES PER CATEGORY

Note: the CRS Credit Sections are based on the 2017 CRS Coordinator's Manual.

C.2.1 Preventative and Regulatory Measures

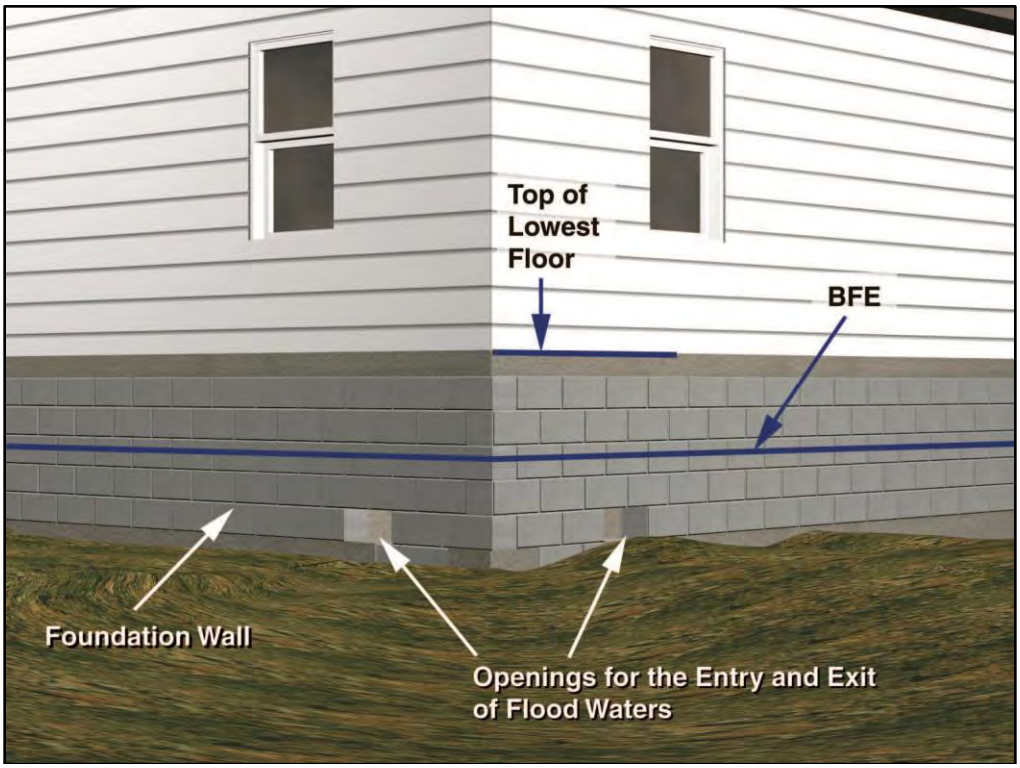
Preventative measures are designed to keep a problem - such as flooding - from occurring or from getting worse. The objective of preventative measures is to ensure that future development is not exposed to damage and does not cause an increase in damages to other properties. Building, zoning, planning and code enforcement offices usually administer preventative measures. Some examples of types of preventative measures include:

- Building codes
- Zoning ordinance
- Comprehensive or land use plan
- Open space preservation
- Floodplain regulations
- Subdivision regulations
- Stormwater management regulations

Building Codes

Building codes provide one of the best methods for addressing natural hazards. When properly designed and constructed according to code, the average building can withstand many of the impacts of natural hazards. Hazard protection standards for all new and improved or repaired buildings can be incorporated into the local building code. Building codes can ensure that the first floors of new buildings are constructed to be higher than the elevation of the 100-year flood (the flood that is expected to have a one percent chance of occurring in any given year). This is shown in Figure B.1.

Just as important as having code standards is the enforcement of the code. Adequate inspections are needed during the course of construction to ensure that the builder understands the requirements and is following them. Making sure a structure is properly elevated and anchored requires site inspections at each step.



Source: FEMA Publication: *Above the Flood: Elevating Your Floodprone House, 2000*

Figure B.1 – Building Codes and Flood Elevations

ASCE 24 is a referenced standard in the International Building Code. Any building or structure that falls within the scope of the IBC that is proposed in a flood hazard area is to be designed in accordance with ASCE 24. Freeboard is required as a function of the nature of occupancy and the flood zone. Dwellings and most other buildings have 1-foot of freeboard; certain essential facilities have 2-3 feet; only agricultural facilities, temporary facilities and minor storage facilities are allowed to have their lowest floors at the BFE.

Comprehensive or Land Use Plan

Building codes provide guidance on how to build in hazardous areas. Planning and zoning activities direct development away from these areas, particularly floodplains and wetlands. They do this by designating land uses that are compatible with the natural conditions of land that is prone to flooding, such as open

space or recreation. Communities in the Outer Banks Region prepare land use plans in compliance with North Carolina Coastal Area Management Act (CAMA) requirements.

Open Space Preservation

Keeping the floodplain and other hazardous areas open and free from development is the best approach to preventing damage to new developments. Open space can be maintained in agricultural use or can serve as parks, greenway corridors and golf courses.

Comprehensive and capital improvement plans should identify areas to be preserved by acquisition and other means, such as purchasing an easement. With an easement, the owner is free to develop and use private property, but property taxes are reduced or a payment is made to the owner if the owner agrees to not build on the part set aside in the easement.

Although there are some federal programs that can help acquire or reserve open lands, open space lands and easements do not always have to be purchased. Developers can be encouraged to dedicate park land and required to dedicate easements for drainage and maintenance purposes.

Zoning Ordinance

Zoning enables a community to designate what uses are acceptable on a given parcel. Zoning can ensure compatibility of land use with the land's level of suitability for development. Planning and zoning activities can also provide benefits by allowing developers more flexibility in arranging improvements on a parcel of land through the planned development approach. Zoning regulations describe what type of land use and specific activities are permitted in each district, and how to regulate how buildings, signs, parking, and other construction may be placed on a lot. Zoning regulations also provide procedures for rezoning and other planning applications. The zoning map and zoning regulations provide properties with certain rights to development.

Floodplain Regulations

A Flood Damage Prevention Ordinance sets development standards for Special Flood Hazard Areas (SFHAs). Communities participating in the National Flood Insurance Program (NFIP) are required to adopt a flood damage prevention ordinance that meets at least the minimum standards of the NFIP; however, a community can incorporate higher standards for increased protection. For example, communities can adopt higher regulatory freeboard requirements, cumulative substantial damage definitions, fill restrictions, and other standards.

Another important consideration in floodplain regulations is the protection of natural and beneficial functions and the preservation of natural barriers such as vegetation. Vegetation along a stream bank is extremely beneficial for the health of the stream. Trees and other plants have an extensive root system that strengthen stream banks and help prevent erosion. Vegetation that has sprouted up near streams should remain undisturbed unless removing it will significantly reduce a threat of flooding or further destruction of the stream channel.

Stormwater Management Regulations

Stormwater runoff is increased when natural ground cover is replaced by urban development. Development in the watershed that drains to a river can aggravate downstream flooding, overload the community's drainage system, cause erosion, and impair water quality. There are three ways to prevent flooding problems caused by stormwater runoff:

1) Regulating development in the floodplain to ensure that it will be protected from flooding and that it won't divert floodwaters onto other properties;

2) Regulating all development to ensure that the post-development peak runoff will not be greater than it was under pre-development conditions; and
3) Set construction standards so buildings are protected from shallow water.

Reducing Future Flood Losses

Zoning and comprehensive planning can work together to reduce future flood losses by directing development away from hazard prone areas. Creating or maintaining open space is the primary way to reduce future flood losses.

Planning for open space must also be supplemented with development regulations to ensure that stormwater runoff is managed and that development is protected from flooding. Enforcement of the flood damage prevention ordinance and the flood protection elevation requirement provides an extra level of protection for buildings constructed in the planning area.

Stormwater management and the requirement that post-development runoff cannot exceed pre-development conditions is one way to prevent future flood losses. Retention and detention requirements also help to reduce future flood losses.

CRS Credit

The CRS encourages strong building codes. It provides credit in two ways: points are awarded based on the community's Building Code Effectiveness Grading Schedule (BCEGS) classification and points are awarded for adopting the International Code series. In North Carolina, communities are limited by the State Building Code Council which has not implemented the most current version of the International Building Code.

CRS credits are available for regulations that encourage developers to preserve floodplains or other hazardous areas away from development. There is no credit for a plan, only for the enforceable regulations that are adopted pursuant to a plan. Communities in the Outer Banks Region could receive credit for Activity 430 – Higher Regulatory Standards and for Activity 420 – Open Space Preservation for preserving parcels within the SFHA as open space. Preserving flood prone areas as open space is one of the highest priorities of the Community Rating System. The credits in the 2017 manual have doubled for OSP (Open Space Preservation). The participating communities could also receive credit for Activity 450 – Stormwater Management for enforcing regulations for stormwater management and soil and erosion control. Several prevention actions considered by the HMPC are detailed below.

Table C.1 – Prevention Mitigation Options and Recommended Projects

Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
Prevention Measures Considered by HMPC and Not Recommended			
-	Maintain participation and membership in the National Flood Insurance Program and the Community Rating System Program.	Not intended to be included in 2015 plan as an action.	n/a
-	Continue to enforce the zoning ordinance and amend when necessary	Daily Function of the Department - Ongoing	n/a
-	Revise the storm preparedness, response, and recovery plan	Done every year	n/a

Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
Prevention Measures and Funding Recommended for Implementation			
CUR60	Encourage NC Building Code to strengthen building codes and incorporate those higher standards for hazard resistance to mitigate structure damage via sending delegation to the Code Council.	Will help prevent damage and lessen cost of mitigation not only throughout County but throughout State.	General Fund
DAR1	Identify Funding to improve stormwater drainage and land management preparation for flooding	Group saw need to expand participants to include adding Soil and Water staff to help identify funding sources.	General Fund, Grant Funds
DCK5	Develop location, density, and intensity criteria for new, existing development and redevelopment including public facilities and infrastructure so that they can better avoid or withstand natural hazards.	Town Code revisions including lot coverage regulations, limitations on residential dwelling size, increased setbacks for accessory structures, additional elevation requirements for V-Zone structures and incentives for use of permeable and semi-permeable materials for driveways and parking have been adopted. Town Council adopted additional limitations on the scale of development through house size limitations and increased setback requirements January, 2019	General Fund

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.

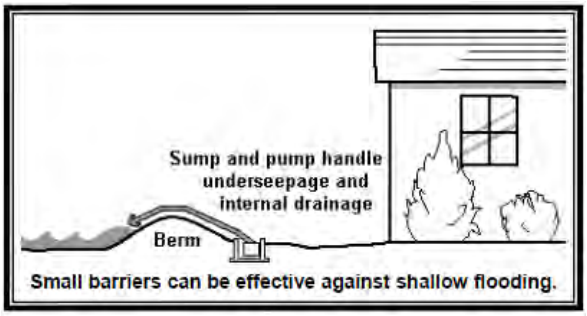


Small, wood frame buildings are the easiest to relocate

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.



Small barriers can be effective against shallow flooding.

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 the Outer Banks Region could receive credit for Activity 520 – Acquisition and Relocation, for acquiring and relocating buildings from the SFHA. The HMPC recommended that communities pursue the purchase of repetitive loss buildings and other buildings which are subject to flood damage in order to return this land to open space.

The CRS also credits barriers and elevating existing buildings under Activity 530. The credit for Activity 530 is based on the combination of flood protection techniques used and the level of flood protection provided. Points are calculated for each protected building. Bonus points are provided for the protection of repetitive loss buildings and critical facilities. Communities could receive credit for Activity 360 – Flood Protection Assistance by providing advice and assistance to homeowners who may want to flood proof their home or business. Advice is provided both on property protection techniques and on financial assistance programs to help fund mitigation.

Flood insurance information for each community is provided in Section 5 and in greater detail in Annex B. 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 Outer Banks 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
Prevention Measures Considered by HMPC and Not Recommended			
-	Assist property owners with safe and efficient clean up after storm events by implementing yearly contract with debris removal services	Ongoing effort that does not require any additional effort or is an already well-established policies/procedures.	n/a
Prevention Measures and Funding Recommended for Implementation			
KDH8	Acquisition - Encourage repetitive loss properties to consider acquisition as a possible solution	Incomplete by lack of funding	NC Division of Emergency Management, FEMA
KH4	Establish long-term plan for funding and implementation of beach renourishment	Keep the beach habitat healthy and thriving which will help with storms and flooding as well.	General Fund
NGH61	Following a severe storm the Town shall consider purchasing land in damage prone areas.	The Town will consider purchasing land in damage prone areas as opportunities arise and on a case by case basis.	General Fund, Grant Fund

C.2.3 Natural Resource Protection

Resource protection activities are generally aimed at preserving (or in some cases restoring) natural areas. These activities enable the naturally beneficial functions of fields, floodplains, wetlands, and other natural lands to operate more effectively. Natural and beneficial functions of watersheds, floodplains and wetlands include:

- Reduction in runoff from rainwater and stormwater in pervious areas
- Infiltration that absorbs overland flood flow
- Removal and filtering of excess nutrients, pollutants and sediments
- Storage of floodwaters
- Absorption of flood energy and reduction in flood scour
- Water quality improvement
- Groundwater recharge
- Habitat for flora and fauna
- Recreational and aesthetic opportunities

As development occurs, many of the above benefits can be achieved through regulatory steps for protecting natural areas or natural functions. This section covers the resource protection programs and standards that can help mitigate the impact of natural hazards, while they improve the overall environment. Six areas were reviewed:

- Wetland protection
- Erosion and sedimentation control
- Stream/River restoration
- Best management practices
- Dumping regulations
- Farmland protection

Wetland Protection



Wetlands are often found in floodplains and topographically depressed areas of a watershed. Many wetlands receive and store floodwaters, thus slowing and reducing downstream flows. They also serve as a natural filter, which helps to improve water quality, and they provide habitat for many species of fish, wildlife and plants.

Erosion and Sedimentation Control

Farmlands and construction sites typically contain large areas of bare exposed soil. Surface water runoff can erode soil from these sites, sending sediment into downstream waterways. Erosion also occurs along stream banks and shorelines as the volume and velocity of flow or wave action destabilize and wash away the soil. Sediment suspended in the water tends to settle out where flowing water slows down. This can clog storm drains, drain tiles, culverts and ditches and reduce the water transport and storage capacity of river and stream channels, lakes and wetlands.

There are two principal strategies to address these problems: minimize erosion and control sedimentation. Techniques to minimize erosion include phased construction, minimal land clearing, and stabilizing bare ground as soon as possible with vegetation and other soil stabilizing practices.

Stream/River Restoration

There is a growing movement that has several names, such as "stream conservation," "bioengineering," or "riparian corridor restoration." The objective of these approaches is to return streams, stream banks and adjacent land to a more natural condition, including the natural meanders. Another term is "ecological restoration," which restores native indigenous plants and animals to an area.

A key component of these efforts is to use appropriate native plantings along the banks that resist erosion. This may involve retrofitting the shoreline with willow cuttings, wetland plants, or rolls of landscape material covered with a natural fabric that decomposes after the banks are stabilized with plant roots.

In all, restoring the right vegetation to a stream has the following advantages:

- Reduces the amount of sediment and pollutants entering the water
- Enhances aquatic habitat by cooling water temperature
- Provides food and shelter for both aquatic and terrestrial wildlife
- Can reduce flood damage by slowing the velocity of water
- Increases the beauty of the land and its property value
- Prevents property loss due to erosion
- Provides recreational opportunities, such as hunting, fishing and bird watching
- Reduces long-term maintenance costs

Communities are required by state and federal regulations to monitor storm water drainage outfalls and control storm water runoff.

Best Management Practices

Point source pollutants come from pipes such as the outfall of a municipal wastewater treatment plant. They are regulated by the US EPA. Nonpoint source pollutants come from non-specific locations and harder to regulate. Examples of nonpoint source pollutants are lawn fertilizers, pesticides, other chemicals, animal wastes, oils from street surfaces and industrial areas, and sediment from agriculture, construction, mining and forestry. These pollutants are washed off the ground's surface by stormwater and flushed into receiving storm sewers, ditches and streams.

The term "best management practices" (BMPs) refers to design, construction and maintenance practices and criteria that minimize the impact of stormwater runoff rates and volumes, prevent erosion, protect natural resources and capture nonpoint source pollutants (including sediment). They can prevent increases in downstream flooding by attenuating runoff and enhancing infiltration of stormwater. They also minimize water quality degradation, preserve beneficial natural features onsite, maintain natural base flows, minimize habitat loss, and provide multiple usages of drainage and storage facilities.

Dumping Regulations

BMPs usually address pollutants that are liquids or are suspended in water that are washed into a lake or stream. Dumping regulations address solid matter, such as shopping carts, appliances and landscape waste that can be accidentally or intentionally thrown into channels or wetlands. Such materials may not pollute the water, but they can obstruct even low flows and reduce the channels' and wetlands' abilities to convey or clean stormwater.

Many cities have nuisance ordinances that prohibit dumping garbage or other "objectionable waste" on public or private property. Waterway dumping regulations need to also apply to "non-objectionable" materials, such as grass clippings or tree branches, which can kill ground cover or cause obstructions in channels. Regular inspections to catch violations should be scheduled.

Many people do not realize the consequences of their actions. They may, for example, fill in the ditch in their front yard without realizing that is needed to drain street runoff. They may not understand how re-grading their yard, filling a wetland, or discarding leaves or branches in a watercourse can cause a problem to themselves and others. Therefore, a dumping enforcement program should include public information materials that explain the reasons for the rules as well as the penalties.

Farmland Protection

Farmland protection is an important piece of comprehensive planning and zoning throughout the United States. The purpose of farmland protection is to provide mechanisms for prime, unique, or important agricultural land to remain as such, and to be protected from conversion to nonagricultural uses.

Frequently, farm owners sell their land to residential or commercial developers and the property is converted to non-agricultural land uses. With development comes more buildings, roads and other infrastructure. Urban sprawl occurs, which can lead to additional stormwater runoff and emergency management difficulties.

Farms on the edge of cities are often appraised based on the price they could be sold for to urban developers. This may drive farmers to sell to developers because their marginal farm operations cannot afford to be taxed as urban land. The Farmland Protection Program in the United States Department of Agriculture's 2002 Farm Bill (Part 519) allows for funds to go to state, tribal, and local governments as well as nonprofit organizations to help purchase easements on agricultural land to protect against the development of the land.

Local Implementation/CRS Credit

There is credit for preserving open space in its natural condition or restored to a state approximating its natural condition. The credit is based on the percentage of the floodplain that can be documented as wetlands protected from development by ownership or local regulations. Communities in the Outer Banks Region could receive credit for Activity 420 – Open Space Preservation for preserving a portion of the SFHA as open space.

Additionally, credit is available for Activity 540 – Drainage System Maintenance. Having a portion of the drainage system inspected regularly throughout the year and maintenance performed as needed would earn a community credit. Communities could also get credit under this activity for providing a listing of problem sites that are inspected more frequently, and for implementing an ongoing Capital Improvements Program.

Table C.3 – Natural Resource Protection Mitigation Options and Recommended Projects

Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
Natural Resource Protection Measures Considered by HMPC and Not Recommended			
-	Preserve and/or restore natural and coastal areas or the natural functions of floodplains (coastal and riverine) and watershed areas.	Not intended to be included in 2015 plan as an action.	n/a
Natural Resource Protection Measures and Funding Recommended for Implementation			
SOS8	Continue implementation of the Waterways and Beaches Ordinance	The Planning and Code Enforcement Department continues to implement the Waterways and Beaches Ordinance. The Town Community Resource Officer and contracted lifeguard service conduct patrols of the beach to ensure compliance. All development along Town waterways is approved following demonstration of compliance. The Town continues to send Notices of Violation for canal obstructions when warranted	General Fund

Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
CUR46	Protect/enhance landforms through both public and private efforts that serve as natural mitigation features by promoting dune grass plantings, installation of sand fencing, importing sand, and other appropriate measures.	The County offers a yearly dune grass, share cost, grant program aimed at enhancing vegetative cover on the dune system.	General Fund
DAR14	Protect natural floodplain function and resilient areas as open space to provide flood and coastal hazard risk reduction and potentially increase CRS 420 open space credit	Get the CRS 420 open space credit and protect natural habitats while reducing risk.	Grants, Donation

C.2.4 Emergency Services Measures

Emergency services measures protect people during and after a disaster. A good emergency management program addresses all hazards, and it involves all local government departments. This section reviews emergency services measures following a chronological order of responding to an emergency. It starts with identifying an impending problem (threat recognition) and continues through post-disaster activities.

Threat Recognition

The first step in responding to a flood is to know when weather conditions are such that an event could occur. With a proper and timely threat recognition system, adequate warnings can be disseminated.

The National Weather Service (NWS) is the prime agency for detecting meteorological threats. Severe weather warnings are transmitted through NOAA's Weather Radio System. Local emergency managers can then provide more site-specific and timely recognition after the Weather Service issues a watch or a warning. A flood threat recognition system predicts the time and height of a flood crest. This can be done by measuring rainfall, soil moisture, and stream flows upstream of the community and calculating the subsequent flood levels.

On smaller rivers and streams, locally established rainfall and river gauges are needed to establish a flood threat recognition system. The NWS may issue a "flash flood watch." This is issued to indicate current or developing hydrologic conditions that are favorable for flash flooding in and close to the watch area, but the occurrence is neither certain nor imminent. These events are so localized and so rapid that a "flash flood warning" may not be issued, especially if no remote threat recognition equipment is available. In the absence of a gauging system on small streams, the best threat recognition system is to have local personnel monitor rainfall and stream conditions. While specific flood crests and times will not be predicted, this approach will provide advance notice of potential local or flash flooding.

Warning

The next step in emergency response following threat recognition is to notify the public and staff of other agencies and critical facilities. More people can implement protection measures if warnings are early and include specific detail.

The NWS issues notices to the public using two levels of notification:

- Watch: conditions are right for flooding, thunderstorms, tornadoes or winter storms.
- Warning: a flood, tornado, etc., has started or been observed.

A more specific warning may be disseminated by the community in a variety of ways. The following are the more common methods:

- CodeRED countywide mass telephone emergency communication system

- Commercial or public radio or TV stations
- The Weather Channel
- Cable TV emergency news inserts
- Telephone trees/mass telephone notification
- NOAA Weather Radio
- Tone activated receivers in key facilities
- Outdoor warning sirens
- Sirens on public safety vehicles
- Door-to-door contact
- Mobile public address systems
- Email notifications

Just as important as issuing a warning is telling people what to do in case of an emergency. A warning program should include a public information component.

StormReady

The National Weather Service (NWS) established the StormReady program to help local governments improve the timeliness and effectiveness of hazardous weather-related warnings for the public. To be officially StormReady, a community must:

- Establish a 24-hour warning point and emergency operations center
- Have more than one way to receive severe weather warnings and forecasts and to alert the public
- Create a system that monitors weather conditions locally
- Promote the importance of public readiness through community seminars
- Develop a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises

Being designated a NWS StormReady community is a good measure of a community's emergency warning program for weather hazards.

Response

The protection of life and property is the most important task of emergency responders. Concurrent with threat recognition and issuing warnings, a community should respond with actions that can prevent or reduce damage and injuries. Typical actions and responding parties include the following:

- Activating the emergency operations center (emergency preparedness)
- Closing streets or bridges (police or public works)
- Shutting off power to threatened areas (utility company)
- Passing out sand and sandbags (public works)
- Holding children at school or releasing children from school (school superintendent)
- Opening evacuation shelters (the American Red Cross)
- Monitoring water levels (public works)
- Establishing security and other protection measures (police)

An emergency action plan ensures that all bases are covered and that the response activities are appropriate for the expected threat. These plans are developed in coordination with the agencies or offices that are given various responsibilities.

Emergency response plans should be updated annually to keep contact names and telephone numbers current and to ensure that supplies and equipment that will be needed are still available. They should be

critiqued and revised after disasters and exercises to take advantage of the lessons learned and of changing conditions. The end result is a coordinated effort implemented by people who have experience working together so that available resources will be used in the most efficient manner possible.

Evacuation and Shelter

There are six key components to a successful evacuation:

- Adequate warning
- Adequate routes
- Proper timing to ensure the routes are clear
- Traffic control
- Knowledgeable travelers
- Care for special populations (e.g., disabled persons, prisoners, hospital patients, schoolchildren)

Those who cannot get out of harm's way need shelter. Typically, the American Red Cross will staff a shelter and ensure that there is adequate food, bedding, and wash facilities. Shelter management is a specialized skill. Managers must deal with problems like scared children, families that want to bring in their pets, and the potential for an overcrowded facility.

Local Implementation /CRS Credit

Flash flood warnings are issued by National Weather Service Offices, which have the local and county warning responsibility. Flood warnings are forecasts of coming floods, are distributed to the public by the NOAA Weather Radio, commercial radio and television, and through local emergency agencies. The warning message tells the expected degree of flooding, the affected river, when and where flooding will begin, and the expected maximum river level at specific forecast points during flood crest.

Communities in the Outer Banks Region could receive credit for Activity 610 – Flood Warning Program for maintaining a program that provides timely identification of impending flood threats, disseminates warnings to appropriate floodplain residents, and coordinates flood response activities. Community Rating System credits are based on the number and types of warning media that can reach the community's flood prone population. Depending on the location, communities can receive credit for the telephone calling system and more credits for additional measures, like telephone trees. Being designated as a StormReady community also provides additional credits.

Table C.4 – Emergency Services Mitigation Options and Recommended Projects

Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
Emergency Services Measures Considered by HMPC and Not Recommended			
-	Develop Emergency Response Plan for Road/Bridge Loss	Ongoing effort that does not require any additional effort or is an already well-established policies/procedures.	n/a
Emergency Services Measures and Funding Recommended for Implementation			
DCK30	Participate in the Dare/Currituck County Local Emergency Preparedness Committee (LEPC)	Dare and Currituck County Emergency Management initiated meetings in 2017 for consideration of forming a joint LEPC. The Outer Banks Regional LEPC was established in order to improve capabilities to meet all threats and hazards not just HAZMAT. Public safety personnel is and will continue to participate in meetings and joint trainings to improve multi-jurisdictional emergency response to all hazards.	General Fund

Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
KDH18	Hazard Warning - Facilitate evacuation	Utilize the Regroup Emergency Alert System to the fullest potential for all hazards and emergency information.	General Fund
KH12	Maintain post-disaster debris management contract with qualified provider.	This will allow the county to continue to remove debris in a timely manner.	General Fund

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			
-	Continue to support coastal barrier protection efforts by the State	Town does not control this.	n/a
-	The Town shall coordinate with Kill Devil Hills regarding fencing around their portion of the Fresh Pond.	Daily Duty	n/a
Structural Project Measures and Funding Recommended for Implementation			
NGH43	Improve fire protection in Nags Head Woods with the installation of 'dry hydrants' and maintenance and improvements to Nags Head Woods Road.	The Nags Head Woods road is maintained by Nags Head Public Works and roadway material is added as needed to maintain an acceptable driving surface.	General Fund, Water Fund
MAN8	Continue to encourage projects undertaken by Town Departments that will lessen the vulnerability of the Town and its residents to natural hazards.	Revised to include all Town Department efforts	General Fund

Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
SOS19	Continue to monitor plans for the Mid-Currituck Bridge to expedite evacuation	The Town continues to monitor the NC Turnpike Authority plans for the Mid-Currituck Bridge to expedite evacuation. Lawsuits are likely to delay the project.	General 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 the Outer Banks Region could receive credit under Activity 330 – Outreach Projects as well as Activity 350 – Flood Protection Information. Credit is available for targeted and general outreach projects. Credit is also provided for making publications relating to floodplain management available in the reference section of the local library.

Table C.6 – Public Information and Outreach Mitigation Options and Recommended Projects

Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
Public Information and Outreach Measures Considered by HMPC and Not Recommended			
-	Educate, empower, and assist the most vulnerable populations from being impacted by potential hazards.	Not intended to be included in 2015 plan as an action.	n/a
Public Information and Outreach Measures and Funding Recommended for Implementation			
CUR19	Increase public awareness and understanding of the locations and proper way to dispose of hazardous waste	PW continues to sponsor an annual household hazardous waste day	General Fund

Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
DAR26	Lobby State Legislators to require realtors to disclose flood zones.	Group saw the need to retain this effort and revisit how best to move it forward in the new plan.	General Fund
DCK18	Provide residents information and links to technical assistance concerning beach re-nourishment and maintenance activities and options such as sand fencing	The Town website, social media and direct email communication is utilized to disseminate information. The Town provides information and issues CAMA permits to oceanfront property owners seeking to maintain their primary and frontal dunes.	General Fund

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