TOWN OF ATLANTIC BEACH RESILIENCE STRATEGY

North Carolina Resilient Coastal Communities Program

APRIL 2025

Dewberry

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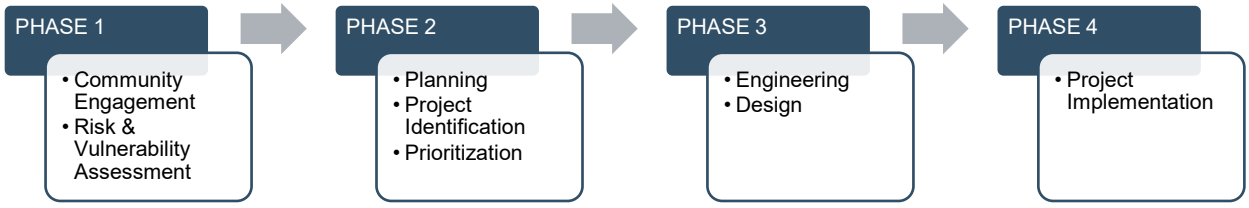
Summary

The Resilient Coastal Communities Program (RCCP) is a grant program administered by the North Carolina Division of Coastal Management (NCDCM). The program's objectives are to address barriers to coastal resilience in North Carolina, to assist communities in the preparation of risk and vulnerability assessments and the development of projects to address community risks, to advance coastal resilience projects to construction, and to link communities to funding streams for project implementation. The RCCP emphasizes the identification of, and outreach to, traditionally underserved communities and the incorporation of natural or nature-based solutions (NNBS) to address community vulnerabilities. The phases of the RCCP are illustrated below.

Figure 1. RCCP Phases



The Town of Atlantic Beach, North Carolina was selected for Phases 1 and 2 of the RCCP in 2023. Phases 1 and 2 of the RCCP process included the preparation of a Risk and Vulnerability Assessment, community engagement, and the development of a Project Portfolio with projects that would address community vulnerabilities. The entire effort was guided by the input of a Community Action Team (CAT) comprising of Town residents and staff.

Prepared under Phase 1 of the RCCP, the Risk and Vulnerability Assessment identified assets at risk from several coastal hazards, including storm surge, coastal flooding and sea level change, recurring pluvial flooding, and wildfire. Assets receiving the highest risk scores in the present and future conditions included utility and transportation infrastructure, though these higher scores still indicated a low risk to these assets.

Additional work conducted during Phase 1 of the RCCP included community engagement and meetings with the CAT. Feedback from the CAT and the public provided insight on locations of vulnerable infrastructure and on the challenges residents face as a result of recurring flooding during pluvial events.

The information gathered during Phase 1 of the process was used to develop an initial list of project recommendations. These recommendations were prioritized and further detailed based on additional feedback from the CAT and the public. The final recommendations are included in the Project Portfolio, presented in Appendix D of this report. Six projects (or project types) were selected for inclusion in the Project Portfolio; several of the projects may be implemented at multiple locations throughout the Town. These projects, which include options for natural or nature-based solutions, may be funded under later phases of the RCCP or under other federal, state, or local programs.

The enclosed report provides a more in-depth look at the RCCP process and the major outcomes of the effort.

1. Community Overview

Atlantic Beach is located on the Bogue Banks in Carteret County, bounded by the Atlantic Ocean to the south and Bogue Sound to the north. It is the easternmost community on the island, with Fort Macon State Park encompassing the portion of the island east of Town limits. Approximately 70%[1] of land within Town limits is considered developed, with the remaining undeveloped acreage largely consisting of natural areas along Bogue Sound; roughly 28% of the Town's land area is classified as Conservation. Publicly owned Town facilities include Town Hall (including the Town's Fire and Police Departments), Public Works facilities (including two water towers), and a community park. The state maintains public beach access, which in some cases the Town also utilizes for additional infrastructure. The Town works closely with the state and the U.S. Army Corps of Engineers on maintenance of the oceanfront shoreline, with the most recent beach nourishment project completed in 2024.

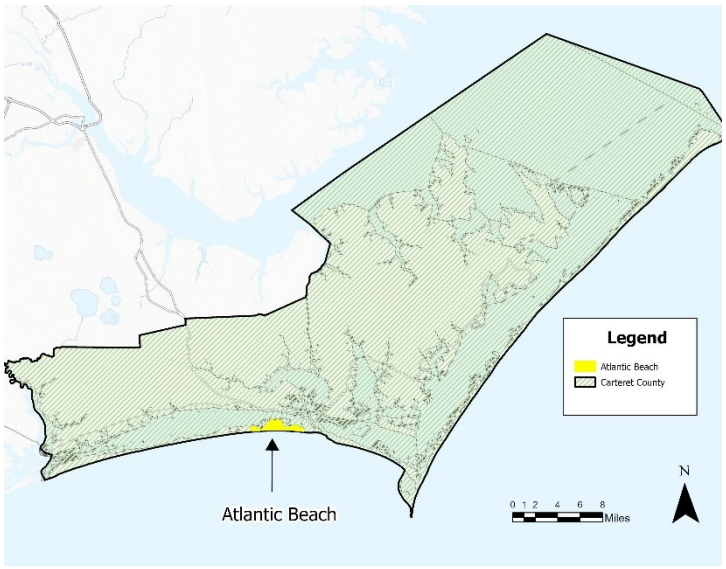


Figure 2. Atlantic Beach Vicinity Map

Figure 3. Atlantic Beach Town Hall

As a barrier island community, Atlantic Beach experiences hazards associated with coastal storms and heavy rainfall events. The Town has experienced significant development in the last five decades, which has increased the density of impervious surface in the watersheds within Town limits. Increases in stormwater runoff and pollution as well as aging infrastructure have affected water quality within the watersheds. The Town recently (2021) updated its CAMA Land Use Plan and completed a Watershed Restoration & Stormwater Resilience Plan to identify land use and infrastructure solutions to address community flooding. Deficiencies in stormwater infrastructure, including the lack of available publicly owned land to implement new projects and facility impacts, present challenges to address the increasing frequency and duration of heavy rainfall events that the Town has experienced.

Figure 4. Atlantic Beach Public Works Building

Based on the Town's previous work to address community resiliency and feedback from the

[1] Atlantic Beach CAMA Land Use Plan (2021), p. 85.

Community Action Team (CAT), the community vision for Town of Atlantic Beach is ***to build community resiliency to flooding and other coastal hazards, with the Town working in partnership with residents to implement solutions that maximize efficiency while minimizing impact***. To achieve this vision, community goals include **implementing stormwater infrastructure improvements** (such as those included in the Watershed Restoration & Stormwater Resilience Plan), **partnering within the community** to identify ways private property owners can be a part of the process, and **developing long-term solutions** that minimize impacts to the natural and coastal environment.

Community Vision

To build community resiliency to flooding and other coastal hazards, with the Town working in partnership with residents to implement solutions that maximize efficiency while minimizing impact.

Community Goals

1. *Implement stormwater infrastructure improvements*
2. *Partner within community*
3. *Develop long-term solutions*

2. Community Action Team

The Resilient Coastal Communities Program (RCCP) requires each community to establish a multi-disciplinary Community Action Team (CAT), composed of diverse stakeholders who will provide input throughout the RCCP process. The CAT is also to help engage the community at-large to ensure broad community participation in the RCCP. Under-represented communities should be reflected in the CAT and in community engagement efforts. The Town of Atlantic Beach established the CAT for this effort through input from Town staff and the Town Council. The membership of the CAT is listed in **Table 1**.

Table 1. Community Action Team

COMMUNITY ACTION TEAM	
NAME	**POSITION**
Joey Dean	Atlantic Beach Town Council
Neil Chamblee	Atlantic Beach Planning Board
Billy Whitford	Atlantic Beach Resident
Denise Clark	Atlantic Beach Resident
Marc Shulze	Atlantic Beach Public Works Director
Lindsay Allen	Atlantic Beach Public Works Admin

Meetings of the CAT were held in February, May, and October 2024; a summary of each meeting is included in **Appendix A**. The CAT membership included Town staff and community members with a range of experience, and each provided insight on historic hazard planning efforts, infrastructure needs, and community sentiment. In the initial discussions, the CAT described previous experience with flooding events, noting the challenges experienced following heavy rainfall events and coastal storms.

The Town has previously used pop-up events and online forums to engage the public, and the CAT recommended venues and forums that could be utilized for the RCCP community engagement events. The CAT also provided recommendations on the approach to these events and ways to advertise them to reach the broadest audience possible. The community engagement effort is detailed in Section 3.0.

The CAT provided feedback on the initial findings of the Risk and Vulnerability Assessment (RVA), concurring with the assets and their locations within Town limits that experience flooding. A summary of the RVA is provided in **Section 5.0**.

Following completion of the RVA and the community engagement process, the CAT reviewed the feedback received and provided insight on the prioritization of the projects to be included in the project portfolio. As discussed in **Section 6.0**, stormwater facility improvements, pump system improvements, and dune infiltration systems were identified as top community priorities, with educational materials for residents also recommended for implementation.

3. Community Engagement Strategy

The RCCP community engagement strategy utilized a combination of in-person and online outreach opportunities to provide the broadest audience possible an opportunity to participate. Two in-person public events were held for the RCCP:

- The first public meeting, held on April 3, 2024, was a pop-up event held at the Crystal Coast Brewing Company. Posters and maps describing the RCCP and focus area were available for those who visited. Several members of the project team and CAT were available to answer questions.
- An open house was held at the Atlantic Beach Town Hall on July 24, 2024, to gather feedback for Phase 2 of the RCCP, specifically on the types of projects to be included in the project portfolio.

Figure 5. April 3,2024, Public Meeting

As many property owners do not live in Atlantic Beach on a full-time basis, the community engagement process included an online survey associated with each in-person outreach event. A separate survey was prepared for each event, with the questions highlighting the focus of Phases 1 and 2 of the RCCP, respectively. A QR code and link to the appropriate survey was included in meeting announcements, shared through the Town's social media and email lists, and available at each outreach event. Hard copies of each survey were also provided at each outreach event for those who did not want to complete the online version. A copy of the surveys and other public engagement materials, along with summaries of all the comments received, are included in **Appendix B**.

Figure 6. July 24, 2024, Public Meeting

The majority of feedback on the RCCP was provided through online surveys, as attendance at the in-person events was limited. Flooding was identified as the major concern noted by survey

respondents, and projects that would address stormwater infrastructure on neighborhood streets were the most frequently recommended. Respondents noted locations throughout Town limits that would benefit from infrastructure upgrades.

4. Review of Existing Local Regional Plans

Table 2 summarizes the previous plans prepared at the Town or regional level that apply to the RCCP.

Table 2. Existing Local and Regional Plans

EXISTING LOCAL AND REGIONAL PLANS		
YEAR	TITLE	DESCRIPTION
2017	Carteret County Hurricane Matthew Resilient Redevelopment Plan	This document describes the current needs of Carteret County regarding holistic recovery and redevelopment after Hurricane Matthew (2016). It includes recommendations on proposed projects and actions based on community needs and stakeholder feedback.
2020	White Oak River Basin Water Resources Plan	Basin-wide planning is a watershed-based approach to identify areas across the state where water resource concerns should be addressed. The planning process identifies areas that need additional protection, restoration, or preservation to ensure waters of the state are meeting their designated use. This Basin Plan reflects the planning process and serves as a summary document for the river basin.
2020	Pamlico Sound Regional Hazard Mitigation Plan	This Hazard Mitigation Plan (HMP) involves a five-county region including Beaufort County, Carteret County, Craven County, Hyde County, and Pamlico County. The plan looked to identify, assess, and mitigate hazards risk to better protect people and property in the area by developing a mitigation action plan.
2021	Atlantic Beach Watershed Restoration & Stormwater Resilience Plan	The plan identified restoration objectives and several management strategies to achieve the objectives. It also identified 25 projects intended to reduce stormwater runoff and improve water quality.
2021	Atlantic Beach CAMA Land Use Plan Update	Land use plan for the Town of Atlantic Beach that outlines current local conditions and identifies planned future actions in sensitive coastal areas in accordance with guidelines established by the North Carolina Coastal Resources Commission (CRC).
2023	Carteret County National Risk Index	Risk data for Carteret County related to natural disasters.

5. Risk and Vulnerability Assessment

As outlined in the RCCP Handbook (December 2023), a Risk and Vulnerability Assessment (RVA) was conducted to evaluate the susceptibility of the Town's critical built and natural infrastructure to coastal hazards. The assessment process and results of the RVA are summarized on the following pages, and the full report is included in **Appendix C**.

Previous studies pertaining to vulnerability or risk and/or highlighting critical assets were used as a starting point for the RVA. Process steps included the following:

- Identifying and Mapping Hazards
- Assessing Vulnerability
- Estimating Risk

Hazards identified in the RVA included storm surge, coastal flooding, sea level change, recurring pluvial flooding, and wildfire. The vulnerability assessment includes an individual examination of each hazard as well as a discussion of cumulative hazard vulnerability.

Vulnerability and risk scores are assigned for several categories of public and natural infrastructure with Town limits, including the following:

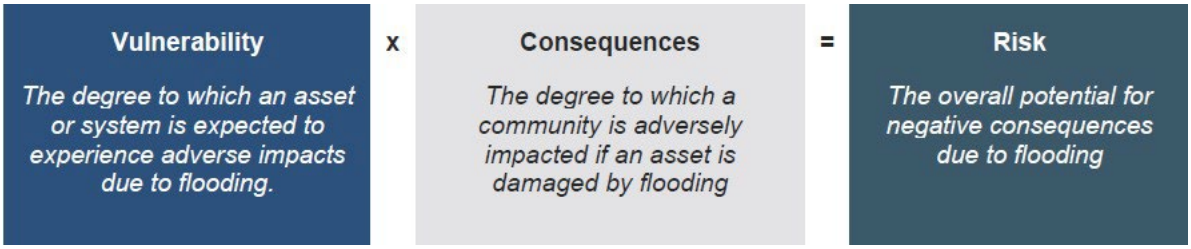
- **Critical Built Infrastructure** includes the physical structures that house or perform essential functions to maintain government operations and are essential to human health and safety or economic safety. This can include Town Halls, emergency facilities, schools, and libraries.
- **Critical Network Infrastructure** includes networks that support the continuous operation of government and business functions and are essential to human health and safety or economic safety. Network infrastructure can include publicly-owned transportation facilities (roadways, bridges, greenways) as well as utility infrastructure (water, sewer lines and associated facilities).
- **Natural Assets** are lands actively managed to serve specific community needs, such as growing food, recreational space, and support for local ecosystems. Vulnerability is evaluated based on loss of functionality.
- **Natural Infrastructure** consists of naturally occurring landscapes and systems that perform ecosystem services that benefit nearby communities, such as flood protection or abatement, erosion control, and water purification. Vulnerability is evaluated based on loss of habitat.

As outlined in the RCCP Handbook, Vulnerability and Risk scores are calculated for each identified asset using the following formulas:

Figure 7. Components of Vulnerability

Exposure	+	Sensitivity	–	Adaptive Capacity	=	Vulnerability
The probability of physical contact between an asset and a hazard		*The degree to which an asset may be affected by a hazard*		*The ability of an asset to change its characteristics or behavior in response to a hazard*		*The degree to which an asset or system is expected to experience adverse impacts due to flooding.*

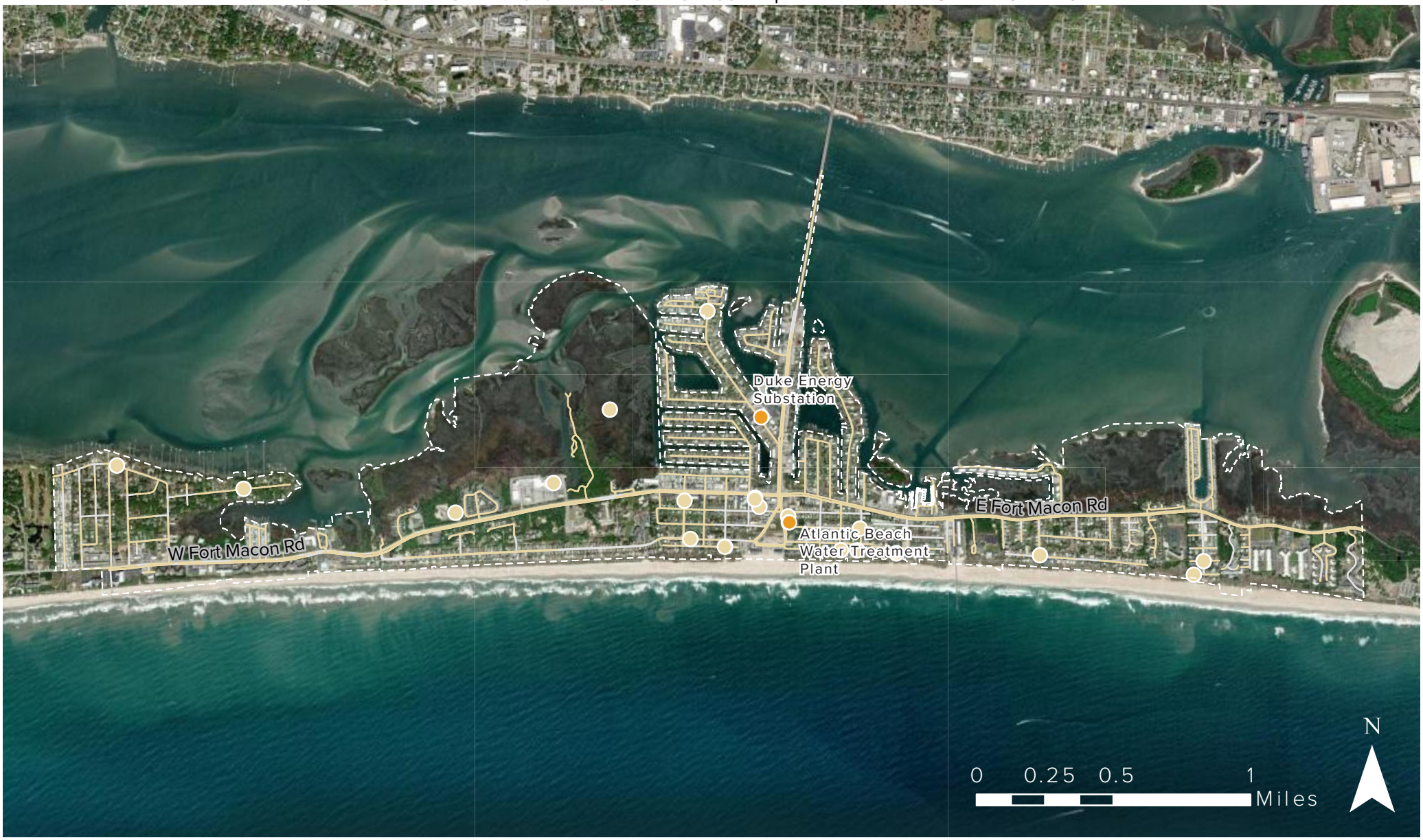
Figure 8. Components of Risk



The assessment assigned risk scores for both present-day and future conditions, relying on the present-day and future cumulative hazard vulnerability scores developed for each asset. As illustrated in **Figure 9** (present-day conditions) and **Figure 10** (future conditions), key findings of the RVA include:

- Critical building infrastructure assets with the highest risk scores are the Duke Energy Substation and the Water Treatment Plant (risk score of 2 – low risk). Under future conditions, the East and West End Water Towers, Atlantic Beach Rescue, and the Atlantic Beach Police Department also have risk scores of 2.
- Segments of West Fort Macon Road and Ocean Boulevard have the highest risk scores for network infrastructure, with risk scores of 2 (low risk). The majority of roads, sidewalks, and trails have a risk score of 1 (very low risk). This score does not account for service disruptions (i.e., access to critical facilities).
- No natural assets have high risk scores; the preserve and Town Park have risk scores of 1 (very low risk) under both current and future conditions.
- The majority of wastewater facilities included in this assessment are pump lift stations. These stations have a low criticality score, due to their redundancy as a system across the Town. Pump failure or degraded functionality may have localized impacts, however.

The RVA includes recommendations for future study or further refinement of this assessment, including the incorporation of more specific building characteristics, modeling impacts to natural infrastructure, conducting a pluvial flood analysis of the County specific to the Town of Atlantic Beach, and consideration of additional climate-influenced hazards included in the 2020 Pamlico Sound Regional Hazard Mitigation Plan.



Town of Atlantic Beach

Present-Day Risk Scores

Legend

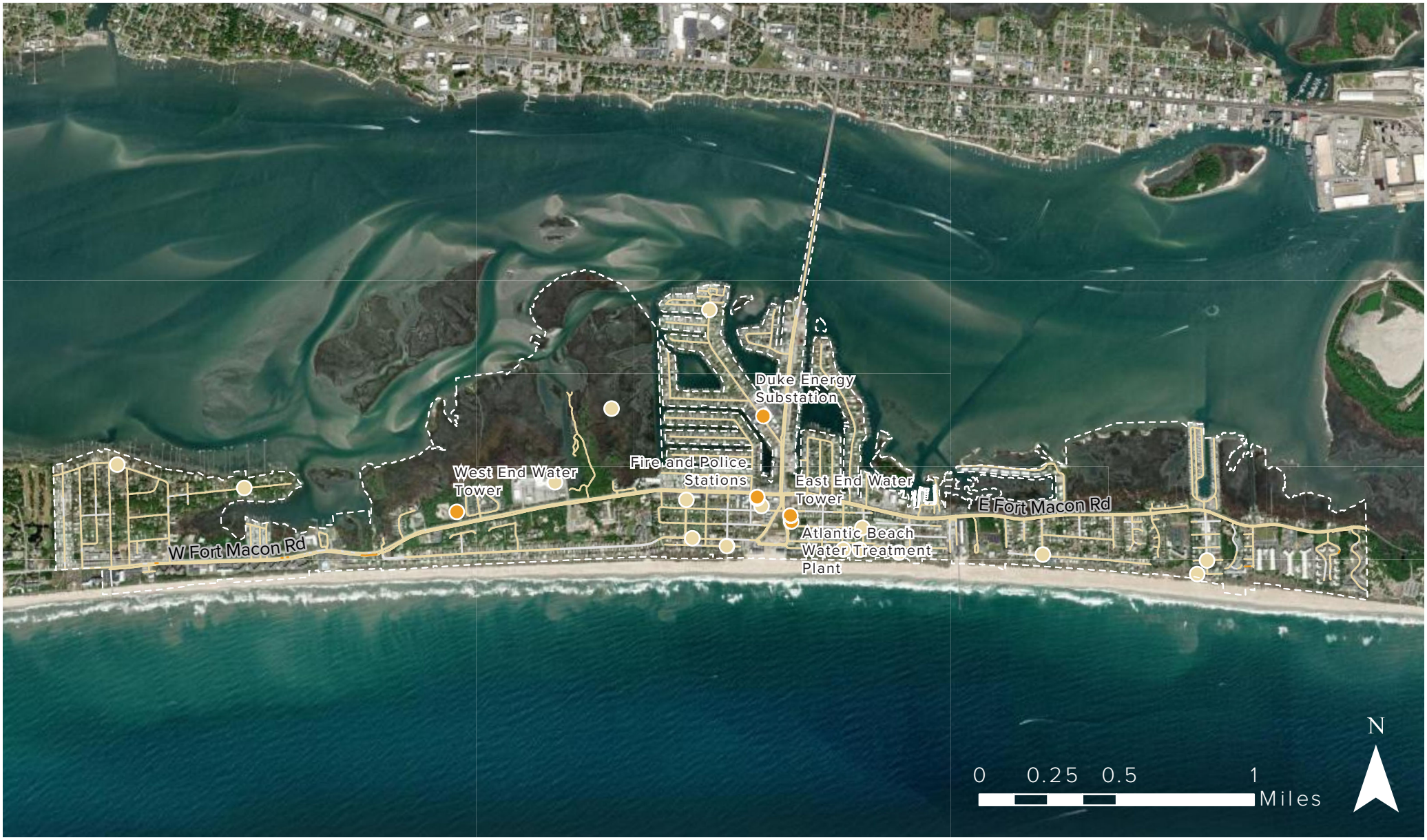
Present-Day Risk Scores

Critical Facilities
- 0
- 1
- 2
- 3
- 4
- 5

Roads and Trails
- 0
- 1
- 2
- 3
- 4
- 5

Boundaries and Context
- Town of Atlantic Beach Boundary
- Wetlands

Figure 9. Present-Day Risk Scores



Town of Atlantic Beach

Future Conditions Risk Scores

Legend

Future Conditions Risk Scores

Critical Facilities
- 0
- 1
- 2
- 3
- 4
- 5

Roads and Trails
- 0
- 1
- 2
- 3
- 4
- 5

Boundaries and Context
- Town of Atlantic Beach Boundary
- Wetlands

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Atlantic BEACH NORTH CAROLINA

North Carolina RESILIENT COASTAL COMMUNITIES PROGRAM

Figure 10. Future Conditions Risk Scores

6. Project Portfolio

Utilizing input from the Risk and Vulnerability Assessment, feedback from the public, and input from the CAT, a list of projects to address specific coastal hazards and recommended locations was developed. The Project Portfolio, detailed in **Appendix D**, lists the following information for each project:

- Project title and description
- Anticipated cost and needs addressed
- Funding status
- Natural or Nature-Based Solution (NNBS) opportunity
- Project timeline and priority

Factors considered in the development of the Project Portfolio include:

- Inclusion of natural or nature-based solutions (included in the RCCP criteria)
- The need(s) addressed and the scope of the project's benefit
- Project implementation timeline (i.e., an emphasis on shovel-ready projects)
- Other potential funding sources for the project
- Community input and support

Table 3 highlights the top five project priorities included in the Portfolio; the complete Portfolio, including detail sheets on each project, is included in **Appendix D**.

Table 3. Priority Projects

PRIORITY PROJECTS	
PROJECT	**DESCRIPTION**
Stormwater Facility Improvements	Improve stormwater facilities (ditches, storm drains, etc.) on multiple Town streets.
Pump Systems	Install pumps at new locations or make improvements at existing pump locations.
Dune Infiltration	System would act as sand filter for stormwater diverted to ocean outfalls. May include pumps or catch basins to move stormwater from roadways into the system.
Stormwater Pre-treatment	Construct stormwater treatment facilities (bioswales, infiltration systems, other green infrastructure) to minimize water quality impacts at multiple locations.
Infrastructure Mapping	Map all stormwater infrastructure within Town limits to determine service gaps and needs.

7. Conclusions and Lessons Learned

The RCCP process provided the Town of Atlantic Beach an opportunity to build upon previous planning efforts and to establish a Project Portfolio to guide the Town in applying for project funding. Potential funding sources include Phases 3 and 4 of the RCCP, which funds the engineering and construction, respectively, for projects that meet specific identified community needs. As not all of the projects identified in this process will be eligible for funding under the RCCP, other potential funding opportunities at the federal, state, and local level have been identified to the extent possible.

The initial Risk and Vulnerability Assessment (RVA), which used available data on storm events, sea level rise scenarios, roadway vulnerability, and asset condition, yielded results that were consistent with community experience and CAT input. Qualitative discussion of localized flooding events helped capture one of the commonly cited hazards experienced in Atlantic Beach in the RVA; however, a more robust localized rainfall dataset would be helpful to model the impact of these events on community assets.

In addition to infrastructure improvements, the importance of continued public education and outreach was discussed. As improvements to, and expansion of, stormwater infrastructure will likely require use of privately-owned land, continued community conversation about the importance of these improvements will be critical for community buy-in and project implementation. Targeted outreach to homeowners, developers, and the real estate community could highlight actions that can be taken on private properties to increase the effectiveness of public infrastructure improvements.

Acknowledgements

We would like to thank the Town of Atlantic Beach for its efforts associated with the development of this report and the Project Portfolio. In particular, we would like to thank the members of the Community Action Team for their honest feedback on the community's needs and guidance on how to engage the community during this process. We also thank the N.C. Division of Coastal Management, as well as the N.C. Sea Grant and the N.C. Office of Recovery and Resiliency, for the guidance and insight they provided throughout this process.

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APPENDIX A

COMMUNITY ACTION TEAM MEETING SUMMARIES

APRIL 2025

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North Carolina
RESILIENT
COASTAL
COMMUNITIES
PROGRAM

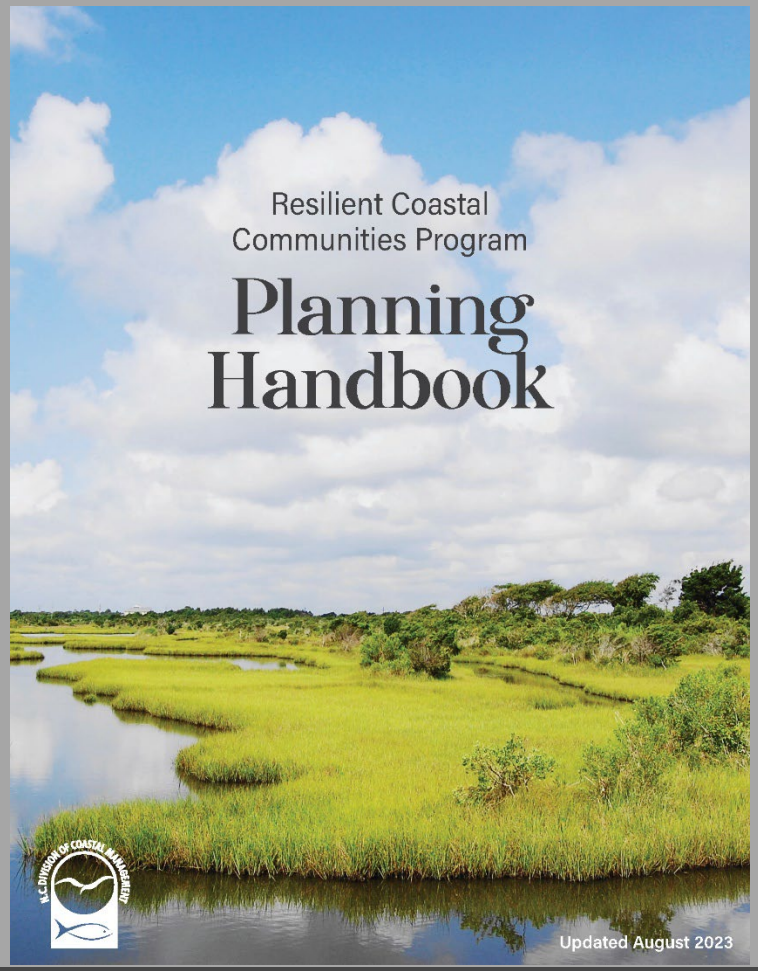
Resilient Coastal Communities Program

Atlantic Beach Community Action Team Mtg. #1

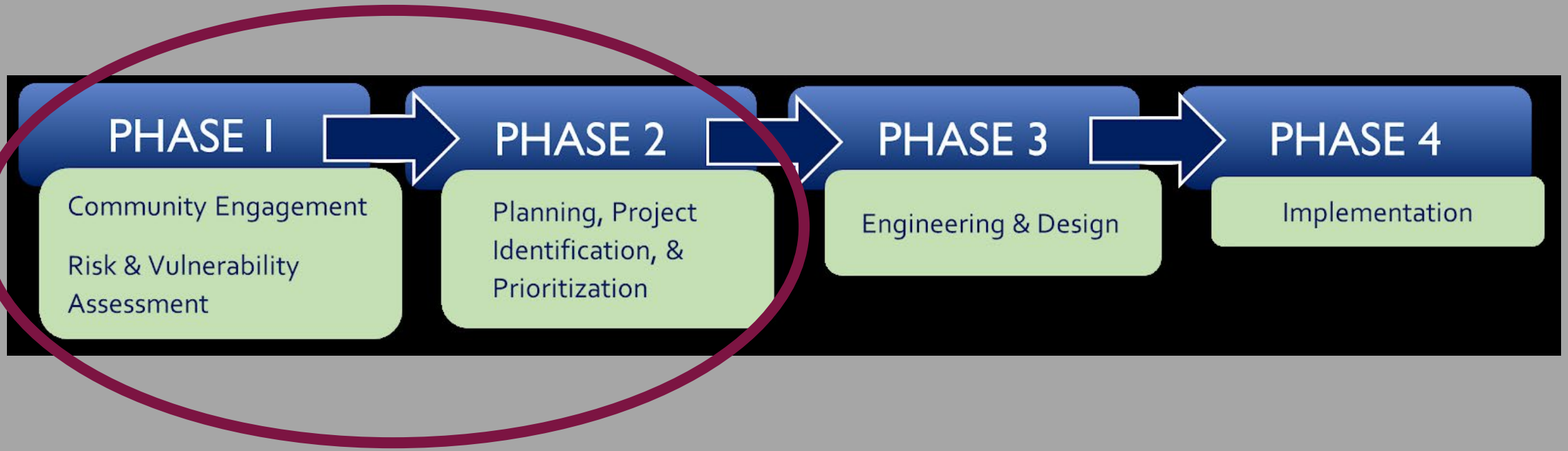
February 8, 2024

Resilient Coastal Communities Program

- Address barriers to coastal resilience;
- Assist communities with risk and vulnerability assessments and developing a portfolio of planned and prioritized projects;
- Advance coastal resilience projects to shovel-readiness; and
- Link communities to funding streams for project implementation

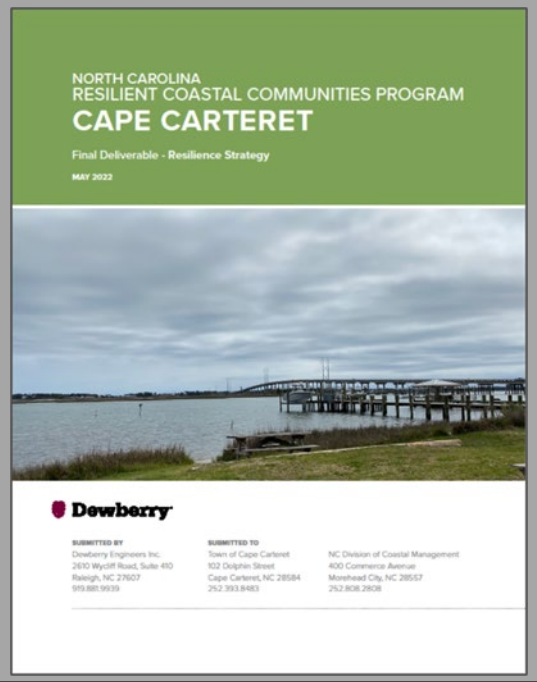


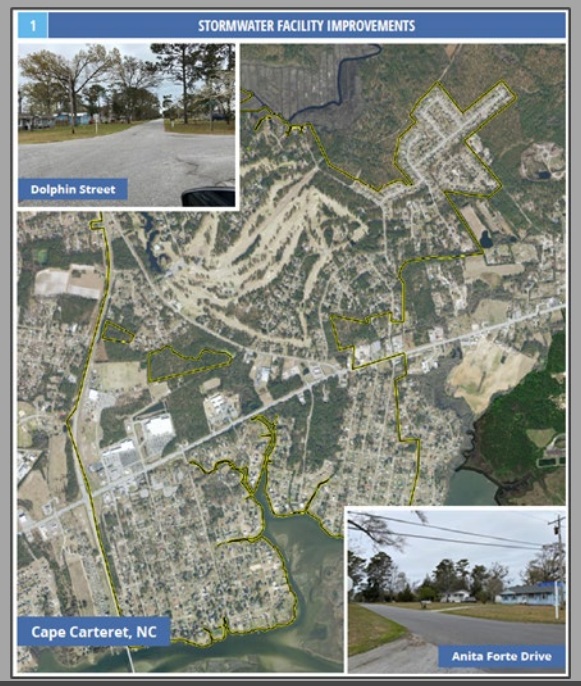
Program Overview



Deliverables

- Risk and Vulnerability Assessment Report
- Project Portfolio





Proposed Project Summary

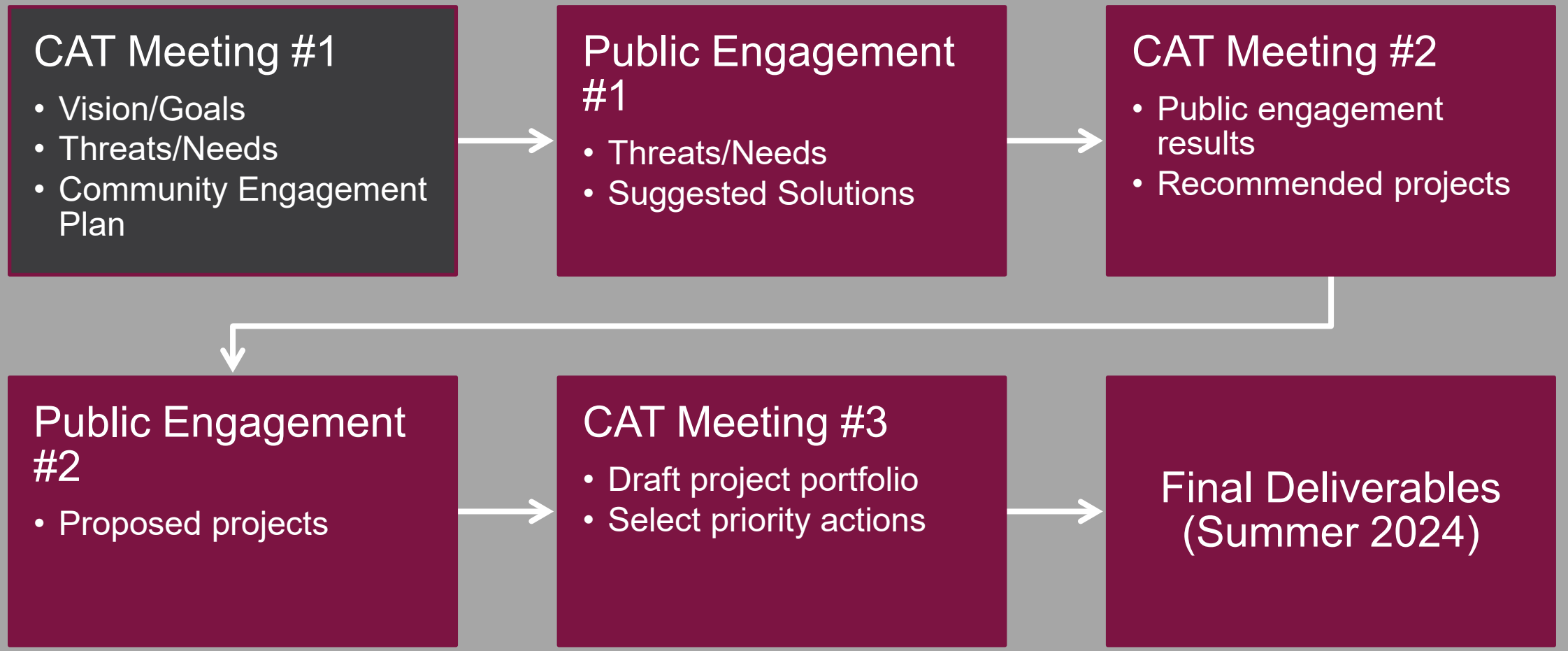
CAPE CARTERET	RESILIENT COASTAL COMMUNITIES PROGRAM PROJECT PORTFOLIO								UPDATED MAY 2022
Project (Priority #)	Project Title	Description	Location	Anticipated Cost	Funding Status	Needs Addressed	NNBS Opportunity	Source Document	Timeline	Notes/ Project Status
1	Stormwater Facility Improvements	Improve stormwater facilities on multiple Town streets, including Sutton Drive, Ardan Oaks Drive, Anita Forte Drive/Loma Linda Court, Dolphin Street, and Bogue Sound Drive. Specific stormwater improvements (grassy swales) are proposed for Sutton Drive, Ardan Oaks Drive, Anita Forte Drive/Loma Linda Court, Dolphin Street, Neptune Drive, Neptune Court, and Bogue Sound Drive.	Multiple street locations	Varies based on location needs and solution to be implemented.	Project is subject of 2021 BRIC program application; award status TBD.	Stormwater Management, Flooding	Yes	Cape Carteret CAT; included in public survey.	Varies based on location needs and solutions to be implemented. Intended as ongoing program.	Identified as top priority by CAT; project was subject of recent (2021) BRIC application (Flood Mitigation and Resiliency Project).
2	Stormwater Infrastructure Mapping	Map all stormwater infrastructure within Town limits to determine service gaps and needs.	Townwide	Expected to be low cost, depending upon level of survey effort.	Not currently funded.	Stormwater Management, Flooding		Cape Carteret CAT; included in public survey.	No proposed timeframe; may take between six months to a year to complete.	A comprehensive survey of stormwater infrastructure has (to date) not been completed. Survey (and condition assessment) needed to determine service needs.
3	Stormwater Pretreatment	Construct stormwater treatment facilities to minimize water quality impacts to Bogue Sound and Pettiford Creek at multiple locations, including Sutton Drive, Ardan Oaks Drive, Anita Forte Drive, Loma Linda Court, Dolphin Street, Neptune Drive, Neptune Court, and Bogue Sound Drive.	Multiple street locations	Varies based on location needs and solution to be implemented.	Not currently funded.	Stormwater Management, Flooding	Yes	Cape Carteret CAT; included in public survey.	Varies based on location needs and solutions to be implemented. Intended as ongoing program.	Project would build upon the improvements listed in Project #1, with the locations determined in part through the mapping completed in Project #2.
4	Living Shoreline Construction	Construct an oyster reef or living shoreline along the Bogue Sound and Deer Creek shoreline.	Bogue Sound/ Deer Creek shorelines	Dependent upon location and extent of proposed shoreline.	Not currently funded.	Stormwater Management, Flooding, Disaster Recovery, Climate Change	Yes	Cape Carteret CAT; included in public survey.	No proposed timeframe; construction may take between three and nine months, not including follow-up monitoring.	
5	Tree Canopy Replacement	Plant young trees to increase overall tree canopy within the Town and replace trees lost during storm events.	Townwide	Dependent upon extent of tree canopy to be replaced.	Not currently funded.	Disaster Recovery	Yes	Cape Carteret CAT; included in public survey.	Intended as ongoing program as funding is available.	
6	Public Engagement and Education Campaign	Engage and educate Cape Carteret residents and business owners on the impacts of storm events and other coastal hazards. This would be a continuous program to involve Town residents in the decision-making process for determining future resilience actions.	Townwide	Limited cost, primarily staff time and publication/ distribution of materials.	Not currently funded.	Stormwater Management, Flooding, Infrastructure Deficiency or Capacity, Climate Change		Cape Carteret CAT.	Intended as ongoing program as funding is available.	Build on the Town's existing public engagement efforts that are conducted as part of the NWS StormReady Community program, as well as prior regional hazard mitigation planning efforts.

Community Action Team (CAT) – Your Role

"..key stakeholders to provide targeted input and champion the effort." – RCCP Handbook, August 2023

- At least 5 members representative of community and diverse perspectives
- Appoint a "CAT Champion" to lead the CAT and coordinate with NCDCM, Dewberry, and the CAT membership

Process


CAT Meeting #1
• Vision/Goals
• Threats/Needs
• Community Engagement Plan
Public Engagement #1
• Threats/Needs
• Suggested Solutions
CAT Meeting #2
• Public engagement results
• Recommended projects
Public Engagement #2
• Proposed projects
CAT Meeting #3
• Draft project portfolio
• Select priority actions
Final Deliverables (Summer 2024)

Discussion

- Community Vision and Goals
- Threats/Challenges to Community Resilience
- Community Engagement Strategy

Thank you!

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Caroline Cunningham, AICP, CFM

984-255-7054

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ATLANTIC BEACH CAT MEETING #1 AGENDA

Date: February 8, 2024

Time: 1:30 p.m.

Location: Atlantic Beach Town Hall, Boardroom

Purpose: Atlantic Beach Resilient Coastal Communities Program Community Action Team Meeting – Establish Vision, Discuss Threats to Community Resilience

Agenda Items

1:30 p.m. **Welcome and Introductions**

1:40 p.m. **Resilient Coastal Communities Program Overview**
Program Objectives
Consultant Deliverables
Proposed Schedule

1:50 p.m. **Discussion**
Community Vision and Goals
Threats/Challenges to Community Resilience
Community Engagement Strategy

2:20 p.m. **Wrap-up**
Action Items and Next Steps

Attendees

Name	✓	Organization	Email
Joey Dean		Atlantic Beach Town Council	jdean@atlanticbeach-nc.com
Neil Chamblee		Atlantic Beach Planning Board Chair	Neil.chamblee@gmail.com
Jimmie Whitford		Atlantic Beach Resident	billy@whitfords.biz
Denise Clark		Atlantic Beach Resident	acdc36@aol.com
Marc Shulze		Atlantic Beach Public Works Director	publicworksdirector@atlanticbeach-nc.com
Lindsay Allen		Atlantic Beach Public Works Admin	publicservicesadmin@atlanticbeach-nc.com
Mackenzie Todd		NC Division of Coastal Management	Mackenzie.Todd@deq.nc.gov
Kasen Wally		NC Division of Coastal Management	kasen.wally@deq.nc.gov
Jennifer Ansell		Atlantic Beach Planning and Development Dir.	planner2@atlanticbeach-nc.com

Beth Smyre		Dewberry	esmyre@dewberry.com
Caroline Cunningham		Dewberry	ccunningham@Dewberry.com

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ATLANTIC BEACH CAT MEETING #1 DISCUSSION

DATE: February 8, 2024

TIME: 1:30 p.m.

LOCATION: Atlantic Beach Town Hall, Boardroom

PURPOSE: Atlantic Beach Resilient Coastal Communities Program Community Action Team Meeting – Establish Vision, Discuss Threats to Community Resilience

DATE: February 27, 2024

ATTENDEES: Joey Dean, Neil Chamblee, Jimmie Whitford, Marc Shulze, Lindsay Allen, Jennifer Ansell, Elisabeth Webster, John O'Daniel, Mackenzie Todd, Kasen Wally, Beth Smyre, Caroline Cunningham

Discussion Topics

1. **Community Vision and Goals**

   The Resilient Coastal Communities Program (RCCP) requires each community to identify a vision statement (an aspirational statement for where the community wants to be in the future in relation to coastal hazards) and a series of goals to achieve that vision. The group was provided copies of Vision and Goal statements from recent Atlantic Beach plans as well as those developed by other communities in the previous round of the RCCP. The CAT provided the following ideas, organized here by topic/theme:

   - *Access*: providing safe access for recreation to the oceanfront beach and the sound, with emphasis on environmentally-friendly options; considerations for continued tourism.
   - *Providing for public services*: Ensuring the safety of residents and visitors on the beach; meeting state requirements for water conveyance and water quality; protection for the grocery store and overall food supply.
   - *Post-storm recovery*: Ability to quickly assess damage caused by storms or other hazard events.

   <u>Other feedback:</u>

   - Discussed definition of resilience- ability to recover from natural hazard events, with a focus on natural hazards. The RCCP allows for consideration of green and gray infrastructure to address resilience challenges, including beach access and other community needs.
   - Discussed whether water quality was something that needed further monitoring; researchers have conducted various studies in recent years, including a previous study by W.K. Dickson on low spots, and a UNC study on climate.
   - Discussed problems associated with restoration of power following storms, including issues at the substation and the distribution lines. Existing poles are not in great condition. Power infrastructure within the Town is owned by Duke Energy.

2. **Threats/Challenges to Community Resilience:**

   The CAT was asked to provide thoughts on what coastal or climate hazards represented a threat or challenge for Atlantic Beach. The following threats and challenges were discussed, organized here by topic/theme:

   - *Climate events*: Hurricanes and coastal storms; flooding after heavy rainfall over a short period; wind; impacts of King tides; "Sunny Day" flooding; wildfire.
   - *Infrastructure needs*: Beach evacuation (following the state hurricane evacuation plan); seawall breaches at the causeway that cause flooding to businesses and surrounding properties; causeway flooding, especially where it interferes with emergency access; power outages, and the post-storm repair timeline; most homes at or below sea level are being replaced.

Other feedback:

- Noted recommended changes to the draft storm surge and flooding maps. Areas that have received flooding include the causeway, South Durham Avenue, around Dunes Avenue (shown as a future flooding area). The area around Island Quay Court was noted as an area that hasn't flooded.
- Discussed a recent beach wildfire, accidentally set by fireworks. Wind caused the fire to spread quickly across the dunes, requiring fire units from across the county to respond. Concerns raised if winds were coming from different direction, fire could have spread into residential area. Potential fires in marsh area could impact residential areas if fueled by winds from the northwest.
- Noted the complexity of having state roads across the community (in terms of planning and project complexity and coordination needs).

3. **Community Engagement Strategy:**

What techniques (in-person meetings, virtual options) have been the most effective at getting feedback?

- In person meetings at Town Hall have typically garnered low attendance (typically a couple of people, with one giving comments).
- The meeting approach will be informal, to include stations with maps or other activities. This style is preferred over a formal, presentation-style, meeting.
- Pop-up events might be more worthwhile, including going to local bars and restaurants. This has been used for other recent studies and has worked well.
- Beach music festival in May, but attendees may mostly be out of towners. Would be difficult to get meaningful feedback.

Attachments

Action Items

ACTION ITEM	ASSIGNED TO	DATE DUE	STATUS
Schedule Public Engagement event/prepare online survey #1	Dewberry	2/29/24	Underway
Provide feedback on Meeting #1 discussion	CAT	2/29/24	Underway
Schedule second CAT meeting	Dewberry	3/31/24	Open

Flip Chart Notes

Vision and Goals:

- Water conveyance vs. water quality
  - Meeting state requirements
- Provide safe access to water for recreation
  - Environmentally safe options
- Tourism considerations
- Provide public services
- Ability to quickly assess damage
- Beach access
- Safety on beach
- Protection for grocery store, food supply

Threats and Challenges to Resilience:

- Hurricane
- Flooding – rainfall over short period
  - Recent stormwater management plan
- Wind
- Beach evacuation plan (state evacuation plan)
- King Tide impacts
- Sunny Day flooding
- Seawall breaches at the causeway
  - Business, property flooding
- More homes at or below sea level being replaced
- Power outages/ repair post-storm
- Causeway flooding – emergency access
- Wildfire on beach – wind fueled spread

Vision and Goals

RCCP Handbook Requirements:

Vision: The vision is an aspirational statement for where the community wants to be in the future (e.g., in the next 10 or more years), particularly in relation to coastal hazards (*p. 19*)

Goals: Specific, measurable goals will help the community identify steps that can be taken to achieve the vision. Resilience goals can relate to preparedness, recovery, community engagement, construction, restoration, etc. The community goals should reflect the triple-bottom-line approach to resilience, which goes beyond traditional hazard mitigation and disaster recovery to emphasize a holistic strategy considering social, environmental, and economic factors. Ideally, considering these factors equally will increase resilience, cost savings, and benefits for all stakeholders involved. (*p. 19-20*)

Recent Examples (other Atlantic Beach plans):

Watershed Restoration & Stormwater Resilience Plan: The goal of this plan is to restore impaired water quality, reduce nuisance flooding, and enhance resilience within two of the three Atlantic Beach watersheds.

CAMA Land Use Plan: Land Use Vision Statement: …In addition to abundant and well-maintained public beach accesses, residents and visitors to our Town also have access to waterfront areas, quality parks, trails, and sidewalks in support of family-oriented recreation and leisure activities. We actively support the establishment and operation of locally-owned businesses that meet people's everyday needs.

In all actions, our Town gives the highest consideration to environmental preservation, recognizing that our coastal environment, including the water, air, and plant an animal life, are our greatest resources and must be protected. Future development will complete, rather than compete with, the historically small-scale development of our Town. Development will be of a high quality that can withstand natural disasters while adding beauty to our picturesque community.

Other Community Examples (2021 RCCP Participants):

Cape Carteret: Vision: To develop environmentally friendly projects to build resiliency to protect both life and property from the events that can cause frequent flooding.

Goals: To meet this vision, community goals include developing an environmentally friendly stormwater infrastructure, producing shovel-ready plans to address current and future stormwater infrastructure needs, accommodating growth, educating the community on coastal flooding hazards, and ensuring improvements have minimal impacts to the natural and coastal environment.

Craven County: Vision: To improve the quality of life for its residents and to ensure their safety by empowering the smaller communities within the County to recover quickly from major storm events.

Goals: To achieve this vision, the County's goals are to address impacts to roadways due to flooding that isolate communities from basic services (including severed utilities such as electricity and cellular coverage), to ensure access to tools and information to assist with timely repairs to homes, to develop strategies for moving people away from future high risk areas, and to build on the project ideas which were developed in the 2017 Hurricane Matthew Resilient Redevelopment Plan.

Dewberry

ATLANTIC BEACH CAT MEETING #2 AGENDA

Date: May 15, 2024

Time: 1:00 p.m.

Location: Atlantic Beach Town Hall, Boardroom

Purpose: Atlantic Beach Resilient Coastal Communities Program Community Action Team Meeting – Review Risk/Vulnerability, Community Engagement, Project Ideas

Agenda Items

1:00 p.m. **Welcome**
Current Status of RCCP Phase I/II Effort

1:10 p.m. **Risk and Vulnerability Assessment**
Initial Assessment Findings
Results of Community Engagement/Survey

1:30 p.m. **Discussion**
Potential Projects to Address Community Resilience
Next Steps in Community Engagement

1:50 p.m. **Wrap-up**
Action Items and Next Steps

Attendees

Name	✓	Organization	Email
Joey Dean		Atlantic Beach Town Council	jdean@atlanticbeach-nc.com
Neil Chamblee		Atlantic Beach Planning Board Chair	Neil.chamblee@gmail.com
Jimmie Whitford	X	Atlantic Beach Resident	billy@whitfords.biz
Denise Clark	X	Atlantic Beach Resident	acdc36@aol.com
Marc Shulze	X	Atlantic Beach Public Works Director	publicworksdirector@atlanticbeach-nc.com
Lindsay Allen	X	Atlantic Beach Public Works Admin	publicservicesadmin@atlanticbeach-nc.com
Mackenzie Todd		NC Division of Coastal Management	Mackenzie.Todd@deq.nc.gov
Kasen Wally		NC Division of Coastal Management	kasen.wally@deq.nc.gov
Jennifer Ansell	X	Atlantic Beach Planning and Development Dir.	planner2@atlanticbeach-nc.com
Elisabeth Webster	X	Atlantic Beach Planning and Development	planner1@atlanticbeach-nc.com

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ATLANTIC BEACH CAT MEETING #2 AGENDA

Sarah Spiegler	X	NC Sea Grant	sespiegl@ncsu.edu
Beth Smyre	X	Dewberry	esmyre@dewberry.com
Joseph McIver	X	Dewberry	jmciver@Dewberry.com

Dewberry

ATLANTIC BEACH CAT MEETING #2 DISCUSSION

DATE: May 15, 2024

TIME: 1:00 p.m.

LOCATION: Atlantic Beach Town Hall, Boardroom

PURPOSE: Atlantic Beach Resilient Coastal Communities Program Community Action Team Meeting – Risk/Vulnerability, Community Engagement, Project Ideas

SUMMARY DATE: June 4, 2024

ATTENDEES: Jimmie Whitford, Denise Clark, Mark Shulze, Lindsay Allen, Jennifer Ansell, Elisabeth Webster, Sarah Spiegler, Beth Smyre, Joseph McIver

Discussion Topics

1. **Risk and Vulnerability Assessment**

   The group reviewed the initial summary of findings of the Risk and Vulnerability Assessment being prepared by Dewberry (see **Attachments**). Attendees were asked for their feedback on the initial results, specifically whether there were community facilities or roadways that either should be included (based on observations) or if any of the results are inconsistent with what the group has observed. The CAT members provided the following feedback:

   - Members agreed with the results, especially for power and water facilities. The initial list of streets covers the basic needs post-storm.
   - It was noted that Duke Energy is testing a generator system that would allow for the entire town to run on generator for the next few days. This is being tested for use post-storm.
     - Duke Energy is also currently replacing a lot of poles (~40) and transformers town-wide.
     - This work is part of the process to rebuild the entire substation, new transformers, and raise the switches.
   - It was recommended to look at any areas near the sound; the groundwater table is rising. Other areas of concern include the west side of town.
   - Bayview has traditionally had issues, but flooding is expected there. Pumps around causeway (can only pump 1000 gal/min) get overloaded. The existing pump system is intended to allow for roadway ingress/egress.
   - Evacuation orders typically issued CAT 3 or higher (once emergency declaration made); most people leave during mandatory evacuation.

2. **Project Ideas:**

   Based on the initial results of the Risk and Vulnerability Assessment as well as the public feedback received during the April comment period, the CAT was asked for ideas on what actions should be taken to address community vulnerabilities. Example project ideas from recent Town plans and other sources were provided for the group to review (see **Attachments**). Dewberry would use this input to generate recommended project ideas for public and CAT review.

   - The recent beach nourishment has performed well; other communities haven't gotten renewed funding for nourishment.
   - Flooding typically occurs closer to the sound. Because the RCCP focuses on community infrastructure (not private property), the concern is that there is limited Town infrastructure on the soundside that would allow for a living shoreline. A boatlift would also be helpful. Due to lack of available Town-owned property, a group of private property owners would have to fund construction, or even donate portions of property for projects (for wetland restoration, for example). Other suggestions, which may require private property or cooperation, include:

    - Have seen neighbors work together to put in bulkheads or raise yards (limited scale).
    - Given concerns about flooded roadways, it was recommended to look at roadway drainage (lack of drains or increasing culvert sizing). Recommended looking at areas close to the "Circle" (West Drive/East Drive/Atlantic Circle). However, this work wouldn't be recommended if it would involve more concrete, destroying natural areas. Big issue is where you put the end of the pipe; if the only available locations are on private property, there are no options until there's an emergency.
    - Most of the pump/lift stations have been constructed.
    - Discussed a public outreach/awareness campaign on what the Town can/can't do in terms of addressing flooding, especially on private property. Public tends to be more reactive.
    - Recommended that the town start looking into aging water plant replacement options.

- Members noted that there have been rumors about replacing existing trailer parks that are becoming unlivable due to septic issues, increasing development; concern is that there should not be any big buildings within the Town. Oceana has started work on a major development (trailers will be asked to move); this development will have their own wastewater treatment system (package plant).
    - Letting people know that the Town is very aware of flooding concerns, and that these are considered.
- Interest was expressed for a in dune infiltration system, though there are more flooding issues are on sound side.
- The group discussed the use of permeable pavers, which have been included in previous plans. There are maintenance concerns with permeable pavers; currently, the Town requires property owners to have a maintenance agreement when using permeable pavers.

3. **Community Engagement Strategy:**

Once an initial list of actions/projects to address community resilience has been generated, a second public outreach event/online survey will be held to solicit feedback. The CAT was asked for any suggestions to promote more community participation.

- Announcement for the first meeting was posted on website, Facebook; however, announcements in the Town newsletter are only accessible to those with a subscription.

Action Items

ACTION ITEM	ASSIGNED TO	DATE DUE	STATUS
Provide feedback on potential actions/projects	CAT Membership	6/30/24	Open
Schedule next Public Outreach event	Dewberry	6/30/24	Open

Risk and Vulnerability Assessment – Initial Findings

Key Findings

Assets and Roadways with Higher Vulnerability Scores

Assets (with estimated replacement costs for building and contents)	Roadways
Duke Energy Substation ($3.6 million)	East/West Fort Macon Drive
Water Treatment Plant ($40 million)	Atlantic Beach Causeway
West End Water Tower ($300,000)	West Drive/East Drive/Atlantic Blvd. "The Circle"
East End Water Tower ($300,000)	Atlantic Station Shopping Center
Pump stations (no estimate available)	N. Money Island Drive (subdivision)
	Subdivisions surrounding causeway

Natural Infrastructure

- Atlantic Beach is a barrier island and as such, has extensive tidal wetlands surrounded by tidal flats and unconsolidated shores within Bogue Sound.
- Under the sea level rise projection for 2050, the Town will lose approximately 7.8 percent of critical natural infrastructure habitats.
- The largely built-out land use in Atlantic Beach prevents potential marsh migration routes within the Town.

Natural infrastructure vulnerability to sea level change by habitat type

Habitat Type	Starting Acreage	Acreage Lost	% Lost	Vulnerability
Non-Tidal Wetland	4.9	0.6	12.2	Moderate
Tidal Wetland	14.9	1.9	12.8	Moderate
Unconsolidated Shore	19.9	1.7	8.5	Moderate
Upland Habitat	40.7	2.1	5.2	Low
Total Habitat Acres	**80.4**	**6.3**	**7.8**	

Asset Types

	**Critical Built Infrastructure** *Physical structures that house or perform functions that enable the continuous operation of government and business functions and are essential to human health and safety or economic safety.[1] This includes buildings such as government service offices, schools, health services, and public safety or emergency services.*
	**Critical Network Infrastructure** *Physical infrastructure networks that support the continuous operation of government and business functions and are essential to human health and safety or economic safety. These include infrastructure networks such as roads, pedestrian trails, and water or sewer lines. Transportation networks facilitate the movement of people and goods, and water and sewer networks provide potable water and remove wastewater.*
	**Natural Assets** *Lands that are actively managed to serve specific community needs, such as growing food (agricultural lands), providing recreational space (recreational lands), and support local ecosystems (natural lands). Note that Natural Asset vulnerability is evaluated based on potential loss of functionality.*
	**Natural Infrastructure** *Naturally occurring landscapes and systems that perform ecosystem services that benefit nearby communities, like flood protection or abatement, erosion control, and water purification. Note that Natural Infrastructure vulnerability is evaluated based on loss of habitat, rather than loss of ecosystem service functionalities that directly benefit communities.*

Hazards Evaluated

	Coastal flooding	Flood hazard	Present-day conditions, 2050 conditions
	Storm surge	Flood hazard	Category 1, Category 2 storm surge
	Rainfall-driven flooding	Flood hazard	Present-day conditions
	Wildfire	Wildfire hazard	Present-day conditions

[1] Federal Emergency Management Agency. *Community Lifelines.* https://www.fema.gov/emergency-managers/practitioners/lifelines

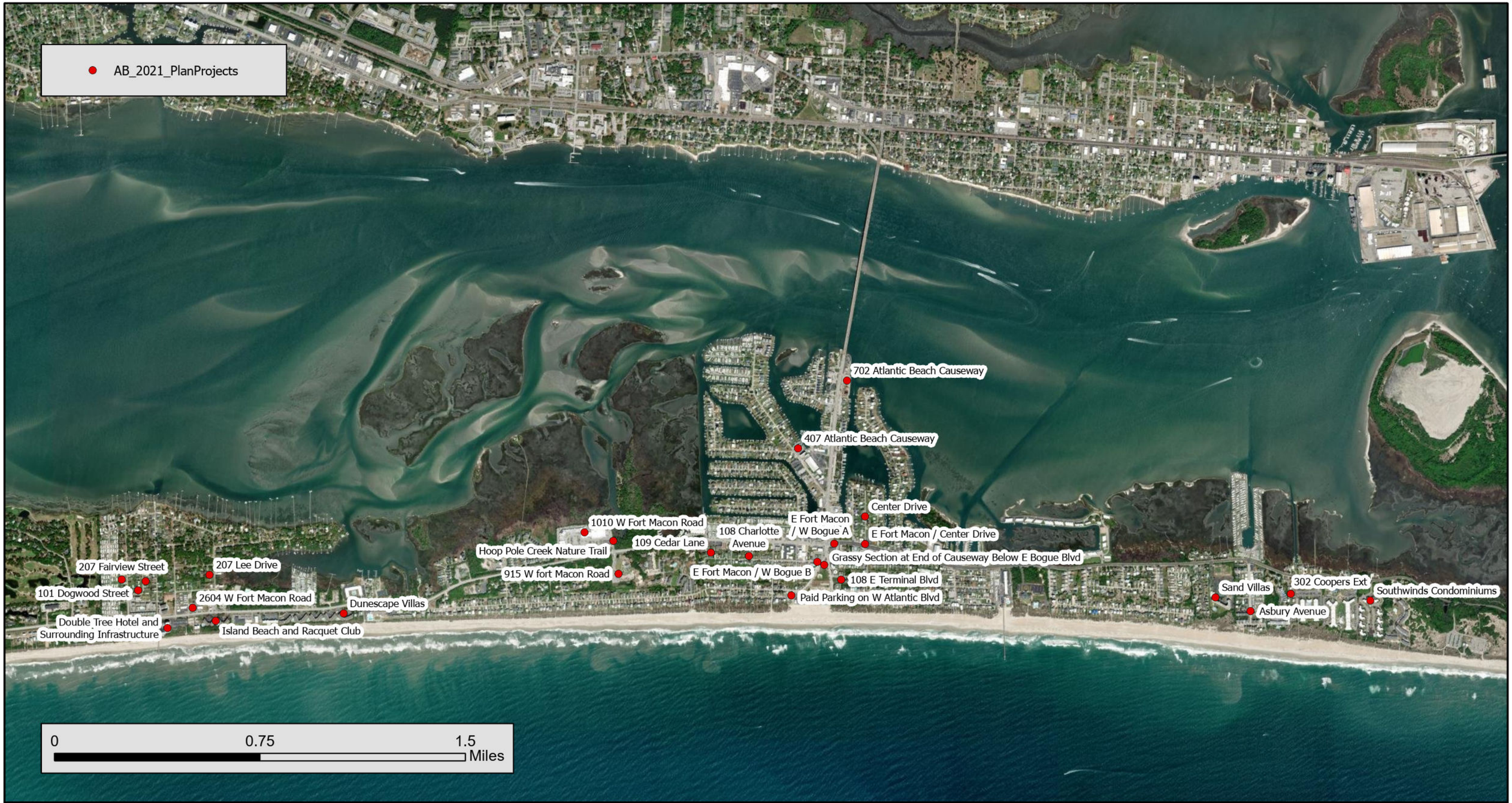
Projects to Address Community Resilience – Project Ideas

Projects in other Atlantic Beach or Regional Plans

- AB Watershed Restoration & Stormwater Resilience Plan (2021):
  - Permeable Pavement, Bioretention cells, Bioswales
  - Linear wetland construction
  - Dune infiltration
  - Education and outreach program
- Pamlico Regional Hazard Mitigation Plan (2021):
  - Backup generators
  - Education and outreach for "Know Your Zone" initiative – handouts about evacuation routes/procedures
- AB CAMA Land Use Plan (2021):
  - Small Area Planning (around causeway)
  - Maintain Beach Nourishment Schedule
  - Update Town Stormwater Map
  - UDO Revisions

Other Ideas

- 2021 RCCP Community Examples:
  - Operational Continuity – data security during/after storm events
  - Asset Mapping – Updating infrastructure mapping/datasets
  - Dune Stabilization and Protection Program
  - Shoreline Management Plan
  - Living Shoreline Construction (Bogue Sound shoreline)
  - Public Engagement and Education Campaign
  - Low-impact Development Education Campaign



Prepared by
Dewberry
Prepared for
Atlantic Beach

Sources: ESRI Basemap, Project Study Area created by Dewberry

2021 Atlantic Beach Watershed Restoration and Stormwater Resilience Plan
Carteret County, NC

N

Project Locations Map
Date: 10/22/2024
Drwn/Chkd: GES/DLE
1 of 1

Dewberry

ATLANTIC BEACH CAT MEETING #3 DISCUSSION

DATE: October 23, 2024

TIME: 11:00 a.m.

LOCATION: Atlantic Beach Town Hall, Boardroom

PURPOSE: Atlantic Beach Resilient Coastal Communities Program Community Action Team Meeting – Review Project Recommendations

SUMMARY DATE: November 1, 2024

ATTENDEES: Denise Clark, Mark Shulze, Lindsay Allen, Elisabeth Webster, Beth Smyre, Ellie Hair

Discussion Topics

1. **Community Engagement Summary**

   Following the July public open house, Dewberry received 56 responses to the online survey. Most of the responses to the questions on project recommendations favored stormwater management and stormwater treatment projects. Responses to other questions were relatively evenly distributed. A summary of the responses received, including the locations of recommended improvements, will be included in the final report.

2. **Projects to Address Community Resilience:**

   Attendees reviewed the initial list of projects (attached) and offered the following comments:

   - Stormwater Facility Improvements
     - Recommendation is to focus as much on stormwater facility expansion as on improvements to current facilities.
     - The 2021 Watershed Restoration and Stormwater Resilience Plan focuses on stormwater conveyance, when the RCCP typically focuses Natural and Nature-Based Solutions (NNBS).
     - Recommendation is to prioritize improvements on the West End, including Knollwood, Dogwood, Pelican, and Fairview. Future phases of this project would require private property easements. The Fairview project is recommended for Phase 3 of the RCCP, but private property easements will be an issue. The West End improvements would combine a lift station improvement with stormwater NNBS.
     - Additional focus area should be the Bayview community, which has previously been involved in conversations about potential stormwater management facility improvements.
   - Stormwater Pretreatment
     - Stormwater is currently pretreated before it is released into the sound via the pump system. Pretreating the water before it enters the pump system may not be warranted.
     - If implemented, a recommended location for pretreatment is the Shore Drive area.
   - Education Materials
     - Recommended outreach outlets include the new women's club, brochures that could be distributed at community events and in mailers, and better marketing of successful projects.
     - Educational materials are recommended on emergency preparedness topics, reasons why stormwater problems are increasing (results of increase in impervious surface, etc.).
     - Any outreach materials should be written in layman's terms.

- Stormwater Infrastructure Mapping
    - This project would provide very beneficial information to understand where to expand and/or improve stormwater facilities.
    - The Town currently has maps of all stormwater infrastructure, but it has not been mapped in GIS.
- Pump Systems
    - This project can be combined with other improvements on the list to create comprehensive area improvements.
    - The Town provided a map of Lift Station locations, noting where potential improvements should be prioritized.
- Targeted Land Acquisition
    - It is not recommended that this be included on the project list. Land is very limited within Town limits, and any acquisition would have to be done in partnership with other entities (non-profits, etc.).
- Dune Infiltration System
    - Atlantic Beach has several successful dune infiltration systems in place, including Lift Stations 5 and 6. This project should remain on the list, so that new systems could be implemented at other locations, including existing public beach access points.
- Additional Project Options
    - Development of a maintenance plan or capital improvements plan; the Town has not developed this in the past, which has hindered some previous grant opportunities.
    - NNBS project at Hoop Pole Creek Nature Trail – identified in the 2021 Watershed Resilience Plan, the project called for the restoration of a linear wetland.

It was recommended that the projects be prioritized as follows: Stormwater Facility Improvements, Pump Systems, Dune Infiltration, Stormwater Pre-treatment, Infrastructure Mapping, and Educational Materials.

3. **Other Discussion Items:**

Dewberry will use the feedback from this meeting to develop the final project list, which will be included in the final Phase 1/2 RCCP report for Atlantic Beach.

- An updated project list will be distributed to the CAT for final review before the report is finalized.
- The CAT recommended that the report should note the issues with the rising water table and insight on why flooding is increasing in the community. This impacts septic systems and the ability to construct other improvements.

Action Items

ACTION ITEM	ASSIGNED TO	DATE DUE	STATUS
Provide feedback on prioritized project list	CAT Membership	11/8/24	Open
Finalize project list, develop final report	Dewberry	11/30/24	Open

Projects to Address Community Resilience – Recommendations for Final Report

Projects

Project Description	Questions/Considerations
Stormwater Facility Improvements: Improve stormwater facilities (ditches, storm drains) on multiple Town streets.	• Implement projects included in the 2021 Watershed Restoration & Stormwater Resilience Plan • Includes projects that qualify as natural or nature-based solutions (NNBS), a requirement of the Resilient Coastal Communities Program
Stormwater Pretreatment: Construct stormwater treatment facilities (bioswales, infiltration systems, other green infrastructure) to minimize water quality impacts at multiple locations.	• Includes projects that qualify as natural or nature-based solutions (NNBS), a requirement of the Resilient Coastal Communities Program
Educational Materials: Materials for homeowners and business owners on what can be done to address flooding on private property.	• What topics should be covered in these materials?
Stormwater Infrastructure Mapping: Map all stormwater infrastructure within Town limits to determine service gaps and needs.	• Scope of project could provide survey-grade data for both GIS mapping and for use in future project design. Effort could be scoped to include condition assessment of each stormwater facility.
Pump Systems: Install pumps at new locations or make improvements at existing pump locations.	• Are there locations where existing pumps need to be replaced, or where new pumps should be located? • Are there any locations where pump capacity needs to be increased?
Targeted Land Acquisition: Purchase areas for conservation and open space.	• Are there potential sites within the Town that should be considered?
Dune Infiltration System: System would act as sand filter for stormwater diverted to ocean outfalls. May include pumps or catch basins to move stormwater from roadways into the system.	• Elements of this may qualify as a natural or nature-based solution (NNBS), a requirement of the Resilient Coastal Communities Program.

Questions for Consideration

- How would you prioritize the projects listed in the table?
- Are there locations that you would like to see addressed first?
- Are there any gaps in planning documentation or ordinances that could be included on the project list?
- Are there example resilience measures/solutions that you have heard of in other communities that you would like to see implemented in Atlantic Beach?
- Are there any emergency preparedness measures that you would like to see included on the project list?

Dewberry

APPENDIX B

PUBLIC ENGAGEMENT MATERIALS AND SUMMARY RESULTS

APRIL 2025

Dewberry

ATLANTIC BEACH PUBLIC OUTREACH #1 SUMMARY

DATE: April 4, 2024

TIME: 5:00 p.m.-7:00 p.m.

MEETING LOCATION: Crystal Coast Brewing Company

PURPOSE: Resilient Coastal Communities Program – Atlantic Beach Public Outreach Event #1

SUMMARY DATE: May 13, 2024

A Public Involvement opportunity for the Resilient Coastal Communities Program (RCCP) was held on April 4, 2024 as a pop-up outreach event. The purpose of the event was to gather the community's feedback on the types of coastal hazards that impact the Town and the areas and resources within the Town that are impacted by these hazards.

A single "interactive station" was set up for the pop-up event. The station included a welcome poster that described the purpose of the RCCP, a map of Atlantic Beach, and copies of the public survey (both hard copies and a posted QR code to access the online survey). The map was available for attendees to indicate areas where hazards and/or damage has been witnessed.

Representatives with the Town of Atlantic Beach, the Community Action Team, the NC Division of Coastal Management, and the RCCP consultant team were in attendance to answer questions.

Attendance

Given the structure of the event, formal attendance was not logged.

A total of 33 responses to the survey were received: 29 online responses and 4 hard copies.

Event "Interactive Station" Results

Locations of concern:

- Flooding at Bowen Street (east end, near intersection with North Kinston Avenue)
- Flooding at intersection of West Fort Macon Road and North Kinston Avenue
- Flooding at West Drive near East Bogue Boulevard

Survey Results

The following section highlights the major response trends of the survey, including the responses received both through the online platform and via hard copy. A full breakdown of responses is attached to this memo.

1. **Coastal hazards of concern**

<u>What type of coastal or climate hazards concern you the most?</u>

- Of the coastal hazards listed, the top two responses were hurricanes, tropical storms, and nor'easters (27) and flooding (21), followed by shoreline or beach erosion (12) and severe weather (10).
- Write-in answers (2) noted development, a need to maintain maritime forest and the island's natural character, and tourism as other concerns.

<u>If selected flooding, what kind of flooding concerns you the most?</u>

- All three types of flooding are a concern to respondents, with rainfall the highest concern, followed by storm surge. Overall response distribution between the three options (tidal, storm surge, and rainfall) was even.

On a scale of 1 to 5, how significant of a risk are coastal hazards and/or flooding to your community?

- Over 72% of respondents ranked the risk from flooding presently as a 3 or 4 out of 5
- Over 75% of respondents ranked the risk from flooding in the future as a 4 or 5 out of 5.

2. Damage and Areas of Concern

Have you ever witnessed property or infrastructure damage due to coastal or climate hazards in your community?

- 75% of respondents answered in the affirmative.
- Responses to the type and location of damage observed are shown on the attached map, generated via the online survey tool. Additional comments listed in the paper survey noted damage to personal property. Specific locations included a condo at Sea Spray and debris on Bowen Street.

What are the top three challenges facing the Town of Atlantic Beach immediately after a storm, flood, or other coastal hazard event?

- The top three challenges were **Restoration of power, electricity or other utilities** (most responses gave this the highest ranking); **Re-opening businesses, government offices, or other community facilities**; or **Repairing or rebuilding physical infrastructure**. **Informing citizens about available assistance and resources** and **Loss or damage of natural infrastructure, including parks and recreation areas** also received rankings.

3. Resilience projects to be implemented

Survey respondents were asked to provide recommendations on the types and locations of projects to help address the coastal or climate hazards they identified earlier in the survey. Responses to this question are shown in the attached map, generated via the online survey tool.

North Carolina
RESILIENT
COASTAL
COMMUNITIES
PROGRAM

Welcome!

What is the RCCP?

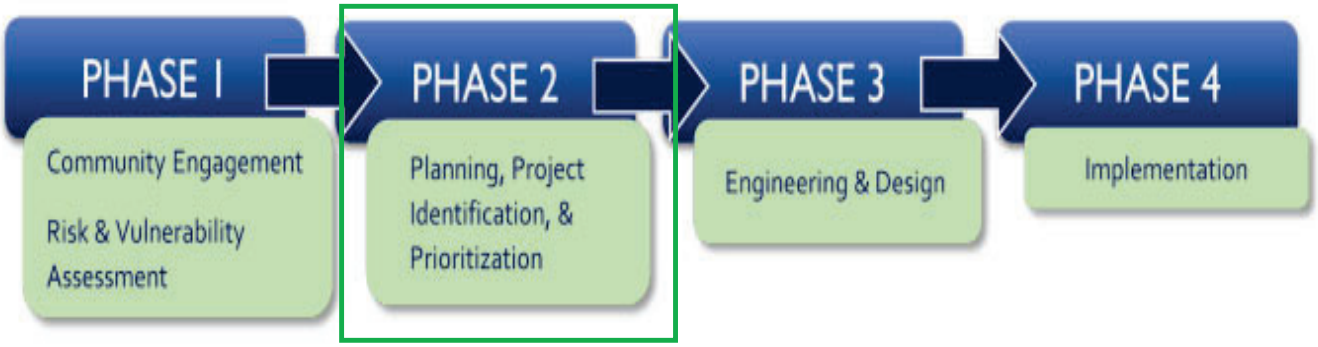
The RCCP is a program administered by the NC Division of Coastal Management that helps communities identify ways to become more resilient to coastal hazards. The goals include:

Understand how flooding and other natural hazards are impacting your community.

Determine areas and assets that are susceptible to coastal hazards today and in the future.

Identify projects that increase community resilience to coastal hazards.

What is the process?



We Are Here

We need your input!

The RCCP is a community-driven program, and public input is key to the process. Please tell us what coastal hazards you have experienced and what you think should be done to address them. You can take the survey or talk to the project team at today's event.

Thank you for your help!

North Carolina
RESILIENT
COASTAL
COMMUNITIES
PROGRAM

Atlantic
BEACH
NORTH CAROLINA

Tell us what you think!

Please complete the survey handout available at today's event,

OR

Scan the QR code and fill out the survey over your phone.

Have questions? Feel free to email the study team at **rccp@dewberry.com**

North Carolina Resilient Coastal Communities Program
Public Input Questionnaire

The Town of Atlantic Beach is gathering public feedback on proposed options to improve the Town's resilience to coastal hazards. The Town received a grant under North Carolina's Resilient Coastal Communities Program to develop a list of projects to address critical infrastructure needs, and public input is a key part of the process to determine what improvements are most important to the community.

1. What type of coastal or climate hazards concern you the most? *(Select all that apply.)*

	Flooding (Tidal, Storm Surge, Rainfall)		Severe Weather (Thunderstorm, Wind, Lightning, Hail)
	Shoreline or Beach Erosion		Wildfire
	Extreme Heat		Other:
	Hurricane, Tropical Storm, Nor'easter		

2. If you selected flooding, what kind of flooding concerns you the most? Rank these options from **least (1)** to **most (3)** concerning.

	Tidal (from king tides, increasing sea levels, etc.)		Rainfall (stormwater, urban flooding)
	Storm surge (from hurricanes, tropical storms, nor'easters, etc.)		

3. On a scale of 1 to 5, how significant of a risk do you think coastal hazards currently pose to Atlantic Beach? (Circle one)

1 ***(not a concern)***	**2**	**3**	**4**	**5** ***(extreme risk)***

4. On a scale of 1 to 5, how significant of a risk do you think coastal hazards will pose to Atlantic Beach in the future? (Circle one)

1 ***(not a concern)***	**2**	**3**	**4**	**5** ***(extreme risk)***

5. Have you ever witnessed property or infrastructure damage due to coastal or climate hazards (including any of the hazards listed in Question #1) in your community? (Circle one: **YES/NO**) If **Yes**, where did you witness the damage? (Be as specific as possible – note the neighborhood, street name, etc.)

_____

_____

Please send your comments to:
Beth Smyre, Dewberry, 2610 Wycliff Road, Suite 410, Raleigh NC 27607
or **rccp@dewberry.com**.

6. If you answered **Yes** to question 5, what type of damage did you witness?

	Property damage, including homes, businesses, or personal possessions (including vehicles)		Damage or disruption to transportation systems (e.g., flooded roadways, transportation delays)
	Utility disruption, including power loss or lack of access to clean drinking water		Limited access to services, such as healthcare, education, or government offices
	Injury, illness, and/or concerns for personal health and safety		Other:

7. Based on your experience, please rank the **top <u>three</u> challenges** facing Atlantic Beach immediately after a storm, flood, or other coastal hazard event.

	Repairing or rebuilding physical infrastructure		Re-opening businesses, government offices, or other community facilities
	Loss of income or wages		Informing citizens about available assistance and resources
	Loss or damage of natural infrastructure, including parks and recreation areas		Restoring power, electricity, or other utilities
	Other:		

8. What types of projects should the Town of Atlantic Beach implement to minimize future damage from storms, floods, and other coastal hazards? Where should these projects be located?

_____

_____

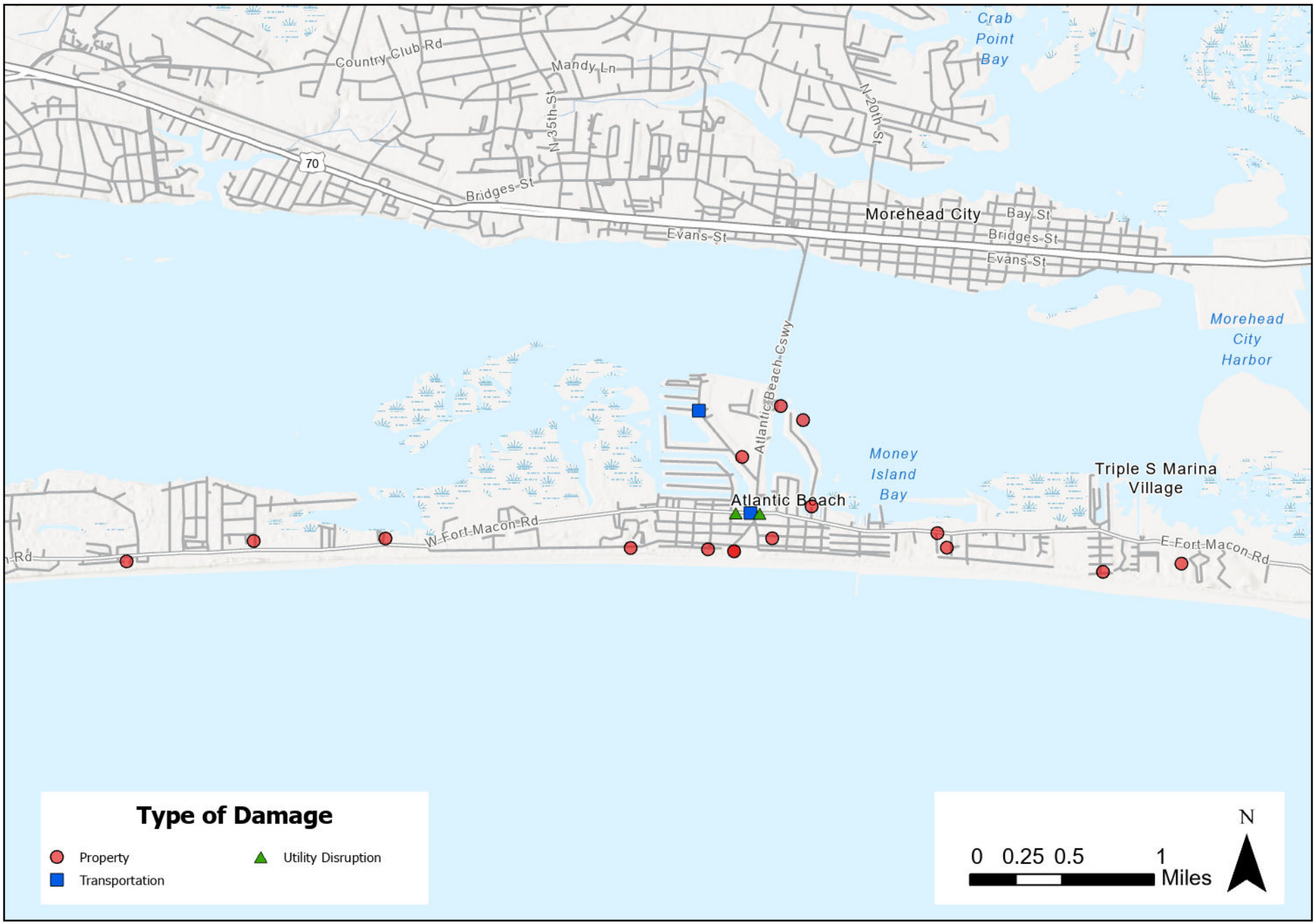
Thank you for taking this survey! If you want to know more about how this survey will be used, please feel free to contact us at the address or email listed below.

(<u>Optional</u>) Please identify the zip code of your primary residence: _____

(<u>Optional</u>) How would you like the Town to communicate with you or your community regarding this project or similar projects in the future?

	Newspaper		Mail
	Email		Online forum (NextDoor, Community Page, etc.)
	Social Media		In Person Meeting
	Other:		

Please send your comments to:
Beth Smyre, Dewberry, 2610 Wycliff Road, Suite 410, Raleigh NC 27607
or **<u>rccp@dewberry.com</u>**.



Town of Atlantic Beach Public Meeting #1

Observed Damage From Natural Hazard Location

Dewberry

Atlantic BEACH NORTH CAROLINA

North Carolina RESILIENT COASTAL COMMUNITIES PROGRAM

Dewberry

ATLANTIC BEACH PUBLIC OUTREACH #2 SUMMARY

DATE: July 24, 2024

TIME: 4:00 p.m.-6:00 p.m.

MEETING LOCATION: Atlantic Beach Town Hall-Council Chambers

PURPOSE: Resilient Coastal Communities Program – Atlantic Beach Public Outreach Event #2

SUMMARY DATE: November 6, 2024

A Public Involvement opportunity for the Resilient Coastal Communities Program (RCCP) was held on July 24, 2024, as a pop-up outreach event. The purpose of the event was to gather the community's feedback on the types of coastal hazards that impact the Town, the areas and resources within the Town that are impacted by these hazards, as well as potential mitigation projects.

Three "interactive station" was set up for the pop-up event. The first station included a welcome poster that described the purpose of the RCCP, had a QR code linked to the online survey, and described what stage in the process the project was at. The second station included a map of Atlantic Beach and let individuals place a sticker where they had seen damage from coastal hazards. The third station let attendees vote on which resilience strategy they would most like to see in their community. The survey was also available online and had high number of responses.

Representatives with the Town of Atlantic Beach, the Community Action Team, the NC Division of Coastal Management, NC Sea Grant and the RCCP consultant team were in attendance to answer questions.

Attendance

At the meeting a sign-in sheet was provided that encouraged attendees to let the organizers know of their attendance. 4 individuals signed into the sign-in sheet.

A total of 73 responses to the survey were received: 72 online responses and 1 hard copy.

Comments From In-Person Conversation

- Flooding affects the bridge area coming into Atlantic Beach and can even flood during King Tide events.
- Reef construction and green infrastructure may not garner the interest or support needed since many won't be affected by it.
- Educational material would help mitigate issues with re-entry and are necessary for the implementation of GSI projects for the community.

Survey Results

The following section highlights the major response trends of the survey, including the responses received both through the online platform and via hard copy. A full breakdown of responses is attached to this memo.

1. **Coastal hazards of concern**

   What type of coastal or climate hazards concern you the most?

   - Of the coastal hazards listed, the top two responses were hurricanes, tropical storms, and nor'easters (59) and flooding (55), followed shortly by shoreline or beach erosion (51) and behind that severe weather (27).
   - The bottom two answers were extreme heat (11) and wildfire (1).

2. **Damage and Areas of Concern**

Have you ever witnessed property or infrastructure damage due to coastal or climate hazards in your community?

- 98%of respondents answered in the affirmative.
- 94% of respondents said they had witnessed property damage and 86% said they had witnessed utility distribution.

3. Resilience Actions to be Taken

Please select the top 5 actions that you think would make your community more resilient to storms, floods, and other coastal hazards.

- The top 2 choices were increased stormwater drainage capacity (61) followed closely by nature-based solutions (55), both votes from over 75% of participants.
- Other answers receiving over 45% of the votes were resilience planning, policies, and development standards (34) and elevating homes, businesses and public infrastructure (35).

In addition to improving public infrastructure, private property owners can also help make their own communities more resilient to coastal and climate hazards. What actions are you willing to consider for your property?

- The top 2 responses were shoreline protection (35) and construction of rain gardens or other low impact landscaping measures (35) both receiving slightly under 50% of votes.
- The other actions receiving votes were elevate buildings (22) and incorporation of rain barrels, green roofs or other structural improvements (19).
- Over 20% of respondents replied they would prefer no action to be performed on their property.

4. Resilience Projects Considered by Atlantic Beach

The Town of Atlantic Beach is considering several projects to increase its resilience to coastal and climate hazards. Please rank the projects listed below in the order you feel they would benefit the community.

- The project receiving the highest ranking by respondents was stormwater facility improvement receiving over 50% of the highest ranking by respondents.
- The project receiving the second highest importance was pretreatment, receiving the most 2nd place votes.
- The respondents ranked stormwater infrastructure mapping 3rd, pump system 4th, educational material 5th, and targeted land acquisition last of the 6 projects listed in the question.
- In the attached map, respondents located where within the town resilience projects should be located.

North Carolina Resilient Coastal Communities Program
Public Input Questionnaire – Summer 2024

The Town of Atlantic Beach is gathering public feedback on proposed options to improve the Town's resilience to coastal hazards. The Town received a grant under North Carolina's Resilient Coastal Communities Program to develop a list of projects to address critical infrastructure needs, and public input is a key part of the process to determine what improvements are most important to the community.

1. What type of coastal or climate hazards concern you the most? (*Check all that apply.*)

	Flooding (Tidal, Storm Surge, Rainfall)		Severe Weather (Thunderstorm, Wind, Lightning, Hail)
	Shoreline or Beach Erosion		Wildfire
	Extreme Heat		Other:
	Hurricane, Tropical Storm, Nor'easter		

2. Have you ever witnessed property or infrastructure damage due to coastal or climate hazards in your community? (Circle one: **YES/NO**) If **Yes**, what type of damage did you witness?

	Property damage, including homes, businesses, or personal possessions (including vehicles)		Damage or disruption to transportation systems (e.g., flooded roadways, transportation delays)
	Utility disruption, including power loss or lack of access to clean drinking water		Limited access to services, such as healthcare, education, or government offices
	Injury, illness, and/or concerns for personal health and safety		Other:

3. Please select the **top five actions** that you think would make your community more resilient to storms, floods, and other coastal hazards. (*Check up to **5** options.*)

	Nature-based solutions, such as living shorelines or habitat restoration		Elevating homes, businesses, and public infrastructure, including roads
	Acquisition and conservation of flood-prone land		Utility upgrades for community facilities, such as increased generator capacity for hospitals
	Increased stormwater drainage capacity		Resilience planning, policies, and development standards
	Structural protection, such as floodwalls or tide gates		Public education and outreach
	Other:		

Please send your comments to:
Beth Smyre, Dewberry, 2610 Wycliff Road, Suite 410, Raleigh NC 27607
or rccp@dewberry.com

4. In addition to improving public infrastructure (roads, utilities, public buildings), private property owners can also help make their communities more resilient to coastal and climate hazards. What actions would you be willing to consider for your property? (*Check all that apply.*)

	Shoreline protection (living shorelines, bulkheads)		Construction of drainage facilities (ditches, pumps)
	Elevate buildings		Rain gardens or other low impact landscaping measures
	Incorporate rain barrels, green roofs, or other structural improvements		Other:
	Prefer No Action on my property		

5. The Town of Atlantic Beach is considering several projects to increase its resilience to coastal and climate hazards. Please rank the projects listed below in the order you think they would benefit the community. (**1 = greatest benefit; 6 = least benefit**).

	Stormwater Facility Improvements: Improve stormwater facilities (ditches, storm drains) on multiple Town streets.		**Stormwater Infrastructure Mapping:** Map all stormwater infrastructure within Town limits to determine service gaps and needs.
	Stormwater Pretreatment: Construct stormwater treatment facilities (bioswales, infiltration systems, other green infrastructure) to minimize water quality impacts at multiple locations.		**Pump Systems:** Install pumps at new locations or make improvements at existing pump locations.
	Educational Materials: Materials for homeowners and business owners on what can be done to address flooding on private property.		**Targeted Land Acquisition:** Purchase areas for conservation and open space

6. In addition to the projects listed in Question #5, are there other resilience strategies that the Town of Atlantic Beach should consider? Where should these projects be located?

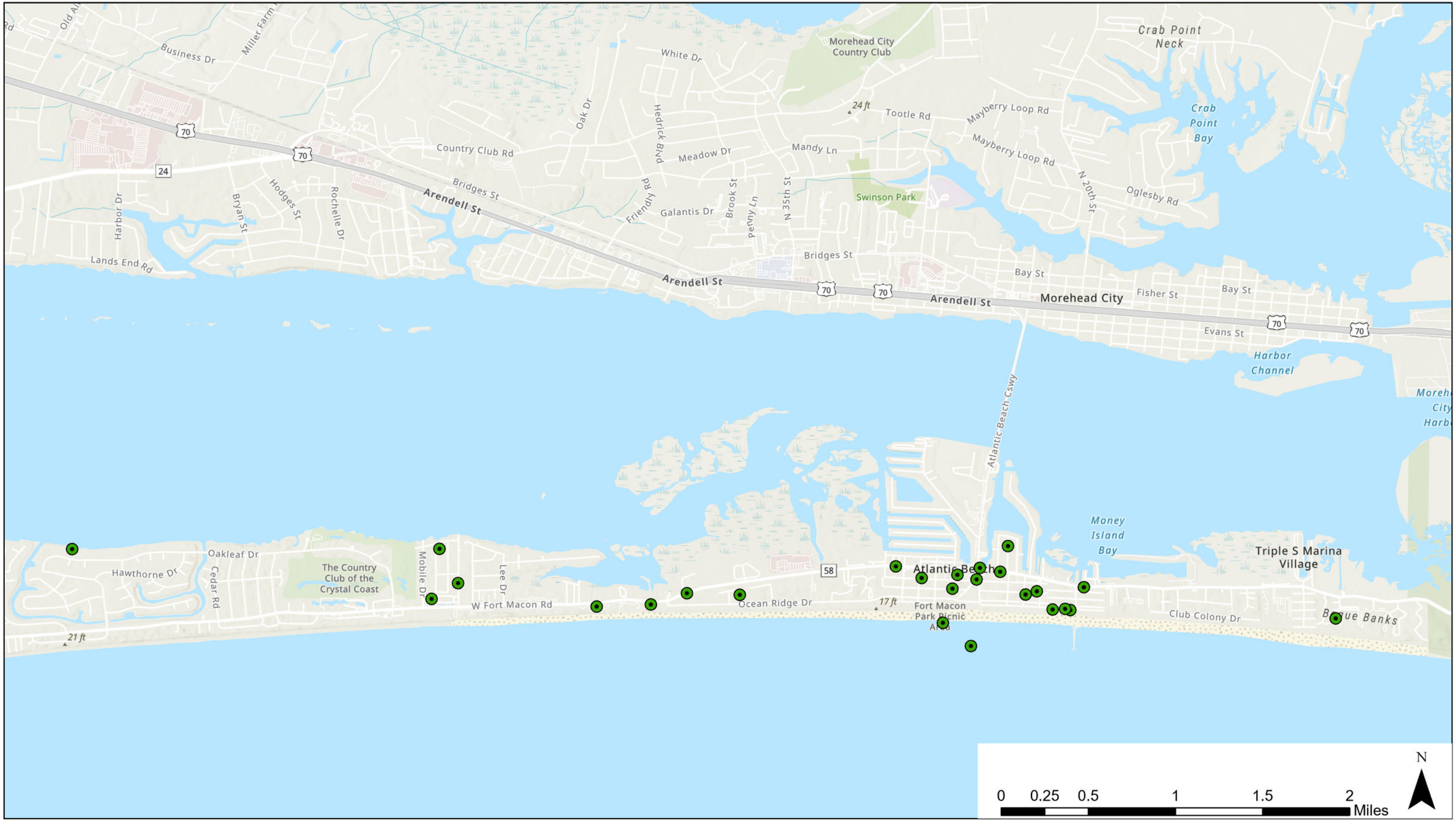
_____

_____

_____

Thank you for your feedback!

Please send your comments to:
Beth Smyre, Dewberry, 2610 Wycliff Road, Suite 410, Raleigh NC 27607
or rccp@dewberry.com



Legend

- Proposed Project Locations

Town of Atlantic Beach Public Meeting #2

Resiliency Project Selection Location

Dewberry

Atlantic BEACH NORTH CAROLINA

North Carolina RESILIENT COASTAL COMMUNITIES PROGRAM

Dewberry

APPENDIX C

RISK AND VULNERABILITY ASSESSMENT

APRIL 2025

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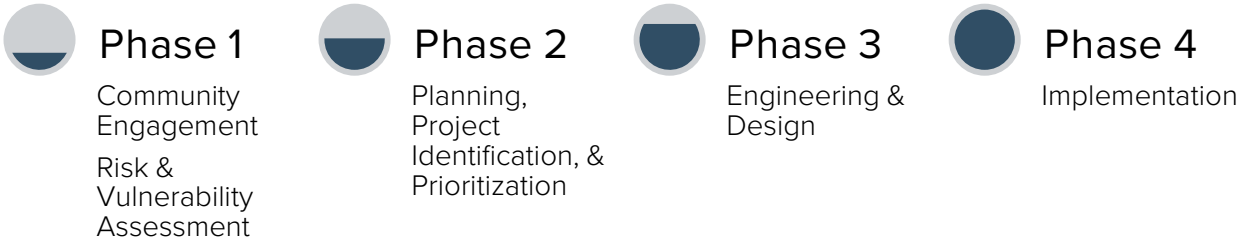
1.0 Background

With support from the North Carolina Division of Coastal Management's Resilient Coastal Communities Program (RCCP), a Risk and Vulnerability Assessment was conducted for the Town of Atlantic Beach (Town) to evaluate the susceptibility of the Town's critical assets and natural infrastructure to coastal hazards. The RCCP facilitates a community-driven process for setting coastal resilience goals, assessing existing and needed local capacity, and identifying and prioritizing "shovel-ready" projects to enhance community resilience to coastal hazards.[1] This report summarizes the assessment process and results.

As part of Phase 1 of the RCCP (**Figure 1.1**), this assessment supports the program objectives by identifying and mapping structures and areas vulnerable to potential damage or harm from coastal hazards. Determining whether these assets are or will be exposed to hazards facilitates the identification and prioritization of resilience projects in Phase 2 of the Program. These projects and strategies are critical to bolstering the Town's resilience to existing and future coastal risks. The North Carolina Office of Recovery and Resiliency defines "a resilient North Carolina is a state where our communities, economies, and ecosystems are better able to rebound, positively adapt to, and thrive amid changing conditions and challenges, including disasters and climate change; to maintain quality of life, healthy growth, and durable systems; and to conserve resources for present and future generations.[2]"

Figure 1.1 RCCP Program Phases



[1] North Carolina Department of Environmental Quality. *North Carolina Resilient Coastal Communities Program.* Division of Coastal Management. https://deq.nc.gov/about/divisions/coastal-management/coastal-adaptation-and-resiliency/nc-resilient-coastal-communities-program

[2] North Carolina Office of Recovery and Resiliency. https://www.deq.nc.gov/climate/2020-climate-risk-assessment-resilience-plan/open.

2.0 Assessment Framework

The RCCP Handbook (August 2023) provides the basis for this framework to assess the risk and vulnerability of the Town of Atlantic Beach's assets. Based on the RCCP Handbook, this method and the following section is organized in the following three steps:

Identify and Map Hazards

Review Pamlico Sound Regional Hazard Mitigation Plan and other plans and studies developed for the Town and/or region, including the Atlantic Beach Watershed Restoration & Stormwater Resilience Plan. Augment hazard assessment based on input from the Community Action Team (CAT). Collect relevant spatial asset and hazard data.

Assess Vulnerability

Examine the likelihood that an asset will be affected by coastal hazards. Develop an index to assign Vulnerability Scores to estimate asset susceptibility to coastal hazards.

Estimate Risk

Determine potential risk to assets to prioritize actions that increase resilience to future hazards. Develop an index to assign Risk Scores to estimate potential impacts on community assets. Assess community asset risk scores to inform potential community-wide impacts of hazards.

This assessment focuses on coastal hazards and their potential impacts on the Town of Atlantic Beach. As identified in the RCCP Handbook, this process considers the following hazards: rainfall, storm surge and tidal flooding, and sea level rise; in addition, this assessment considers wildfire hazard, based on a review of the Pamlico Sound Regional Hazard Mitigation Plan, available hazard data, and community interest in evaluating wildfire hazard. This assessment does not evaluate riverine flooding, as Atlantic Beach does not experience this hazard.

A primary goal of the RCCP is to support the identification and implementation of resilient projects in participating communities. In support of this goal, this assessment focuses on potential impacts on critical built infrastructure, critical network infrastructure, natural assets, and natural infrastructure, defined as the following:

Critical Built Infrastructure

Physical structures that house or perform functions that enable the continuous operation of government and business functions and are essential to human health and safety or economic safety.[3] This includes buildings such as government service offices, schools, health services, and public safety or emergency services.

Critical Network Infrastructure

Physical infrastructure networks that support the continuous operation of government and business functions and are essential to human health and safety or economic safety. These include infrastructure networks such as roads, pedestrian trails, and water or sewer lines. Transportation networks facilitate the movement of people and goods, and water and sewer networks provide potable water and remove wastewater.

[3] Federal Emergency Management Agency. *Community Lifelines.* https://www.fema.gov/emergency-managers/practitioners/lifelines

Natural Assets

Lands that are actively managed to serve specific community needs, such as growing food (agricultural lands), providing recreational space (recreational lands), and support local ecosystems (natural lands). Natural Asset vulnerability is evaluated based on potential loss of functionality.

Natural Infrastructure

Naturally occurring landscapes and systems that perform ecosystem services that benefit nearby communities, like flood protection or abatement, erosion control, and water purification. Natural Infrastructure vulnerability is evaluated based on loss of habitat, rather than loss of ecosystem service functionalities that directly benefit communities.

After identifying and mapping hazards, the assessment determines which critical built infrastructure, natural infrastructure, and natural assets are vulnerable – the degree to which they are expected to experience adverse impacts – to coastal hazards, primarily flooding. This framework considers three components that contribute to vulnerability: exposure, sensitivity, and adaptive capacity.

Metrics are developed for each component, and assets are scored zero to three for each component of the vulnerability score. As outlined in the RCCP Handbook, an asset's Vulnerability Score is determined by adding the Exposure and Sensitivity Score and subtracting the Adaptive Capacity Score (Figure 2.1).

Figure 2.1 Components of Vulnerability

Exposure	+	**Sensitivity**	–	**Adaptive Capacity**	=	**Vulnerability**
The probability of physical contact between an asset and a hazard		*The degree to which an asset may be affected by a hazard*		*The ability of an asset to change its characteristics or behavior in response to a hazard*		*The degree to which an asset or system is expected to experience adverse impacts due to a hazard.*

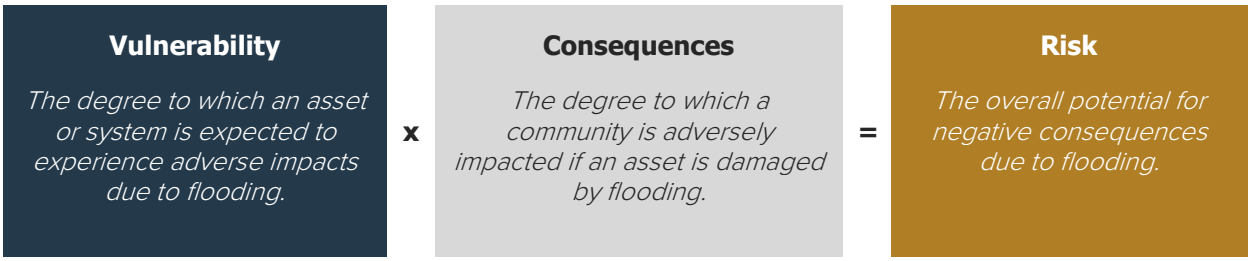
As noted in Figure 2.1, an asset's ***Vulnerability*** defines the degree to which coastal hazards threaten its physical structure or core function. However, interruption to services or physical damage to assets can affect entire communities, depending on the asset's importance to the region and the regional context. These consequences can amplify an asset's vulnerability to the adverse impacts of hazards.

After examining vulnerability, the assessment estimates ***Risk*** – the overall potential for negative consequences – by considering two components: vulnerability and consequences. Vulnerability is measured using the Vulnerability Score. Consequences refer to the degree to which a community is adversely impacted if an asset is damaged by a hazard.

The assessment examines two factors that contribute to its severity to understand the consequences of potential coastal hazards: social vulnerability and asset criticality. *Social vulnerability* refers to the susceptibility of social groups, indicated by certain social conditions such as poverty, to experience adverse impacts during hazard events. *Asset criticality* aims to characterize how important an asset is to its surrounding community based on the potential scale of economic loss caused by its damage during a flood.

Consequence metrics are multiplied by the Vulnerability Score to produce a Risk Score for each asset (Figure 2.2). Due to limited data, this step is not applied to natural infrastructure.

Figure 2.2 Components of Risk



3.0 Identify & Map Hazards

3.1 Hazard Identification

Based on a review of recent community plans and CAT meeting discussions, four relevant hazards were selected to examine in the assessment process: coastal flooding, storm surge, rainfall-driven flooding, and wildfires (as noted above, riverine flooding was excluded as the Town does not experience this hazard). The Town has experienced each of the flood hazards and would experience severe consequences from a wildfire. Each hazard is considered a high-priority hazard in the 2020 Pamlico Sound Regional Hazard Mitigation Plan.

Coastal flooding is assessed using floodplain data produced for the North Carolina Sea Level Rise Impact Study. Present (baseline) and future flood conditions are considered for three frequency events: mean higher high water (MHHW), 100-year, and 500-year. Future flood conditions approximate a 30-year projection for sea level rise by using a 1.3-feet (40-centimeter) sea level rise scenario to estimate coastal hazards for 2050.

Storm surge is assessed using surge flood depth data from NOAA's Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model[4] for two storm scenarios: Category 1 and Category 2 storms. The Category 1 storm surge flood depths are used to represent present-day flooding conditions, and the Category 2 storm is a proxy for potential future increases in storm severity.

Rainfall-driven flooding is incorporated based on hotspot data provided by the Town of Atlantic Beach. These hotspots are areas that flood frequently during rainstorms. The rainfall-driven flooding assessment does not include a climate projection scenario.

Wildfire hazard is evaluated based on burn probability data from USFS[5], which estimates the annual probability of wildfires burning in a specific location. The assessment for wildfire does not include a climate projection scenario.

3.2 Asset Identification

3.2.1 Critical Built Infrastructure

Critical built infrastructure refers to physical structures that house or perform functions that enable the continuous operation of government and business functions and are essential to human health and safety or economic safety. The assessment identified critical built infrastructure assets using multiple datasets

[4] NOAA, NWS, National Hurricane Center. Sea, Lake, and Overland Surges from Hurricanes (SLOSH). https://www.nhc.noaa.gov/surge/slosh.php

[5] Referred to as Wildfire Likelihood in Wildfire Risk to Communities web application: https://wildfirerisk.org/

available on the Carteret County Open GIS Portal[6] and feedback from the project's advisory committee, known as the Community Action Team (CAT). Built infrastructure assets are individual sites – point-level data representing structures, facilities, and other buildings. The Federal Emergency Management Agency's (FEMA) Community Lifeline framework served as a starting point to identify and categorize critical built infrastructure assets.

Table 3.2.1 summarizes the individual sites examined within the Town of Atlantic Beach. For assets that perform multiple functions, such as a fire and rescue station, the asset is evaluated separately under each category (in this example, as both an Emergency Medical Services asset and a Fire Station). These assets, hazard exposure extents, and all other maps can be found in the Appendix.

Table 3.2.1 Summary of Critical Built Infrastructure Sites by Type

Type	Includes	No. of Assets
Communications Infrastructure	Infrastructure that supports communications, alerts, warnings, and messages to first responders and the general public.	0
Emergency Medical Services	Locations where EMS personnel are stationed, based out of, or store the equipment used to carry out their job functions, including independent ambulatory services.	1*
Energy Facilities	Facilities that generate or distribute electric power, or store or transfer energy resources (e.g., petroleum products).	1
Fire Stations	Buildings that house firefighting personnel and their equipment.	1
Government Services	Buildings and facilities that provide government services, including town halls, government agency offices, and government agency operational facilities (e.g., Public Works maintenance yard).	1
Law Enforcement Sites	Buildings that house local, state, federal, and special jurisdiction law enforcement agencies, e.g., municipal police, county sheriffs, and park police.	1
Local Food Markets	Businesses that sell produce and other food products.	1
Medical Facilities	Facilities that provide health and medical services, including hospitals, nursing homes, mental health homes, and hospices.	0
Public Schools	Locations of pre-kindergarten, elementary, middle, high, and early college schools.	0
Wastewater Facilities	Locations of wastewater discharge sites and treatment plants.	13
Water Supplies	Locations of public water supply sources, including both ground, spring, and surface water sources.	4
Total		22
* Emergency Medical Services are provided by the Atlantic Beach Fire Department. The Fire Department is counted in both the "Fire Stations" and "Emergency Medical Services" asset types.		

3.2.2 Critical Network Infrastructure

Physical infrastructure networks support the continuous operation of government and business functions and are essential to human health and safety or economic safety. Roadway data is from the NC Department of

[6] Carteret County Open GIS Portal: https://gisdata-cc-gis.opendata.arcgis.com/

Transportation (NCDOT)[7], and pedestrian trail and sidewalk data is from the Carteret County Open GIS portal. Road networks are classified by use and ownership: state, secondary, and other road networks. The Federal Emergency Management Agency's (FEMA) Community Lifeline framework served as a starting point to identify and categorize critical network infrastructure assets.

Table 3.2.2 summarizes the network infrastructure examined within the Town of Atlantic Beach. These assets, hazard exposure extents, and all other maps can be found in the Appendix.

Table 3.2.2 Summary of Critical Built Infrastructure Sites by Type

Type	Includes	Length of Assets (miles)
Federal Roads[1]	Roads maintained by federal agencies.	0
State Roads	Roads maintained by NCDOT that are cross-state routes.	4.7
Secondary Roads	Local roads that are maintained by NCDOT.	1.2
Other Roads	Local roads that are not maintained by NCDOT.	24.2
Pedestrian Trails and Sidewalks	Sidewalks along roads and trail networks separate from roadways.	19.8
Sewer outfalls[1]	Drainage pipes that channel stormwater from on-road drains to outfall locations	0
Total		49.9

1. Federal roads and sewer outfalls are included in this table for consistency with other analyses; these asset types are excluded from vulnerability and risk summary results because there are no Federal roads or sewer outfalls in Atlantic Beach.

3.2.3 Natural Assets

Natural assets are lands that are actively managed to serve specific community needs, such as growing food (agricultural lands), providing recreational space (recreational lands), and supporting local ecosystems (natural lands). Natural Asset vulnerability is evaluated based on potential loss of functionality. Natural asset data is from the Carteret County Open GIS Portal[8] and supplementary information from the CAT. While natural assets are geographic areas, this analysis relies on the center point of asset locations to evaluate exposure and vulnerability. The Federal Emergency Management Agency's (FEMA) Community Lifeline framework and FEMA's definition of ecosystem service benefits[9] served as a starting point to identify and categorize natural assets.

Table 3.2.3 summarizes the natural assets examined within the Town of Atlantic Beach. These assets, hazard exposure extents, and all other maps can be found in the Appendix.

Table 3.2.3 Summary of Natural Asset Sites by Type

Type	Includes	No. of assets	Acreage
Agricultural Land	Lands used for the growing of produce or other agricultural activities, including community gardens.	0	0
Recreational Land	Lands used for recreational activities that are not preserved lands.	1	7.3

[7] NCDOT. GIS Data Layers [database]. https://connect.ncdot.gov/resources/gis/Pages/GIS-Data-Layers.aspx

[8] Carteret County Open GIS Portal: https://gisdata-cc-gis.opendata.arcgis.com/

[9] https://www.fema.gov/sites/default/files/2020-09/fema_ecosystem-service-benefits_policy_september-2020.pdf

Type	Includes	No. of assets	Acreage
Preserved Land	Lands preserved and protected from development. Hoop Pole Creek Preserve is the preserved land in Atlantic Beach and may be referred to as "the Preserve" colloquially.	1	31.4
Total		2	38.7

3.2.4 Natural Infrastructure

Areas containing natural infrastructure were identified using marsh land cover data from the National Oceanic and Atmospheric Administration's (NOAA) Sea Level Affecting Marshes Model (SLAMM). This data focuses on marsh habitats, such as tidal and non-tidal wetlands, and identifies upland habitats and parks in developed areas. **Table 3.2.4**, below, provides estimated habitat acreages for present-day conditions.

Table 3.2.4 Natural Infrastructure Vulnerability to Sea Level Change by Habitat Type

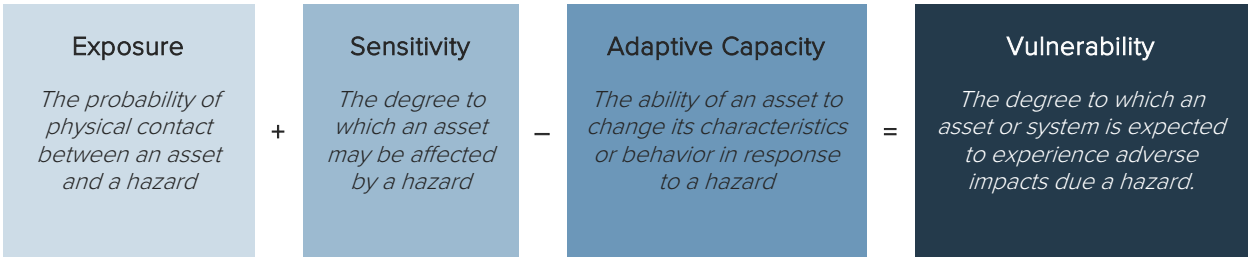
Habitat Type	Present-Day Acreage
Non-Tidal Wetland	4.6
Tidal Wetland	14.9
Unconsolidated Shore	19.8
Upland Habitat	40.0
Total Habitat Acres	79.3

4.0 Assess Vulnerability

An asset's vulnerability is a function of its exposure, sensitivity, and adaptive capacity to coastal hazards. Assessing the vulnerability of a structure, like critical built infrastructure, differs from that of natural infrastructure. Thus, the metrics for evaluating exposure, sensitivity, and adaptive capacity differ for the two types of assets considered.

A Vulnerability Score is calculated for **critical built infrastructure** by assessing exposure, sensitivity, and adaptive capacity separately to produce scores for each component. For each metric, assets are assigned a score from zero to three. Following the equation outlined in **Figure 4.1** (for reference only; identical to **Figure 2.1**), the Vulnerability Score is the sum of the exposure and sensitivity scores, less the adaptive capacity score. This process makes it possible for critical built infrastructure to receive a negative Vulnerability Score. A negative score does not indicate an asset would be unaffected by hazards. For clarity, assets with a negative score are manually assigned a vulnerability score of zero.

Figure 4.1. Components of Vulnerability



For **natural infrastructure**, this assessment leverages NOAA's Sea Levels Affecting Marshes Model (SLAMM) to identify changes in marsh land cover. SLAMM assumes that specific types of wetlands can exist within an established range of tidal elevations, based on which vegetation can thrive given the varying frequency,

time, and salinity impacts of inundation.[10] The model incorporates a habitat's exposure, sensitivity, and adaptive capacity into one metric: projected habitat lost to open water due to sea level rise. Vulnerability Scores are assigned to a habitat type based on its overall projected land loss.

This chapter presents individual asset vulnerability first by each hazard type; this data is then used to generate cumulative vulnerability scores under present-day and future conditions for each asset (see Section 4.5: Cumulative Hazard Vulnerability Assessment).

4.1 Storm Surge

The storm surge assessment relies on storm surge extent and flood depth modeling outputs from the National Weather Service (NWS) at NOAA's Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model[11]. Specifically, this assessment looks at flood depths from the Maximum of Maximum Envelopes of Water (MOMs) composite modeling output. SLOSH model outputs are typically used for emergency management purposes and are the best available data for the planning area to analyze vulnerability to hurricane storm surge. The composite modeling includes thousands of hypothetical hurricanes to account for forecasting uncertainty, but it is often considered a "worst case scenario" when used for planning purposes.

This assessment uses the MOM flood depths for Category 1 storms for current storm surge hazard exposure and Category 2 storm MOM flood depths for as a proxy for future conditions. The findings below summarize storm surge vulnerability for critical built infrastructure, natural assets, and critical network infrastructure.

Key Findings:

- Few assets experience storm surge vulnerability under a Category 1 storm
- Pump lift stations experience no or very low vulnerability under a Category 1 storm, but approximately seven of 13 experience low (score of 2) vulnerability under a Category 2 storm.
- Other Atlantic Beach water and sewer infrastructure are vulnerable to storm surge hazards, including the Atlantic Beach Water Treatment Plant, West End Water Tower, and East End Water Tower.
- Few roads experience vulnerability under a Category 1 storm; one section at East Fort Macon Road near Dunes Club has low vulnerability. Fort Macon Road (E & W) and roads north of Fort Macon Road experience low vulnerability under a Category 2 storm. This includes the Atlantic Beach Causeway (note that underlying data does not include road elevation, which may reduce sensitivity if roadway is elevated).

As a reminder, Vulnerability is calculated by the following formula. The components of the Vulnerability scores as they pertain to the Storm Surge hazard are detailed below, in Sections 4.1.1 (Exposure Scoring) and 4.1.2 (Sensitivity and Adaptive Capacity Scoring).

Exposure + **Sensitivity** − **Adaptive Capacity** = **Vulnerability**

[10] NOAA Office for Coastal Management. 2017. "Detailed Method for Mapping Sea Level Rise Marsh Migration." NOAA. https://coast.noaa.gov/data/digitalcoast/pdf/slr-marsh-migration-methods.pdf

[11] NOAA, NWS, National Hurricane Center. Sea, Lake, and Overland Surges from Hurricanes (SLOSH). https://www.nhc.noaa.gov/surge/slosh.php

4.1.1 Exposure Scoring

Assets are assigned **Exposure Scores** from zero (no flood depth exposure) to three (greater than four feet of flood surge depth exposure) based on flood depths assets are expected to experience under Category 1 (Baseline) and Category 2 (Projection) storm surge events.

Assets' Exposure Scores are referenced from low to high exposure, as summarized in **Table 4.1.1**, to facilitate the discussion of these results.

Table 4.1.1 Exposure Scoring for Storm Surge Hazards

Score	Flood Depth
0	No flooding
1	Less than or equal to two feet of surge
2	Greater than two feet and less than or equal to four feet of surge
3	Greater than four feet of surge

Table 4.1.2 Critical Built Infrastructure Exposure Scores for Assets with High Vulnerability to Storm Surge Hazards. Exposure scores for all assets are provided in the **Appendix**.

Asset Type	Asset Name	Exposure	
		Cat 1 Storm Surge (Baseline)	Cat 2 Storm Surge (Projected)
Energy Facilities	Duke Energy Substation	1	3
Water Supplies	West End Water Tower	1	3
Fire Stations	Atlantic Beach Rescue	1	3
Law Enforcement Sites	Atlantic Beach Police Dept	1	3
Local Food Markets	Food Lion	0	3
Wastewater Facilities	PLS at 105 South Durham	0	3
Wastewater Facilities	PLS at 136 Hoop Pole Creek	0	3
Wastewater Facilities	PLS at 314 East Terminal/Wilson	0	3
Wastewater Facilities	PLS at 314/315 Old Causeway	1	3
Wastewater Facilities	PLS at Forest Knoll	0	3
Water Supplies	Atlantic Beach Water Treatment Plant	0	2
Water Supplies	East End Water Tower	0	2

Table 4.1.3 Natural Assets Exposure Scores for Storm Surge Hazards

Asset Type	Asset Name	Exposure	
		Cat 1 Storm Surge (Baseline)	Cat 2 Storm Surge (Projected)
Natural Land	Hoop Pole Creek Preserve	3	3
Recreational Land	Atlantic Beach Town Park/ Coral Bay Park	1	2

Table 4.1.4 Network Miles by Asset Type and Exposure Scores for Storm Surge Hazards

Asset Type	Storm Category	Miles of network by Exposure Score			
		0	1	2	3
State Roads	Cat 1	3.46	1.20	0.08	0
	Cat 2	0.46	0.34	0.95	2.98
Secondary Routes	Cat 1	1.08	0.12	0.00	0.00
	Cat 2	0.51	0.05	0.12	0.52
Other Roads	Cat 1	18.14	6.00	0.03	0
	Cat 2	7.04	2.47	3.45	11.20
All Roads	**Cat 1**	**22.67**	**7.32**	**0.10**	**0.00**
	Cat 2	**8.01**	**2.86**	**4.53**	**14.69**
Sidewalks	Cat 1	16.92	2.70	0.15	0
	Cat 2	1.85	2.54	4.05	11.33
Outfalls	Cat 1	0	0	0	0

Supporting maps of storm surge hazard extents and asset exposure scores can be found in the **Appendix**.

4.1.2 Sensitivity and Adaptive Capacity Scoring

Sensitivity reflects the potential damage to critical built infrastructure's materials, functions, or the surrounding environment if it were flooded. Critical built infrastructure that cannot immediately accommodate floodwaters or increased water levels is more likely to experience higher damage levels. **Sensitivity Scores** are assigned by asset types and consider the potential for damage and disruption of essential services or functions.

Adaptative capacity illustrates the ability of an asset to change its characteristics or behavior in response to a hazard. An asset's potential to adapt depends on the potential suite of options available and a community's ability to implement those actions. The **Adaptive Capacity Scores** are assigned by asset types and consider the potential for assets to be relocated or adapt to flood depths.

Table 4.1.5 Sensitivity and Adaptive Capacity Scoring

Asset category	Asset type	Sensitivity	Adaptive Capacity
Critical Built Infrastructure	Buildings[1]	2	3
	Energy facilities	2	2
	Communications infrastructure	1	2
	Waste infrastructure	3	1
	Water Supplies[2]	2	2
Critical Network Infrastructure	Transportation	1	2
Natural Assets	Agricultural land	3	2
	Natural land	1	2
	Recreational land	1	2

1. Includes all critical built infrastructure except for communications infrastructure, energy facilities, wastewater facilities, and water supplies.
2. Outfall lines are classified as Water/Sewer assets that are Critical Network Infrastructure. Note that this assessment for Atlantic Beach does not include outfall lines.

Table 4.1.6 Critical Built Infrastructure Sensitivity and Adaptive Capacity Scores for Assets with High Vulnerability to Storm Surge Hazards. Sensitivity and adaptive capacity scores for all assets are provided in the Appendix.

Asset Type	Asset Name	Sensitivity	Adaptive Capacity
Energy Facilities	Duke Energy Substation	2	2
Water Supplies	West End Water Tower	2	2
Fire Stations	Atlantic Beach Rescue	2	3
Law Enforcement Sites	Atlantic Beach Police Dept	2	3
Local Food Markets	Food Lion	2	3
Wastewater Facilities	PLS at 105 South Durham	2	3
Wastewater Facilities	PLS at 136 Hoop Pole Creek	2	3
Wastewater Facilities	PLS at 314 East Terminal/Wilson	2	3
Wastewater Facilities	PLS at 314/315 Old Causeway	2	3
Wastewater Facilities	PLS at Forest Knoll	2	3
Water Supplies	Atlantic Beach Water Treatment Plant	2	2
Water Supplies	East End Water Tower	2	2

Table 4.1.7 Natural Assets Sensitivity and Adaptive Capacity Scores for Storm Surge Hazards

Asset Type	Asset Name	Sensitivity	Adaptive Capacity
Natural Land	Hoop Pole Creek Preserve	1	2
Recreational Land	Atlantic Beach Town Park/ Coral Bay Park	1	2

Table 4.1.8 Sensitivity and Adaptive Capacity Scores by Network Asset Type for Storm Surge Hazards

Asset Type	Storm Category	Sensitivity	Adaptive Capacity
State Roads	Cat 1	1	2
	Cat 2		
Secondary Routes	Cat 1	1	2
	Cat 2		
Other Roads	Cat 1	1	2
	Cat 2		
All Roads	Cat 1	1	2
	Cat 2		
Sidewalks	Cat 1	1	2
	Cat 2		
Outfalls	Cat 1	2	2

4.1.3 Vulnerability Scoring

Storm surge flood depths are greatest in Atlantic Beach on the Bay-side of the island. Flood depths increase significantly between Category 1 and Category 2 model results. No assets in Atlantic Beach have a

vulnerability score higher than three; although some assets have exposure scores of three, these assets are estimated to have sufficient adaptive capacity and limited sensitivity.

Table 4.1.9 Critical Built Infrastructure Vulnerability Scores for Assets with High Vulnerability to Storm Surge Hazards. Vulnerability scores for all assets are provided in the **Appendix**.

Asset Type	Asset Name	Exposure		Sens.	A.C.	Vulnerability	
		Cat 1 Storm Surge (Baseline)	Cat 2 Storm Surge (Projected)			Cat 1 Storm Surge (Baseline)	Cat 2 Storm Surge (Projected)
Energy Facilities	Duke Energy Substation	1	3	2	2	1	3
Water Supplies	West End Water Tower	1	3	2	2	1	3
Fire Stations	Atlantic Beach Rescue	1	3	2	3	0	2
Law Enforcement Sites	Atlantic Beach Police Dept	1	3	2	3	0	2
Local Food Markets	Food Lion	0	3	2	3	0	2
Wastewater Facilities	PLS at 105 South Durham	0	3	2	3	0	2
Wastewater Facilities	PLS at 136 Hoop Pole Creek	0	3	2	3	0	2
Wastewater Facilities	PLS at 314 East Terminal/Wilson	0	3	2	3	0	2
Wastewater Facilities	PLS at 314/315 Old Causeway	1	3	2	3	0	2
Wastewater Facilities	PLS at Forest Knoll	0	3	2	3	0	2
Water Supplies	Atlantic Beach Water Treatment Plant	0	2	2	2	0	2
Water Supplies	East End Water Tower	0	2	2	2	0	2

Table 4.1.10 Natural Assets Vulnerability Scores for Storm Surge Hazards

Asset Type	Asset Name	Exposure		Sens.	A.C.	Vulnerability	
		Cat 1 Storm Surge (Baseline)	Cat 2 Storm Surge (Projected)			Cat 1 Storm Surge (Baseline)	Cat 2 Storm Surge (Projected)
Natural Land	Hoop Pole Creek Preserve	3	3	1	2	2	2
Recreational Land	Atlantic Beach Town Park/ Coral Bay Park	1	2	1	2	0	1

Table 4.1.11 Network Miles by Asset Type and Vulnerability Scores for Storm Surge Hazards

Network Type	Storm Category	Vulnerability Scores					
		0	1	2	3	4	5
State Roads	Cat 1	4.7	0.1	0	0	0	0
	Cat 2	0.8	1.0	3.0	0	0	0
Secondary Routes	Cat 1	1.2	0	0	0	0	0
	Cat 2	0.6	0.1	0.5	0	0	0
Other Roads	Cat 1	24.1	0	0	0	0	0
	Cat 2	9.5	3.5	11.2	0	0	0
All Roads	**Cat 1**	**30.3**	**0.1**	**0**	**0**	**0**	**0**
	Cat 2	**10.9**	**4.5**	**14.7**	**0**	**0**	**0**
Sidewalks and Trails	Cat 1	19.1	0	0	0	0	0
	Cat 2	4.35	4.03	10.7	0	0	0

Town of Atlantic Beach

Category 1 Storm Surge Vulnerability

Storm surge data source: NOAA Meteorological Development Laboratory. SLOSH model outputs, 2022.

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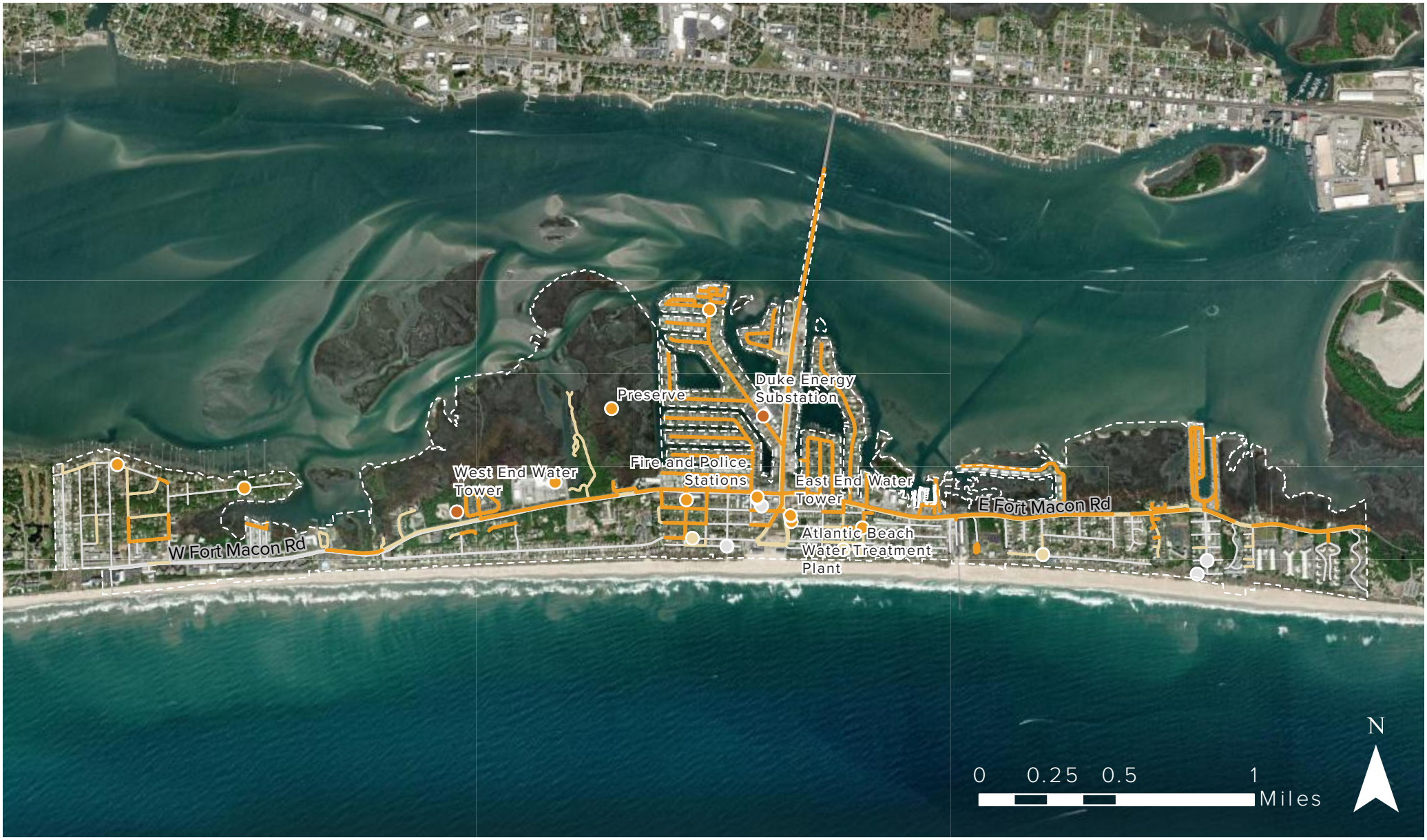
Storm Surge Vulnerability Scores

Critical Facilities	Roads and Trails
0	0
1	1
2	2
3	3
4	4
5	5

Boundaries and Context

- Town of Atlantic Beach Boundary
- Wetlands



Town of Atlantic Beach

Category 2 Storm Surge Vulnerability

Storm surge data source: NOAA Meteorological Development Laboratory. SLOSH model outputs, 2022.

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Storm Surge Vulnerability Scores

Critical Facilities

- 0
- 1
- 2
- 3
- 4
- 5

Roads and Trails

- 0
- 1
- 2
- 3
- 4
- 5

Boundaries and Context

- Town of Atlantic Beach Boundary
- Wetlands

4.2 Coastal Flood and Sea Level Change

This hazard addresses the RCCP requirement to evaluate tidal flooding and a 30-year sea level change projection. While the storm surge assessment in the previous section evaluates asset vulnerability to flood depths from hurricanes and other extreme weather events, this section evaluates asset vulnerability to coastal flooding benchmarked to specific flood probabilities, both today and into the future. Data relies on modeling output from the North Carolina Sea Level Impact Study (2014) for coastal storm frequencies and extents. Based on current sea level change projections, sea levels are projected to rise by approximately 40cm (1.3 feet) by 2050.

This analysis considers storm surge and tidally driven flooding for both present-day and a 2050 projection scenario for 100-year (1% annual exceedance probability) and 500-year (0.2% annual exceedance probability) storm events. The findings below summarize coastal flooding and sea level change vulnerability for critical built infrastructure, natural assets, and critical network infrastructure.

Key Findings:

- The Duke Energy Substation, Atlantic Beach Water Treatment Plant, and the East and West End Water Towers are the assets with the highest vulnerability under both current and future coastal flooding conditions.
- The majority (eight of 13) of pump lift stations have low vulnerability under current coastal flooding conditions, and all pump lift stations except one have low vulnerability under projected coastal flooding conditions.
- The primary grocery store (Food Lion), the Atlantic Beach Police Department, Fire and Rescue, and Town Hall have low vulnerability to coastal flooding under current and projected conditions.
- No roads experience high or moderate vulnerability, but critical roadways and evacuation routes experience low vulnerability under both current conditions and projected conditions of sea level rise. These roadways include the Atlantic Beach Causeway, Fort Macon Road, and the triangle (East Drive, West Drive, and Atlantic Boulevard).

As a reminder, Vulnerability is calculated by the following formula. The components of the Vulnerability scores as they pertain to the Coastal Flooding hazard are detailed below, in Sections **4.2.1** (Exposure Scoring) and **4.2.2** (Sensitivity and Adaptive Capacity Scoring).

Exposure + **Sensitivity** – **Adaptive Capacity** = **Vulnerability**

4.2.1 Exposure Scoring

Assets are assigned **Exposure Scores** from zero (no storm annual exceedance probability) to three (greater than or equal to one percent) based on storm annual exceedance probabilities assets are expected to experience under Baseline (present-day) and Projected (1.5 feet of sea level rise) sea level rise conditions.

Assets' Exposure Scores are referenced from low to high exposure, as summarized in **Table 4.2.1** , to facilitate the discussion of these results.

Table 4.2.1 Exposure Scoring for Coastal Flood Hazards

Score	Storm Annual Exceedance Probability
0	None
1	Less than 0.2%
2	Less than one percent and greater than or equal to 0.2%
3	Greater than or equal to one percent

Table 4.2.2 Critical Built Infrastructure Exposure Scores for Assets with High Vulnerability to Coastal Flood Hazards. Exposure scores for all assets are provided in the Appendix.

Asset Type	Asset Name	Exposure	
		Present-Day Coastal Flooding (Baseline)	2050 Coastal Flooding (Projected 1.5 FT SLR)
Energy Facilities	Duke Energy Substation	3	3
Water Supplies	West End Water Tower	3	3
Water Supplies	Atlantic Beach Water Treatment Plant	3	3
Water Supplies	East End Water Tower	3	3
Fire Stations	Atlantic Beach Rescue	3	3
Law Enforcement Sites	Atlantic Beach Police Dept	3	3
Local Food Markets	Food Lion	3	3
Wastewater Facilities	PLS at 105 South Durham	3	3
Wastewater Facilities	PLS at 136 Hoop Pole Creek	3	3
Wastewater Facilities	PLS at 314 East Terminal/Wilson	3	3
Wastewater Facilities	PLS at 314/315 Old Causeway	3	3
Wastewater Facilities	PLS at Forest Knoll	3	3
Government Services	Atlantic Beach Town Hall	3	3
Wastewater Facilities	PLS at 216 East Boardwalk (Greenville Beach Access)	3	3
Wastewater Facilities	PLS at 312 East Boardwalk	3	3
Wastewater Facilities	PLS at 506 West Atlantic (507 W. Terminal)	3	3

Table 4.2.3 Natural Assets Exposure Scores for Coastal Flood Hazards

Asset Type	Asset Name	Exposure	
		Present-Day Coastal Flooding (Baseline)	2050 Coastal Flooding (Projected 1.5 FT SLR)
Natural Land	Hoop Pole Creek Preserve	3	3
Recreational Land	Atlantic Beach Town Park/ Coral Bay Park	3	3

Table 4.2.4 Network Miles by Asset Type and Exposure Scores for Coastal Flood Hazards

Asset Type	Coastal Flooding Scenario	Miles of network by Exposure Score			
		0	1	2	3
State Roads	Baseline	0	1.26	0	3.47
	Projected	0	0.78	0	3.95
Secondary Routes	Baseline	0	0.11	0	1.08
	Projected	0	0.06	0	1.13
Other Roads	Baseline	0	9.81	0	14.35
	Projected	0	7.15	0	17.01
All Roads	**Baseline**	**0**	**11.19**	**0**	**18.90**
	Projected	**0**	**8.00**	**0**	**22.09**
Sidewalks	Baseline	0	4.66	0	15.10
	Projected	0	2.84	0	16.93

Supporting maps of coastal flooding hazard extents and asset exposure scores can be found in the **Appendix**.

4.2.2 Sensitivity and Adaptive Capacity Scoring

Sensitivity reflects the potential damage to critical built infrastructure's materials, functions, or the surrounding environment if it were flooded. Critical built infrastructure that cannot immediately accommodate floodwaters or increased water levels is more likely to experience higher damage levels. **Sensitivity Scores** are assigned by asset types and consider the potential for damage and disruption of essential services or functions.

Adaptative capacity illustrates the ability of an asset to change its characteristics or behavior in response to a hazard. An asset's potential to adapt depends on the potential suite of options available and a community's ability to implement those actions. The **Adaptive Capacity Scores** are assigned by asset types and consider the potential for assets to be relocated or adapt to coastal flooding exposure.

Table 4.2.5 Sensitivity and Adaptive Capacity Scoring

Asset Category	Asset Type	Sensitivity	Adaptive Capacity
Critical Built Infrastructure	Buildings[1]	2	3
	Energy facilities	2	2
	Communications infrastructure	1	2
	Waste infrastructure	3	1
	Water Supplies[2]	2	2
Critical Network Infrastructure	Transportation	1	2
Natural Assets	Agricultural land	3	2
	Natural land	1	2
	Recreational land	1	2

1. Includes all critical built infrastructure except for communications infrastructure, energy facilities, wastewater facilities, and water supplies.
2. Outfall lines are classified as Water/Sewer assets that are Critical Network Infrastructure. Note that this assessment for Atlantic Beach does not include outfall lines.

Table 4.2.6 Critical Built Infrastructure Sensitivity and Adaptive Capacity Scores for Assets with High Vulnerability to Coastal Flooding Hazards. Sensitivity and adaptive capacity scores for all assets are provided in the Appendix.

Asset Type	Asset Name	Sensitivity	Adaptive Capacity
Energy Facilities	Duke Energy Substation	2	2
Water Supplies	West End Water Tower	2	2
Water Supplies	Atlantic Beach Water Treatment Plant	2	2
Water Supplies	East End Water Tower	2	2
Fire Stations	Atlantic Beach Rescue	2	3
Law Enforcement Sites	Atlantic Beach Police Dept	2	3
Local Food Markets	Food Lion	2	3
Wastewater Facilities	PLS at 105 South Durham	2	3
Wastewater Facilities	PLS at 136 Hoop Pole Creek	2	3
Wastewater Facilities	PLS at 314 East Terminal/Wilson	2	3
Wastewater Facilities	PLS at 314/315 Old Causeway	2	3
Wastewater Facilities	PLS at Forest Knoll	2	3
Government Services	Atlantic Beach Town Hall	2	3
Wastewater Facilities	PLS at 216 East Boardwalk (Greenville Beach Access)	2	3
Wastewater Facilities	PLS at 312 East Boardwalk	2	3
Wastewater Facilities	PLS at 506 West Atlantic (507 W. Terminal)	2	3

Table 4.2.7 Natural Assets Sensitivity and Adaptive Capacity Scores for Coastal Flooding Hazards

Asset Type	Asset Name	Sensitivity	Adaptive Capacity
Natural Land	Hoop Pole Creek Preserve	1	2
Recreational Land	Atlantic Beach Town Park/ Coral Bay Park	1	2

Table 4.2.8 Sensitivity and Adaptive Capacity Scores by Network Asset Type for Coastal Flooding Hazards

Asset Type	Coastal Flooding Scenario	Sensitivity	Adaptive Capacity
State Roads	Baseline	1	2
	Projection		
Secondary Routes	Baseline	1	2
	Projection		
Other Roads	Baseline	1	2
	Projection		
All Roads	Baseline	1	2
	Projection		
Sidewalks	Baseline	1	2
	Projection		

4.2.3 VULNERABILITY SCORING

Much of the Town is vulnerable to coastal flooding; similar to storm surge vulnerability, coastal flooding is from the Bay-side of the island. The areas and assets vulnerable to coastal flooding are similar to those vulnerable to storm surge hazards, with additional pump lift stations (PLS) vulnerable to coastal flooding.

Table 4.2.9 Critical Built Infrastructure Vulnerability Scores for Assets with High Vulnerability to Storm Surge Hazards. Vulnerability scores for all assets are provided in the **Appendix.**

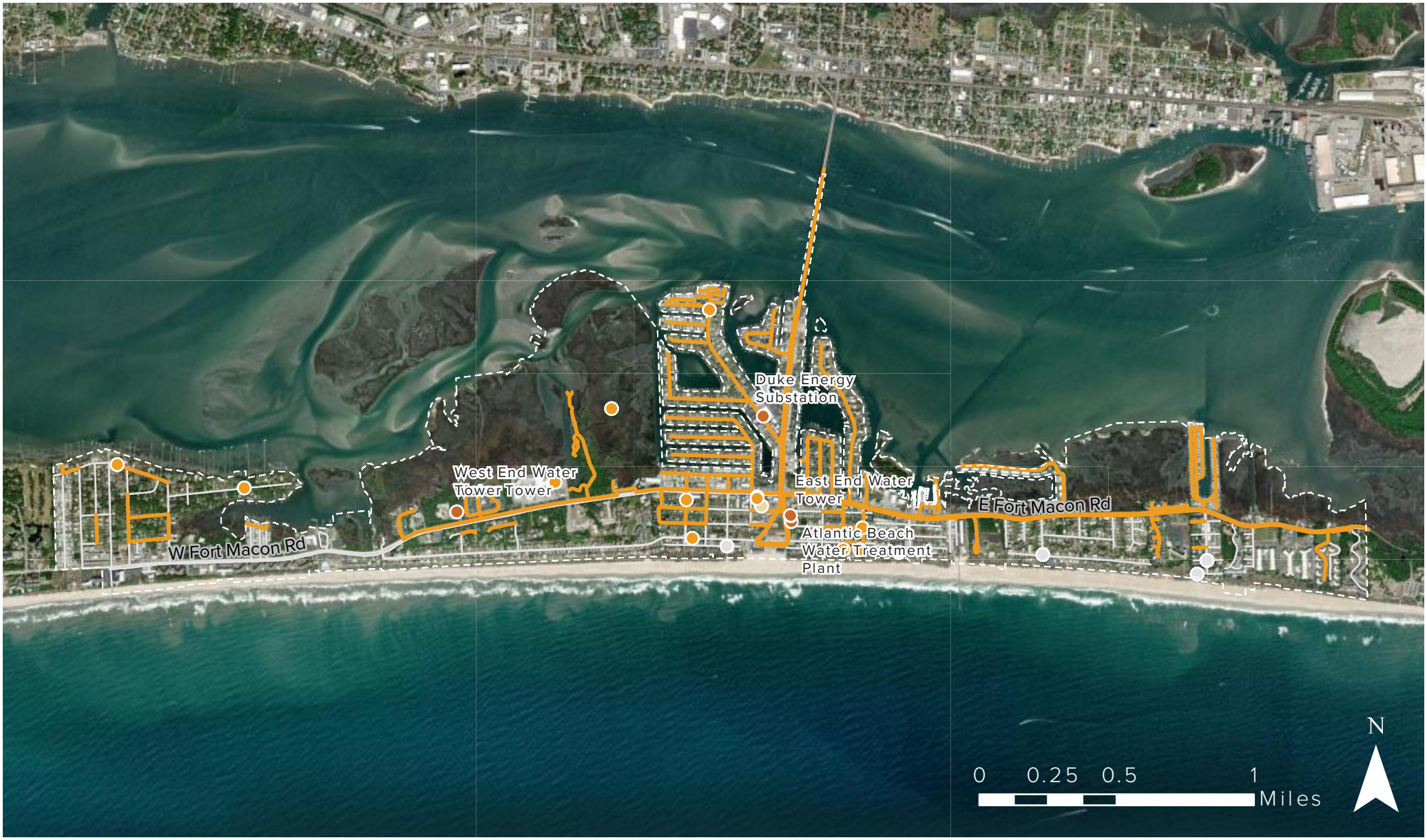
Asset Type	Asset Name	Exposure		Sens.	A.C.	Vulnerability	
		Present-Day Coastal Flooding (Baseline)	2050 Coastal Flooding (Projected 1.5 SLR)			Present-Day Coastal Flooding (Baseline)	2050 Coastal Flooding (Projected 1.5 SLR)
Energy Facilities	Duke Energy Substation	3	3	2	2	3	3
Water Supplies	West End Water Tower	3	3	2	2	3	3
Water Supplies	Atlantic Beach Water Treatment Plant	3	3	2	2	3	3
Water Supplies	East End Water Tower	3	3	2	2	3	3
Fire Stations	Atlantic Beach Rescue	3	3	2	3	2	2
Law Enforcement Sites	Atlantic Beach Police Dept	3	3	2	3	2	2
Local Food Markets	Food Lion	3	3	2	3	2	2
Wastewater Facilities	PLS at 105 South Durham	3	3	2	3	2	2
Wastewater Facilities	PLS at 136 Hoop Pole Creek	3	3	2	3	2	2
Wastewater Facilities	PLS at 314 East Terminal/Wilson	3	3	2	3	2	2
Wastewater Facilities	PLS at 314/315 Old Causeway	3	3	2	3	2	2
Wastewater Facilities	PLS at Forest Knoll	3	3	2	3	2	2
Government Services	Atlantic Beach Town Hall	3	3	2	3	2	2
Wastewater Facilities	PLS at 216 East Boardwalk (Greenville Beach Access)	3	3	2	3	2	2
Wastewater Facilities	PLS at 312 East Boardwalk	3	3	2	3	2	2
Wastewater Facilities	PLS at 506 West Atlantic (507 W. Terminal)	3	3	2	3	2	2

Table 4.2.10 Natural Assets Vulnerability Scores for Coastal Flood Hazards

Asset Type	Asset Name	Exposure		Sens.	A.C.	Vulnerability	
		Present-Day Coastal Flooding (Baseline)	2050 Coastal Flooding (Projected 1.5 SLR)			Present-Day Coastal Flooding (Baseline)	2050 Coastal Flooding (Projected 1.5 SLR)
Natural Land	Hoop Pole Creek Preserve	3	3	1	2	2	2
Recreational Land	Atlantic Beach Town Park/ Coral Bay Park	3	3	1	2	2	2

Table 4.2.11 Network Miles by Asset Type and Vulnerability Scores for Coastal Flood Hazards

NETWORK TYPE	COASTAL FLOODING SCENARIO	VULNERABILITY SCORE					
		0	1	2	3	4	5
State Roads	Baseline	1.3	0	3.5	0	0	0
	Projected	0.8	0	4.0	0	0	0
Secondary Routes	Baseline	0.1	0	1.1	0	0	0
	Projected	0.1	0	1.1	0	0	0
Other Roads	Baseline	9.8	0	14.4	0	0	0
	Projected	7.2	0	17.0	0	0	0
All Roads	**Baseline**	**11.2**	**0**	**18.9**	**0**	**0**	**0**
	Projected	**8.0**	**0**	**22.1**	**0**	**0**	**0**
Sidewalks and Trails	Baseline	4.7	0	14.4	0	0	0
	Projected	2.8	0	16.3	0	0	0



Town of Atlantic Beach

Coastal Flooding and Sea Level Change Vulnerability: Existing Conditions

Existing and Projected Coastal Flood Hazard: NC SLR Impact Study, 2014.

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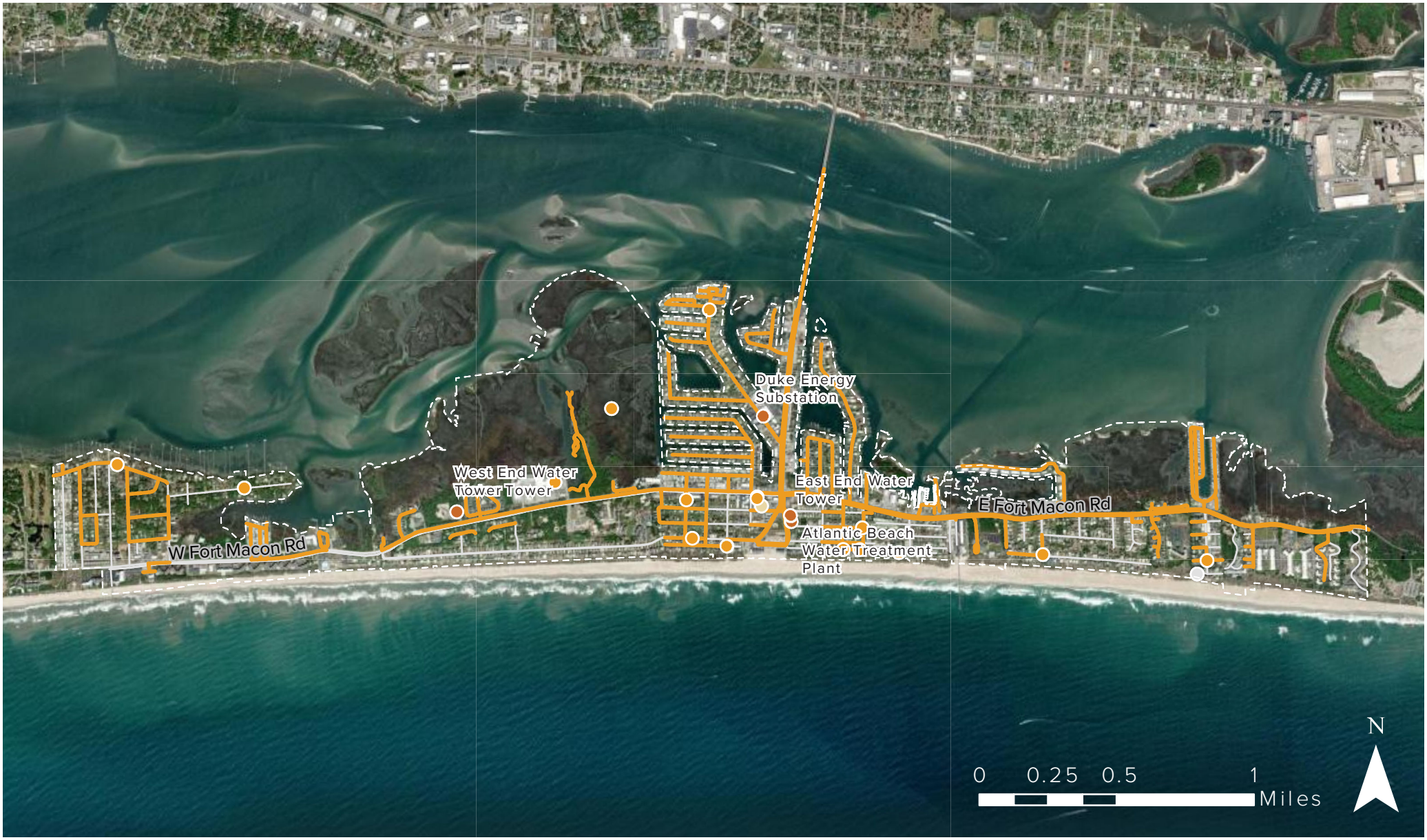
Coastal Flooding Vulnerability Scores

Critical Facilities
- 0
- 1
- 2
- 3
- 4
- 5

Roads and Trails
- 0
- 1
- 2
- 3
- 4
- 5

Boundaries and Context
- Town of Atlantic Beach Boundary
- Wetlands



Town of Atlantic Beach

Coastal Flooding and Sea Level Change Vulnerability: Projected Conditions

Existing and Projected Coastal Flood Hazard: NC SLR Impact Study, 2014.

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North Carolina RESILIENT COASTAL COMMUNITIES PROGRAM

Legend

Coastal Flooding Vulnerability Scores

Critical Facilities
- 0
- 1
- 2
- 3
- 4
- 5

Roads and Trails
- 0
- 1
- 2
- 3
- 4
- 5

Boundaries and Context
- Town of Atlantic Beach Boundary
- Wetlands

4.3 Recurring Pluvial Flooding Hotspots

The Town of Atlantic Beach experiences periodic rain-driven, localized, flooding events. Locations identified by town officials as hotspots of recurring flooding are the basis of the analysis for this flood hazard. The hazard analysis for pluvial flood hotspots does not include a climate projection scenario. However, shifting precipitation regimes coupled with sea level rise and an associated higher water table are likely to contribute to more frequent and intense pluvial flooding.

This assessment uses the distance from an identified hotspot area as an indicator of asset exposure. Asset sensitivity and adaptive capacity scoring are consistent with other flood hazards. The findings below summarize pluvial flood hotspot vulnerability for critical built infrastructure, natural assets, and critical network infrastructure.

Key Findings:

- Vulnerability to recurring pluvial flooding hotspots is limited to transportation infrastructure.
- Pluvial hotspots are located at the intersection of Fort Macon Rd and the Atlantic Beach Causeway, Bayview Boulevard and Pond Drive near the causeway, and Pelican Drive and Knollwood Drive on the west side of Atlantic Beach.

As a reminder, Vulnerability is calculated by the following formula. The components of the Vulnerability scores as they pertain to the Pluvial Flooding Hotspots hazard are detailed below, in Sections 4.3.1 (Exposure Scoring) and 4.3.2 (Sensitivity and Adaptive Capacity Scoring:).

Exposure + **Sensitivity** − **Adaptive Capacity** = **Vulnerability**

4.3.1 Exposure Scoring

Assets are assigned Exposure Scores from zero (more than 50 feet away) to three (within 10 feet) based on asset distance from hotpot areas.

Assets' Exposure Scores are referenced from low to high exposure, as summarized in Table 4.3.1, to facilitate the discussion of these results.

Table 4.3.1 Exposure Scoring for Pluvial Flood Hazards

Score	Distance From Hotspot Area
0	More than 50 feet away
1	More than 25 feet away and less than 50 feet away
2	More than 10 feet away and less than 25 feet away
3	Inside identified hot spot area, or within 10 feet of hotspot

Table 4.3.2 Critical Built Infrastructure Exposure Scores for Assets with High Vulnerability to Pluvial Hotspot Flood Hazards. Exposure scores for all assets are provided in the Appendix.

Asset Type	Asset Name	Exposure
		Present-Day Pluvial Hotspots
No critical built infrastructure assets have a vulnerability score greater than 0.		

Table 4.3.3 Natural Assets Exposure Scores for Pluvial Hotspot Flood Hazards

Asset Type	Asset Name	Exposure
		Present-Day Pluvial Hotspots
No natural assets haven a vulnerability score greater than 0.		

Table 4.3.4 Network Miles by Asset Type and Exposure Scores for Pluvial Hotspot Flood Hazards

Asset Type	Miles of network by Exposure Score			
	0	1	2	3
State Roads	4.59	0.03	0.03	0.09
Secondary Routes	1.10	0.01	0	0.09
Other Roads	22.65	0.05	0.07	1.39
All Roads	**28.34**	**0.09**	**0.09**	**1.58**
Sidewalks	18.93	0.14	0.03	0.67

Supporting maps of recurring pluvial flooding hotspot hazard extents and asset exposure scores can be found in the **Appendix**.

4.3.2 Sensitivity and Adaptive Capacity Scoring

Sensitivity reflects the potential damage to critical built infrastructure's materials, functions, or the surrounding environment if it were flooded. Critical built infrastructure that cannot immediately accommodate floodwaters or increased water levels is more likely to experience higher damage levels. **Sensitivity Scores** are assigned by asset types and consider the potential for damage and disruption of essential services or functions.

Adaptative capacity illustrates the ability of an asset to change its characteristics or behavior in response to a hazard. An asset's potential to adapt depends on the potential suite of options available and a community's ability to implement those actions. The **Adaptive Capacity Scores** are assigned by asset types and consider the potential for assets to be relocated or adapt to recurring flooding.

Table 4.3.5 Sensitivity and Adaptive Capacity Scoring

Asset Category	Asset type	Sensitivity	Adaptive Capacity
Critical Built Infrastructure	Buildings[1]	2	3
	Energy facilities	2	2
	Communications infrastructure	1	2
	Waste infrastructure	3	1
	Water Supplies[2]	2	2
Critical Network Infrastructure	Transportation	1	2
Natural Assets	Agricultural land	3	2
	Natural land	1	2
	Recreational land	1	2

1. Includes all critical built infrastructure except for communications infrastructure, energy facilities, wastewater facilities, and water supplies.
2. Outfall lines are classified as Water/Sewer assets that are Critical Network Infrastructure. Note that this assessment for Atlantic Beach does not include outfall lines.

Table 4.3.6 Critical Built Infrastructure Sensitivity and Adaptive Capacity Scores for Assets with High Vulnerability to Pluvial Hotspot Flood Hazards. Sensitivity and adaptive capacity scores for all assets are provided in the Appendix.

Asset Type	Asset Name	Sensitivity	Adaptive Capacity
No critical built infrastructure assets have a vulnerability score greater than 0.			

Table 4.3.7 Natural Assets Sensitivity and Adaptive Capacity Scores for Pluvial Hotspot Flood Hazards

Asset Type	Asset Name	Sensitivity	Adaptive Capacity
No natural assets have a vulnerability score greater than 0.			

Table 4.3.8 Sensitivity and Adaptive Capacity Scores by Network Asset Type for Pluvial Hotspot Flood Hazards

Asset Type	Sensitivity	Adaptive Capacity
State Roads	1	2
Secondary Routes	1	2
Other Roads	1	2
All Roads	1	2
Sidewalks	1	2

4.3.3 Vulnerability Scoring

Pluvial hotspots are areas that flood during rainfall events. These areas are on roadways and sidewalks, and may be a result of local low-lying areas, or insufficient stormwater infrastructure. Flooding on roadways can disrupt traffic and impede access for emergency services.

Table 4.3.9 Critical Built Infrastructure Vulnerability Scores for Assets with High Vulnerability to Pluvial Hotspot Flood Hazards. Vulnerability scores for all assets are provided in the Appendix.

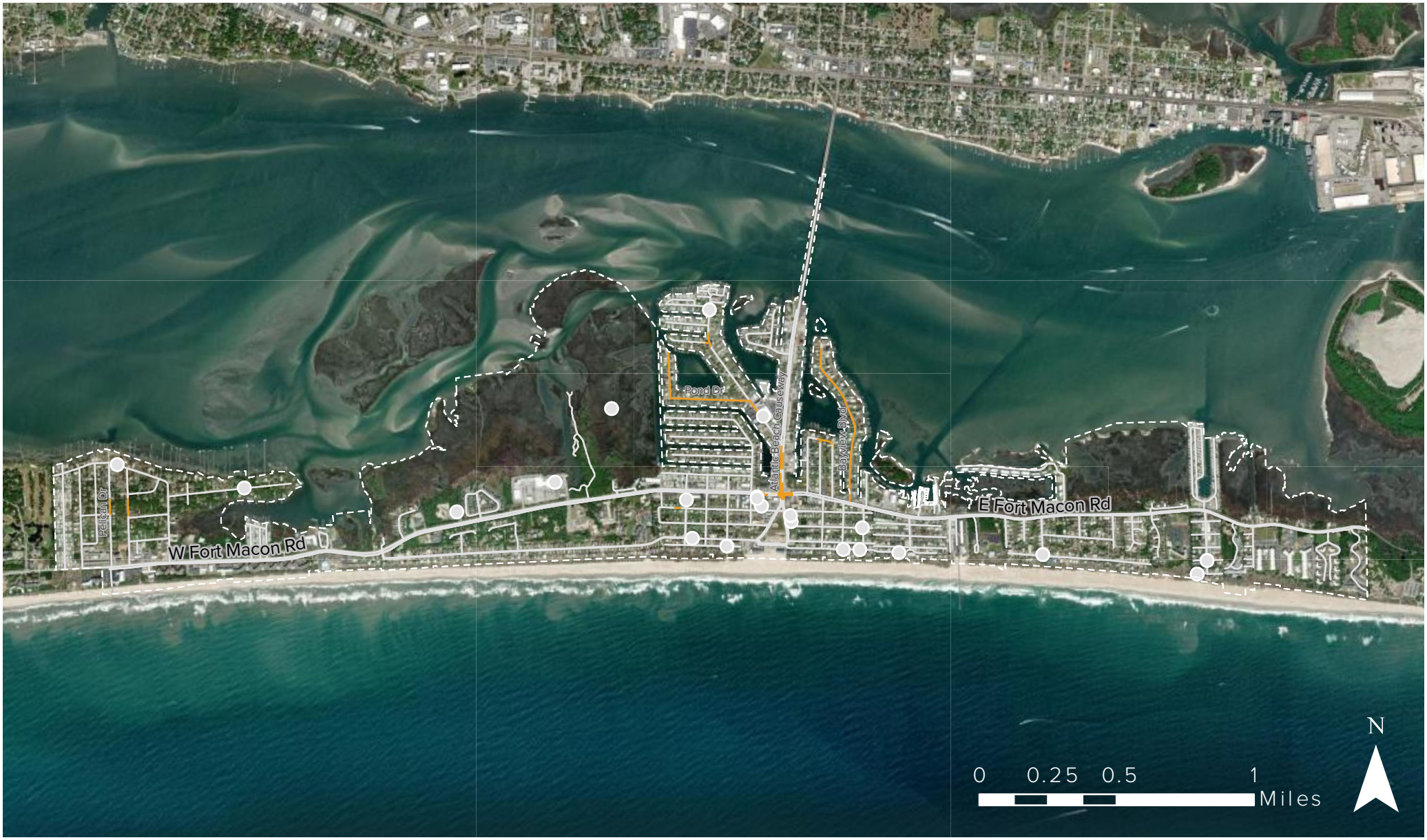
Asset Type	Asset Name	Exposure	Sens.	A.C.	Vulnerability
		Present-Day Pluvial Hotspots			Present-Day Pluvial Hotspots
No critical built infrastructure assets have a vulnerability score greater than 0.					

Table 4.3.10 Natural Assets Vulnerability Scores for Pluvial Hotspot Flood Hazards

Asset Type	Asset Name	Exposure	Sens.	A.C.	Vulnerability
		Present-Day Pluvial Hotspots			Present-Day Pluvial Hotspots
No natural assets have a vulnerability score greater than 0.					

Table 4.3.11 Network Miles by Asset Type and Vulnerability Scores for Pluvial Hotspot Flood Hazards

Network Type	Vulnerability Score					
	0	1	2	3	4	5
State Roads	4.6	0.0	0.1	0	0	0
Secondary Routes	1.1	0	0.1	0	0	0
Other Roads	22.7	0.1	1.4	0	0	0
All Roads	28.4	0.1	1.6	0	0	0
Sidewalks and Trails	19.1	0.0	0.7	0	0	0



Town of Atlantic Beach

Pluvial Hot Spot Vulnerability

Pluvial hazard data: Provided by Town of Atlantic Beach.

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Legend

Pluvial Flooding Vulnerability Scores

Critical Facilities

- 0
- 1
- 2
- 3
- 4
- 5

Roads and Trails

- 0
- 1
- 2
- 3
- 4
- 5

Boundaries and Context

- Town of Atlantic Beach Boundary
- Wetlands

4.4 Wildfire

This analysis relies on burn probability data from USFS[12], which estimates the annual probability of wildfire burning in a specific location. The hazard analysis for wildfire does not include a climate projection scenario. While wildfire probabilities are likely to change with changing climatic conditions, there is insufficient projection data available for us to incorporate forward-looking burn probability exposure scores in this analysis. Despite this, there is qualitative information available that suggests that changing precipitation regimes (including longer and more intense dry periods) can contribute to wildfire probabilities increasing, and encroachment of development into forested or other natural landscapes can increase exposure to high wildfire probability areas.

Using burn probability data, this analysis uses breakpoints of burn probability consistent with annual exceedance probabilities for coastal storm events. Asset sensitivity and adaptive capacity scores for wildfire hazards differ from those assigned to assets for flood hazards. The findings below summarize wildfire vulnerability for critical built infrastructure, natural assets, and critical network infrastructure.

Key Findings:

- The majority of critical facilities in Atlantic Beach have low vulnerability to wildfire.
- High sensitivity and limited adaptive capacity are the primary drivers of vulnerability wildfire hazard.
- Few roads in Atlantic Beach have any vulnerability; those that do are close to Hoop Pole Creek Preserve (west of the Atlantic Beach Causeway) with moderate wildfire hazard exposure.
- Both Hoop Pole Creek Preserve and Atlantic Beach Town Park have some wildfire vulnerability; these assets also have higher adaptive capacity and lower sensitivity than built or network infrastructure.

As a reminder, Vulnerability is calculated by the following formula. The components of the Vulnerability scores as they pertain to the Wildfire hazard are detailed below, in Sections 4.4.1 (Exposure Scoring) and 4.4.2 (Sensitivity and Adaptive Capacity Scoring).

Exposure + **Sensitivity** − **Adaptive Capacity** = **Vulnerability**

4.4.1 Exposure Scoring

Assets are assigned **Exposure Scores** from zero (no annual burn probability) to three (annual burn probability greater than or equal to one percent) based on flood depths assets are expected to experience under Category 1 (Baseline) and Category 2 (Projection) storm surge events.

Assets' Exposure Scores are referenced from low to high exposure, as summarized in **Table 4.4.1**, to facilitate the discussion of these results.

Table 4.4.1 Exposure Scoring for Wildfire Hazards

Score	Annual Burn Probability
0	Zero percent
1	Less than 0.2 percent and greater than zero percent
2	Less than one percent and greater than or equal to 0.2 percent
3	One percent or greater

[12] referred to as Wildfire Likelihood in Wildfire Risk to Communities web application: https://wildfirerisk.org/)

Table 4.4.2 Critical Built Infrastructure Exposure Scores for Assets with High Vulnerability to Wildfire Hazards. Exposure scores for all assets are provided in the Appendix.

Asset Type	Asset Name	Exposure
		Wildfire
Wastewater Facilities	PLS at 136 Hoop Pole Creek	1

Table 4.4.3 Natural Assets Exposure Scores for Wildfire Hazards

Asset Type	Asset Name	Exposure
		Wildfire
Natural Land	Hoop Pole Creek Preserve	1
Recreational Land	Atlantic Beach Town Park/ Coral Bay Park	1

Table 4.4.4 Network Miles by Asset Type and Exposure Scores for Wildfire Hazards

Asset Type	Miles of network by Exposure Score			
	0	1	2	3
State Roads	4.68	0.05	0	0
Secondary Routes	0.71	0.49	0	0
Other Roads	23.38	0.79	0	0
All Roads	28.77	1.32	0	0
Sidewalks	19.50	0.26	0	0

Supporting maps of wildfire hazard extents and asset exposure scores can be found in the Appendix.

4.4.2 Sensitivity and Adaptive Capacity Scoring

Sensitivity reflects the potential damage to critical built infrastructure's materials, functions, or the surrounding environment if it were exposed to wildfire. Critical built infrastructure that would be impacted by fire or high temperatures associated with fire is more likely to experience higher damage levels. Sensitivity Scores are assigned by asset types and consider the potential for damage and disruption of essential services or functions.

Adaptative capacity illustrates the ability of an asset to change its characteristics or behavior in response to a hazard. An asset's potential to adapt depends on the potential suite of options available and a community's ability to implement those actions. The Adaptive Capacity Scores are assigned by asset types and consider the potential for assets to be relocated or to adapt to wildfire exposure.

Table 4.4.5 Sensitivity and Adaptive Capacity Scoring

Asset Category	Asset Type	Sensitivity	Adaptive Capacity
Critical Built Infrastructure	Buildings[1]	3	1
	Energy facilities	3	1
	Communications infrastructure	2	1
	Waste infrastructure	3	1
	Water Supplies[2]	3	1
Critical Network Infrastructure	Transportation	2	1

Natural Assets	Agricultural land	3	1
	Natural land	2	2
	Recreational land	2	2
1. Includes all critical built infrastructure except for communications infrastructure, energy facilities, wastewater facilities, and water supplies. 2. Outfall lines are classified as Water/Sewer assets that are Critical Network Infrastructure. Note that this assessment for Atlantic Beach does not include outfall lines.			

Table 4.4.6 Critical Built Infrastructure Sensitivity and Adaptive Capacity Scores for Assets with High Vulnerability to Wildfire Hazards. Sensitivity and adaptive capacity scores for all assets are provided in the **Appendix.**

Asset Type	Asset Name	Sensitivity	Adaptive Capacity
Wastewater Facilities	PLS at 136 Hoop Pole Creek	3	1

Table 4.4.7 Natural Assets Sensitivity and Adaptive Capacity Scores for Wildfire Hazards

Asset Type	Asset Name	Sensitivity	Adaptive Capacity
Natural Land	Hoop Pole Creek Preserve	2	2
Recreational Land	Atlantic Beach Town Park/ Coral Bay Park	2	2

Table 4.4.8 Sensitivity and Adaptive Capacity Scores by Network Asset Type for Wildfire Hazards

Asset Type	Sensitivity	Adaptive Capacity
State Roads	1	1
Secondary Routes	1	1
Other Roads	1	1
All Roads	1	1
Sidewalks	1	1

4.4.3 Vulnerability Scoring

Atlantic Beach is very built out and as such generally has low wildfire burn probability. However, assets near wetlands and other natural areas may experience higher wildfire vulnerability. Where wildfire exposure is possible, fire may spread quickly, and the Town may face challenges with limited egress options to evacuate from these areas.

Table 4.4.9 Critical Built Infrastructure Vulnerability Scores for Assets with High Vulnerability to Wildfire Hazards. Vulnerability scores for all assets are provided in the **Appendix.**

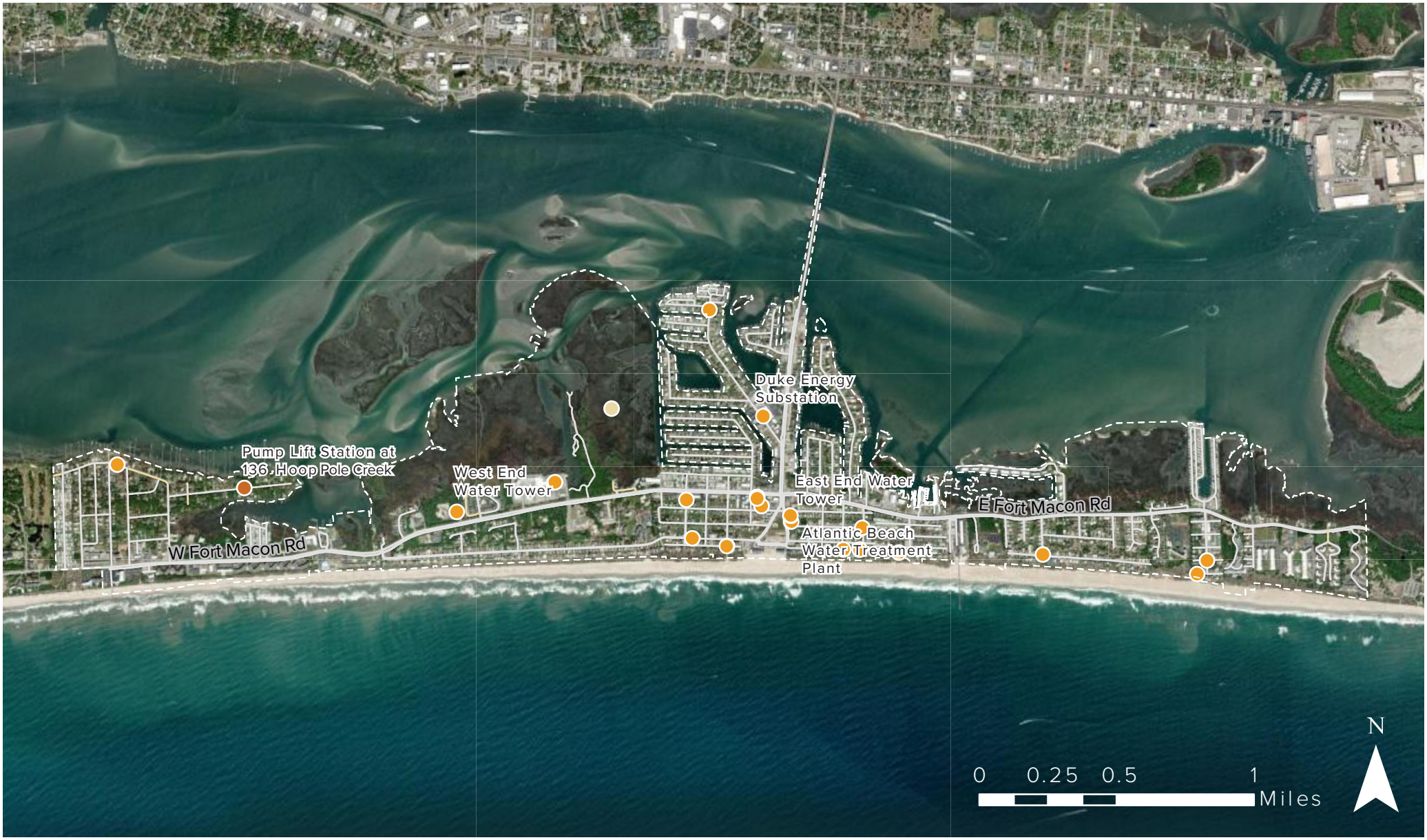
Asset Type	Asset Name	Exposure	Sens.	A.C.	Vulnerability
		Wildfire			Wildfire
Wastewater Facilities	PLS at 136 Hoop Pole Creek	1	3	1	3

Table 4.4.10 Natural Assets Vulnerability Scores for Wildfire Hazards

Asset Type	Asset Name	Exposure	Sens.	A.C.	Vulnerability
		Wildfire			Wildfire
Natural Land	Hoop Pole Creek Preserve	1	2	2	1
Recreational Land	Atlantic Beach Town Park/ Coral Bay Park	1	2	2	1

Table 4.4.11 Network Miles by Asset Type and Vulnerability Scores for Wildfire Hazards

Network Type	Vulnerability Score					
	0	1	2	3	4	5
State Roads	4.68	0.05	0	0	0	0
Secondary Routes	0.71	0.49	0	0	0	0
Other Roads	23.38	0.79	0	0	0	0
All Roads	28.77	1.32	0	0	0	0
Sidewalks and Trails	19.50	0.26	0	0	0	0



Town of Atlantic Beach

Wildfire Vulnerability

Wildfire hazard data: USFS. LANDFIRE data, updated November 2020.

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Wildfire Vulnerability Scores

Critical Facilities

- 0
- 1
- 2
- 3
- 4
- 5

Roads and Trails

- 0
- 1
- 2
- 3
- 4
- 5

Boundaries and Context

- Town of Atlantic Beach Boundary
- Wetlands

4.5 Cumulative Hazard Vulnerability Assessment

The cumulative hazard vulnerability assessment aggregates the vulnerability scores across all the hazards evaluated in this assessment. This assessment includes a current condition (present-day) and a future condition vulnerability score. Figure 4.2, below, describes the components of the current and future conditions cumulative hazard vulnerability scores. Details of vulnerability scores for each specific hazard are provided in the subsections preceding this summary. The findings below summarize cumulative vulnerability for critical built infrastructure, natural assets, and critical network infrastructure.

Key Findings Across Hazards

- Across hazards, all built infrastructure and natural assets experience some level of vulnerability. Generally, assets on the North/Bay-side of the Town have higher vulnerability, both under current and projected (future) conditions.
- Some areas of road and pedestrian network infrastructure are not modeled as experiencing vulnerability across hazard types evaluated, but they would likely be impacted by the vulnerability of connected network areas as a result of reduced access during hazard occurrences.
- Vulnerability is projected to increase under future conditions, with:
    - 12 built infrastructure or natural assets increasing in vulnerability between current and future conditions,
    - 12 percent of roadway miles increasing in vulnerability between current and future conditions, and
    - Nine percent of pedestrian infrastructure miles increasing in vulnerability score between current and future conditions.
- The assets found to have the highest vulnerability include:
    - Duke Energy Substation (Old Causeway Road),
    - Pump station at 136 Hoop Pole Creek,
    - Atlantic Beach Water Treatment Plant,
    - East End Water Tower
    - West End Water Tower and associated public services building, and
    - Hoop Pole Creek Preserve, located West of the Causeway.
- Notable roadway and pedestrian infrastructure sections with higher vulnerability include:
    - Fort Macon Road (and associated sidewalks, trails)
    - The “Circle”: West Drive, Atlantic Boulevard, and East Drive (and associated sidewalks, trails)
    - Segments of neighborhood roads, including Bayview Boulevard, Pond Drive, and Ocean Ridge Drive
    - Sections of Hoop Pole Creek Trail near trailhead

Current and Future Cumulative Vulnerability scores are calculated by the following formulas. The vulnerability components of the Cumulative Vulnerability scores are detailed in the preceding sections.

Figure 4.2 Hazard Vulnerability Scores Used to Calculate Current Cumulative and Future Cumulative Vulnerability Scores

Category 1 Storm Surge Vulnerability	+	Current Coastal Flooding Vulnerability	+	Recurring Flood Hotspot Vulnerability	+	Wildfire Vulnerability	=	Current Cumulative Vulnerability

Category 2 Storm Surge Vulnerability	+	2050 Coastal Flooding Vulnerability	+	Recurring Flood Hotspot Vulnerability	+	Wildfire Vulnerability	=	Future Cumulative Vulnerability

4.5.1 Vulnerability Scoring

Cumulative vulnerability scores are based on assets' scores for each individual hazard, described in the preceding sections.

Table 4.5.1 Critical Built Infrastructure Vulnerability Scores for Assets with High Current Cumulative Vulnerability. Vulnerability scores for all assets are provided in the **Appendix.**

Asset Type	Asset Name	Category 1 Storm Surge (Baseline)	Present Coastal Flooding	Wildfire	Pluvial Hotspots	Current Cumulative Vulnerability
Wastewater Facilities	PLS at 136 Hoop Pole Creek	0	2	3	0	2
Energy Facilities	Duke Energy Substation	1	3	2	0	2
Water Supplies	West End Water Tower	1	3	2	0	2
Water Supplies	Atlantic Beach Water Treatment Plant	0	3	2	0	2
Water Supplies	East End Water Tower	0	3	2	0	2

Table 4.5.2 Critical Built Infrastructure Vulnerability Scores for Assets with High Future Cumulative Vulnerability. Vulnerability scores for all assets are provided in the **Appendix.**

Asset Type	Asset Name	Category 2 Storm Surge (Projection)	2050 Coastal Flooding	Wildfire	Pluvial Hotspots	Future Cumulative Vulnerability
Wastewater Facilities	PLS at 136 Hoop Pole Creek	2	2	3	0	2
Energy Facilities	Duke Energy Substation	3	3	2	0	2
Water Supplies	West End Water Tower	3	3	2	0	2
Water Supplies	Atlantic Beach Water Treatment Plant	2	3	2	0	2
Water Supplies	East End Water Tower	2	3	2	0	2
Fire Stations	Atlantic Beach Rescue	2	2	2	0	2
Law Enforcement Sites	Atlantic Beach Police Dept	2	2	2	0	2
Local Food Markets	Food Lion	2	2	2	0	2
Wastewater Facilities	PLS at 105 South Durham	2	2	2	0	2
Wastewater Facilities	PLS at 314 East Terminal/Wilson	2	2	2	0	2
Wastewater Facilities	PLS at 314/315 Old Causeway	2	2	2	0	2
Wastewater Facilities	PLS at Forest Knoll	2	2	2	0	2

Asset Type	Asset Name	Category 2 Storm Surge (Projection)	2050 Coastal Flooding	Wildfire	Pluvial Hotspots	Future Cumulative Vulnerability
Government Services	Atlantic Beach Town Hall	1	2	2	0	2
Wastewater Facilities	PLS at 216 East Boardwalk (Greenville Beach Access)	1	2	2	0	2
Wastewater Facilities	PLS at 312 East Boardwalk	1	2	2	0	2
Wastewater Facilities	PLS at 506 West Atlantic (507 W. Terminal)	1	2	2	0	2
Wastewater Facilities	PLS at 208 Dunes Avenue	1	2	2	0	2

Table 4.5.3 Natural Assets Vulnerability Scores for Current Cumulative Vulnerability

Asset Type	Asset Name	Category 1 Storm Surge (Baseline)	Present Coastal Flooding	Wildfire	Pluvial Hotspots	Current Cumulative Vulnerability
Natural Land	Hoop Pole Creek Preserve	2	2	1	0	2
Recreational Land	Atlantic Beach Town Park/ Coral Bay Park	0	2	1	0	1

Table 4.5.3 Natural Assets Vulnerability Scores for Current Cumulative Vulnerability

Asset Type	Asset Name	Category 2 Storm Surge (Projection)	2050 Coastal Flooding	Wildfire	Pluvial Hotspots	Future Cumulative Vulnerability
Natural Land	Hoop Pole Creek Preserve	2	2	1	0	2
Recreational Land	Atlantic Beach Town Park/ Coral Bay Park	1	2	1	0	1

Table 4.5.4 Network Miles by Critical Network Infrastructure Asset Type and Vulnerability Scores Aggregated Across Hazards

Network Miles by Vulnerability Score							
Network Type	Time Horizon	Vulnerability Score					
		0	1	2	3	4	5
State Roads	Current	1.25	3.49	0	0	0	0
	Future	0.59	3.91	0.24	0	0	0
Secondary Routes	Current	0.11	1.08	0	0	0	0
	Future	0.06	0.96	0.17	0	0	0
Other Roads	Current	9.60	14.57	0	0	0	0
	Future	6.82	15.49	1.85	0	0	0
All Roads	**Current**	**10.96**	**19.13**	**0**	**0**	**0**	**0**
	Future	**7.47**	**20.36**	**2.26**	**0**	**0**	**0**
Sidewalks and Trails	Current	4.66	15.10	0	0	0	0
	Future	2.81	16.81	0.14	0	0	0

4.6 Natural Infrastructure Vulnerability Assessment

This section focuses specifically on the impacts of sea level rise on wetlands in and around Atlantic Beach that provide ecosystem services to the community. This assessment does not include other hazards due to limited mechanisms for evaluating natural infrastructure vulnerability to these hazards. Relying on marsh migration modeling associated with the sea level rise modeling efforts used in the coastal flooding hazard analysis, vulnerability scores for wetlands are based on the present changes in acreage for each habitat type.

Key Findings

- Atlantic Beach is a barrier island and as such, has extensive tidal wetlands surrounded by tidal flats and unconsolidated shores within Bogue Sound.
- Under the sea level rise projection for 2050, the Town will lose approximately 7.9 percent of critical natural infrastructure habitats.
- The largely built-out land use in Atlantic Beach prevents potential marsh migration routes within the Town.

Table 4.6.1 Natural Infrastructure Vulnerability to Sea Level Change by Habitat Type

Habitat Type	Starting Acreage	Change in Acreage	% Change	Vulnerability
Non-Tidal Wetland	4.6	-0.6	-12.1%	Moderate
Tidal Wetland	14.9	-1.9	-13.0%	Moderate
Unconsolidated Shore	19.8	-1.7	-8.5%	Moderate
Upland Habitat	40.0	-2.1	-5.2%	Low
Total Habitat Acres	79.3	-6.2	-7.9%	

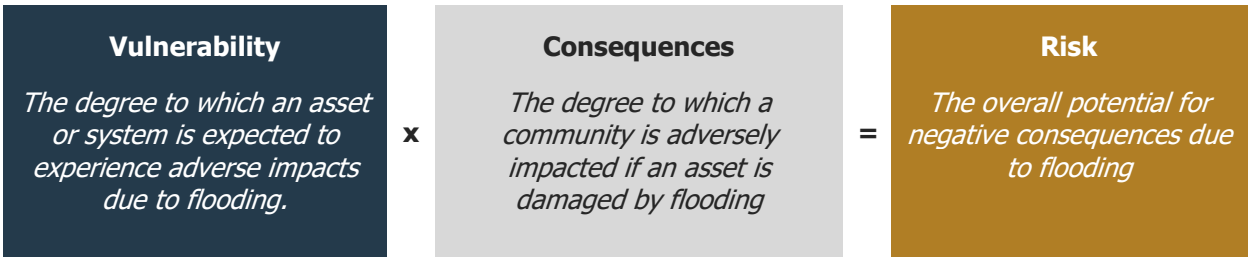
Change in acreage is calculated for present-day (baseline) conditions, and a sea level change scenario for 2050 associated with 1.3ft (40cm) of sea level rise.

5.0 Estimate Risk

After assessing the vulnerability of identified assets, the risk – referring to the overall potential for negative impacts – to each asset is estimated by considering two components: vulnerability and consequences. An asset's vulnerability is determined using the Vulnerability Score calculated in the previous step. Consequences refer to the potential impacts on the surrounding systems and community if an asset is badly damaged or cannot function due to flooding. Due to limited data, this assessment does not quantify the risk to natural infrastructure assets.

Consequences are determined by considering the social vulnerability of the surrounding community and the asset's criticality, or importance, to the community. Each of these metrics is converted into a score ranging from zero to three, which are then summed to produce a single Consequence Score for each asset. This score is divided by the maximum possible score (six) to produce a percentage that is then multiplied by the Vulnerability Score, as outlined in Figure 5.1 (for reference only; identical to Figure 2.2).

Figure 5.1. Components of Risk (Identical to Figure 2.2)



5.1 Social Vulnerability

Social vulnerability refers to the susceptibility of social groups to adverse impacts. This susceptibility is indicated by certain social conditions, such as high poverty, limited vehicle access, or crowded households, that affect a community's ability to prevent human suffering and financial loss in the event of a flood.13 Social vulnerability is a compounding factor to risk because communities with high social vulnerability are more likely to experience adverse impacts.

The assessment leverages the Centers for Disease Control and Prevention's (CDC) Social Vulnerability Index (SVI) to measure social vulnerability. This index uses census data to assess characteristics that indicate social vulnerability within a community. Census tracts are assigned a percentile ranking compared to the rest of the State of North Carolina. A Social Vulnerability Score, ranging from zero to three, is assigned to an asset based on its surrounding tract's SVI percentile compared to the rest of the state. Higher social vulnerability reflects a higher susceptibility of a community surrounding the asset to the adverse impacts of coastal hazards. In 2022, the Council on Environmental Quality published the Climate and Economic Justice Screening Tool (CEJST). The tool categorizes census tracts as disadvantaged if the census tract exceeds at least one threshold for a category of burden or are on land within the boundaries of Federally Recognized Tribes[14]. Atlantic Beach's census tract is not categorized as disadvantaged in the CEJST tool.

The Town of Atlantic Beach falls within census tract 37031971103. There is no variability in the CDC SVI for assets within the town. Relative to SVI scores across North Carolina, Atlantic Beach has a score of 0.4, or low to medium social vulnerability.

[13] Centers for Disease Control and Prevention. 2020. *CDC Social Vulnerability Index Documentation 2018.* https://www.atsdr.cdc.gov/placeandhealth/svi/documentation/SVI_documentation_2018.html

[14] Climate and Economic Justice Screening Tool. Methodology. https://screeningtool.geoplatform.gov/en/methodology

5.2 Criticality

5.2.1 Critical Built Infrastructure

Criticality scores for built infrastructure are based on asset type and structure value, where available. Structure valuation is sourced from building footprint data. Some assets, such as pump lift stations, could not be assigned to a building footprint. This metric assumes that structures with higher values are more critical to the surrounding community, and that an asset's value can illustrate the scale of potential costs required to repair or replace the structure if damaged in a flood. Assets with redundancy (e.g., multiple of the same asset type within the Town) receive a lower criticality score than those asset types for which there is one or few assets.

Table 5.2.1 Summary of Built Infrastructure Criticality Scores

Type	Number Exposed	Avg Unit value*	Total Value*	Criticality Score
Communications Infrastructure	N/A	N/A	N/A	N/A
Emergency Medical Services	N/A	N/A	N/A	N/A
Energy Facilities	1	$790,000	$790,000	3
Fire Stations	1	$510,000	$510,000	3
Government Services	1	$510,000	$510,000	2
Law Enforcement Sites	1	$510,000	$510,000	3
Local Food Markets	1	$5,700,000	$5,700,000	2
Medical Facilities	N/A	N/A	N/A	N/A
Public Schools	N/A	N/A	N/A	N/A
Wastewater Facilities	14	N/A	0	1
Water Supplies	4	$10,250,00	$41,000,000	3
Total	23		$49,000,000	

* Structure values could not be determined for 14 exposed assets. Specifically, the location of pump lift stations (wastewater facilities) could not be applied to specific structures. Further review of these assets may be required to determine asset value and potential economic risk.

5.2.2 Critical Network Infrastructure

Criticality of network infrastructure is determined by the network type. For roadways, criticality is based on road segments' functional classifications, derived from NC Department of Transportation data. This classification is based on the character of the traffic service the road segment aims to provide. Road segments that serve larger traffic volumes are assumed to be more critical to the community, as outlined in Table 14. Sidewalks and trails are assigned a criticality score of 1, and outfalls a score of 2.

Table 5.2.2 Summary of Network Infrastructure Criticality Scores

Criticality	Includes	Criticality Score
High	Interstates, Highways	3
Moderate	Minor Arterials, Major Collectors, Stormwater Outfalls	2
Low	Local Roads, Sidewalks, Trails	1

5.2.3 Natural Assets

Criticality of natural assets is determined by asset type. Table 5.2.3, below, summarizes criticality scores for natural assets and the count and acreage of each asset type in the Town of Atlantic Beach. Note that these assets exclude natural infrastructure, which is evaluated separately (see Section 5.3), and for which there is insufficient information to evaluate criticality and risk.

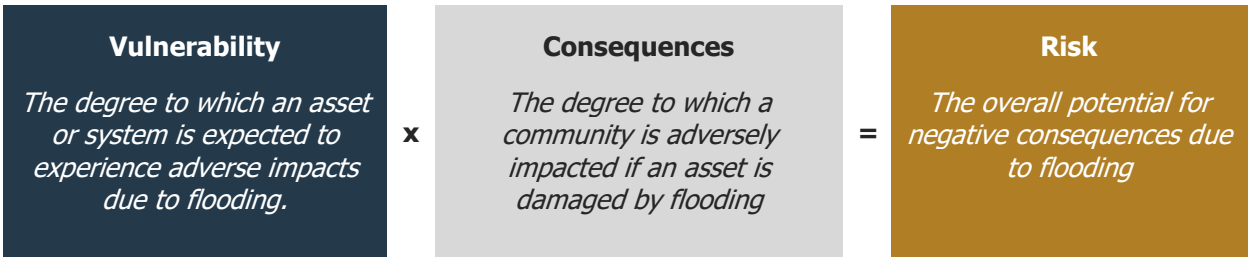
Table 5.2.3 Summary of Natural Asset Criticality Score

Type	Number Exposed	Acreage Determined	Total Acreage	Criticality Score
Agricultural Land	N/A	N/A	N/A	2
Recreational Land	1	1	7.3	1
Preserved Land	1	1	31.4	1

5.2.4 Risk Assessment Results

After assessing vulnerability and consequences, assets are assigned Risk Scores that characterize the potential for adverse consequences of hazard exposure. As shown in Figure 13, risk is calculated as the product of vulnerability and consequence. For ease of scoring, risk scores are normalized to range from zero to five (i.e., the product of the vulnerability and consequence components is divided by three, the maximum value for consequence). The integer scores below are the ceiling value of the calculated product risk. Thus, only assets with a vulnerability score of zero across all hazards evaluated can receive a risk score of zero.

Figure 5.2 Components of Risk (Identical to Figure 2.2)



This assessment includes risk scores for both present-day and future conditions. These risk scores rely on the present-day and future cumulative hazard vulnerability scores, respectively. Results are presented for critical built infrastructure, natural assets, and critical network infrastructure.

Key Findings:

- The critical building infrastructure assets with the highest risk scores are the Duke Energy Substation and the Water Treatment Plant, with a risk score of 2 (low risk). Under future conditions, the East and West End Water Towers, Atlantic Beach Rescue, and the Atlantic Beach Police Department also have risk scores of 2.
- Segments of West Fort Macon Road and Ocean Boulevard have the highest risk scores for network infrastructure, with a risk score of 2 (low risk). The majority of roads, sidewalks, and trails have a risk score of 1 (very low risk). This score does not account for service disruptions (i.e., access to critical facilities).
- No natural assets have high risk scores; the preserve and town park have risk scores of 1 (very low risk) under both current and future conditions.

- The majority of wastewater facilities included in this assessment are pump lift stations. These stations have a low criticality score, due to their redundancy as a system across the Town. Pump failure or degraded functionality may have localized impacts, however.

Table 5.2.4 Critical Built Infrastructure Vulnerability Scores for Assets with High Risk Scores

Risk scores for all assets are provided in the **Appendix**.

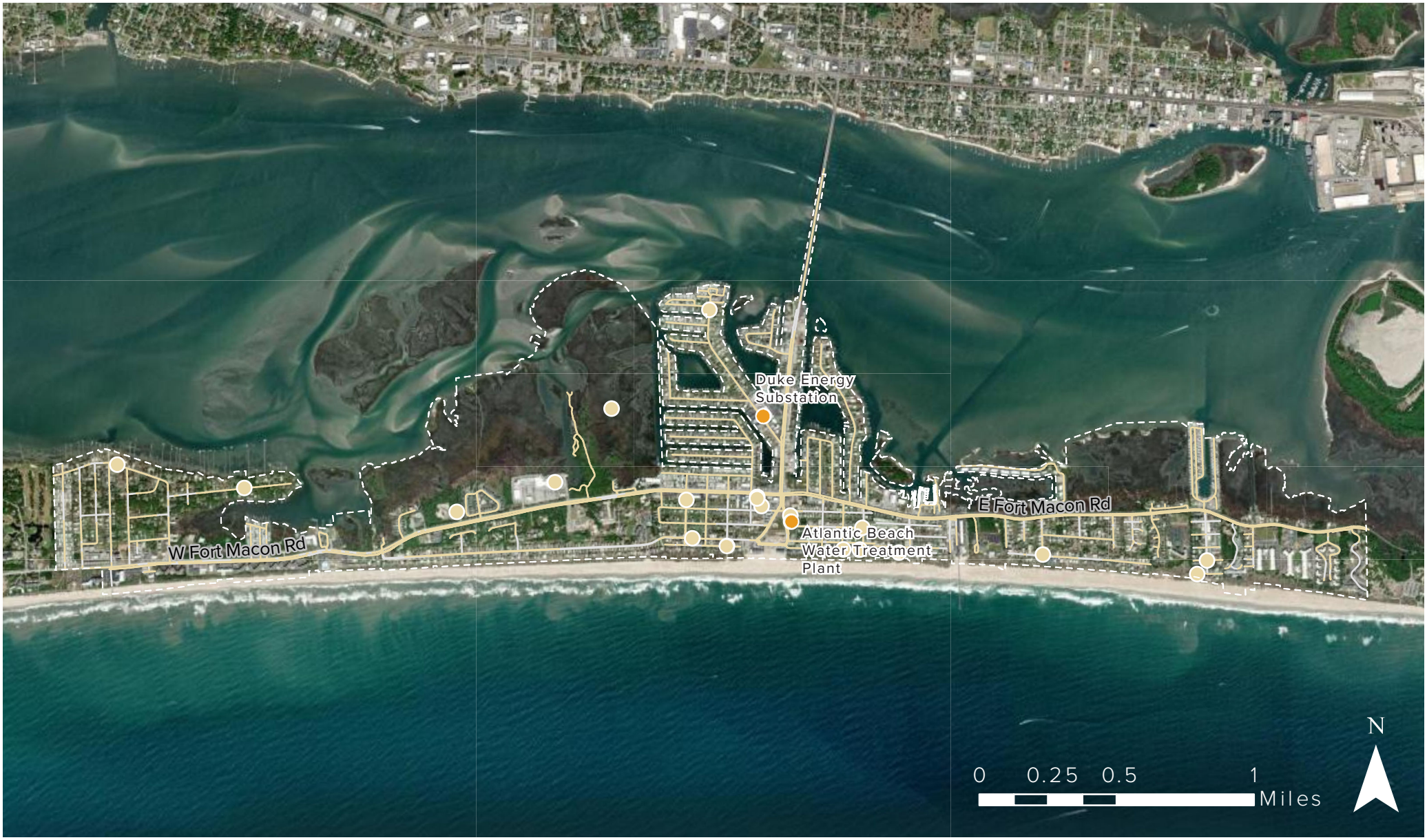
Asset Type	Asset Name	Current Cumulative Vulnerability	Future Cumulative Vulnerability	Criticality	Current Risk	Future Risk
Energy Facilities	Duke Energy Substation	2	2	3	2	2
Water Supplies	Atlantic Beach Water Treatment Plant	2	2	3	2	2
Water Supplies	West End Water Tower	2	2	2	1	2
Water Supplies	East End Water Tower	2	2	2	1	2
Fire Stations	Atlantic Beach Rescue	1	2	3	1	2
Law Enforcement Sites	Atlantic Beach Police Dept	1	2	3	1	2

Table 5.2.5 Natural Lands Risk Scores

Asset Type	Asset Name	Current Cumulative Vulnerability	Future Cumulative Vulnerability	Criticality	Current Risk	Future Risk
Natural Land	Hoop Pole Creek Preserve	2	2	1	1	1
Recreational Land	Atlantic Beach Town Park/ Coral Bay Park	1	1	1	1	1

Table 5.2.6 Network Miles by Asset Type and Aggregate Risk Scores

Network Miles by Risk Score							
Network Type	Time Horizon	Risk Score					
		0	1	2	3	4	5
State Roads	Current	1.25	3.49	0	0	0	0
	Future	0.59	4.14	0	0	0	0
Secondary Routes	Current	0.11	1.08	0	0	0	0
	Future	0.06	1.13	0	0	0	0
Other Roads	Current	9.60	14.57	0	0	0	0
	Future	6.82	17.35	0	0	0	0
All Roads	**Current**	**10.96**	**19.13**	**0**	**0**	**0**	**0**
	Future	**7.47**	**22.62**	**0**	**0**	**0**	**0**
Sidewalks and Trails	Current	4.66	15.10	0	0	0	0
	Future	2.81	16.95	0	0	0	0



Town of Atlantic Beach

Present-Day Risk Scores

Legend

Present-Day Risk Scores

Critical Facilities

- 0
- 1
- 2
- 3
- 4
- 5

Roads and Trails

- 0
- 1
- 2
- 3
- 4
- 5

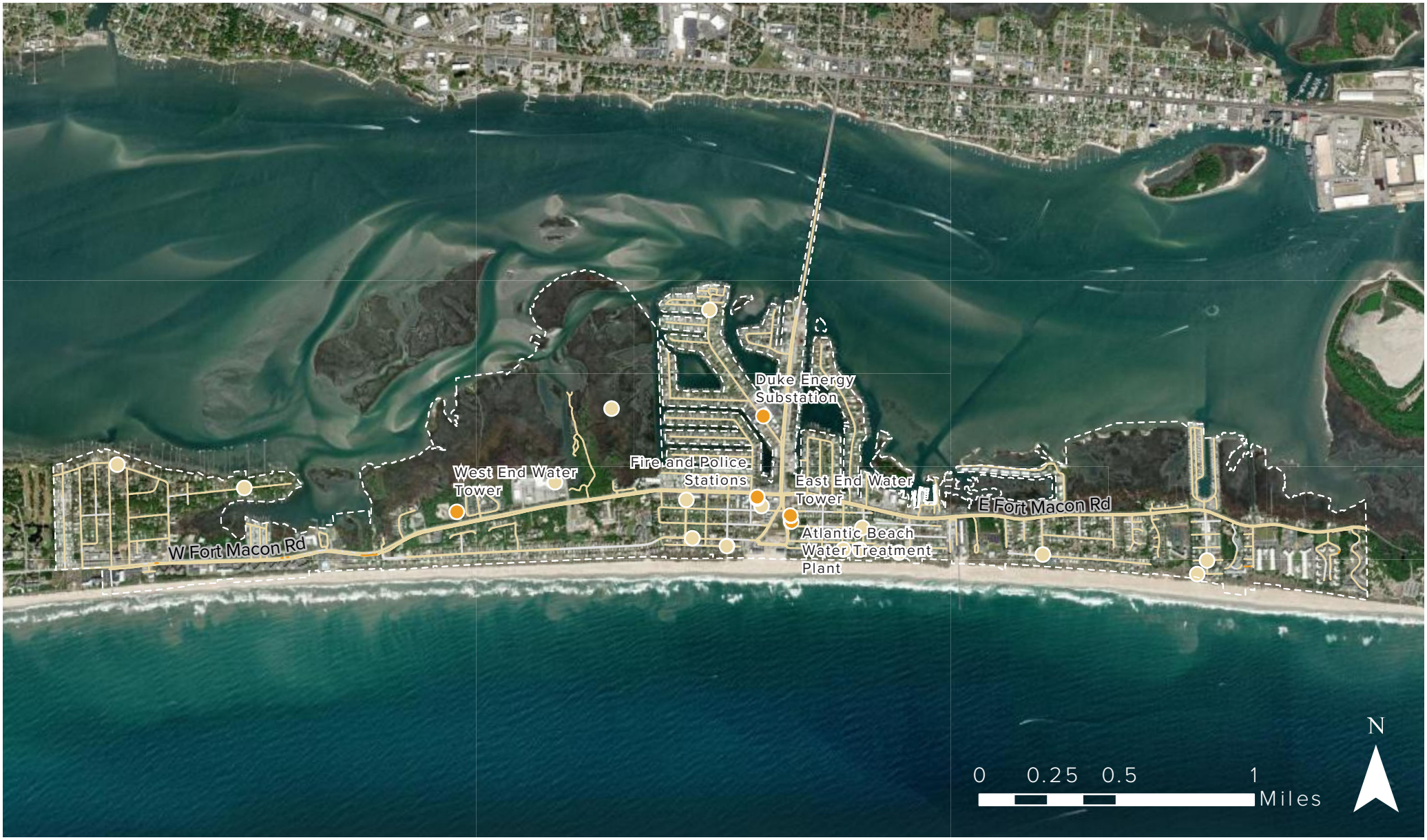
Boundaries and Context

- Town of Atlantic Beach Boundary
- Wetlands

Dewberry

Atlantic BEACH NORTH CAROLINA

North Carolina RESILIENT COASTAL COMMUNITIES PROGRAM



Town of Atlantic Beach

Future Conditions Risk Scores

Legend

Future Conditions Risk Scores

Critical Facilities

- 0
- 1
- 2
- 3
- 4
- 5

Roads and Trails

- 0
- 1
- 2
- 3
- 4
- 5

Boundaries and Context

- Town of Atlantic Beach Boundary
- Wetlands

Dewberry

Atlantic BEACH NORTH CAROLINA

North Carolina RESILIENT COASTAL COMMUNITIES PROGRAM

5.3 Natural Infrastructure

Natural infrastructure provides vital ecosystem services to communities, such as natural flood protection, water quality benefits, recreation opportunities, and ecotourism. Due to limited data on ecosystem services, this assessment does not quantify the values of natural infrastructure assets.

6.0 Considerations for Future Assessments

This assessment may serve as a starting point for future analyses and research efforts. The following list summarizes key areas for further refining this assessment and its results:

- Building Characteristics – Refine the vulnerability assessment to incorporate more specific building characteristics, such as base floor elevation, or site-specific information, such as the existence of mitigation projects.
- Natural Infrastructure – Incorporate complex modeling of impacts to natural infrastructure, including ecosystem service valuation.
- Rainfall-Driven Flood Hazards – Conduct a pluvial flood analysis of Carteret County, specific to Atlantic Beach, that considers multiple events in varying intensities, durations, and return frequencies to facilitate future exposure, vulnerability, and risk assessments of the region's critical built infrastructure.
- Climate-Influenced Hazards – Consider additional climate-influenced hazards included in the 2020 Pamlico Sound Regional Hazard Mitigation Plan, such as extreme heat, and based on priorities as identified by the Town.

7.0 Next Steps

The final Risk and Vulnerability Scores serve as inputs to RCCP Phase 2, through which the Town of Atlantic Beach plans to select and prioritize resilience projects. These assessment results can support this process by ranking assets by final scores or individual components, such as exposure.

Dewberry

APPENDIX D

COMMUNITY PROJECT PORTFOLIO

APRIL 2025

COMMUNITY PROJECT PORTFOLIO

A critical component of the Resilient Coastal Communities Program is the identification and prioritization of a series of projects that are intended to address community vulnerabilities to coastal hazards. The enclosed list of projects, which includes infrastructure improvements (structural, non-structural, natural or nature-based solutions, or hybrid options), policy and planning efforts, and asset management actions, has been synthesized from previous local and regional planning efforts, input from the Community Action Team, and feedback from the public.

Included in this Appendix is a summary list of the proposed projects, followed by an individual sheet for each project. Each project sheet summarizes the factors that were considered in the project identification and prioritization process, including:

Project Name	Brief descriptive title for each given project.
Project Description	Description of strategy being proposed and the scope of the work.
Location	The geographic location of the project.
Hazard(s) addressed by project	A summary of the community-specific coastal hazards that impact the project location. This can include flooding, storm surge, wind damage, or other coastal hazards.
Type of Solution	A description of whether the project represents infrastructure improvements, policy and planning effort, or an asset management/mapping program.
Natural and Nature Based Solution Opportunity?	A symbol is used to denote whether the project includes a natural or nature-based solution (NNBS) component.
Project Estimated Cost	A qualitative analysis of the total project cost, including initial engineering and construction as well as future maintenance (as available). Project cost is shown symbolically ranging from $ to $$$$.
Potential Implementation Funding Sources	Recommendations on potential sources to construct or otherwise implement the project, including the Resilient Coastal Communities Program and other federal and state funding sources.
Project Estimated Timeline	An estimated timeline to complete the project, including notes on any expected delays in the timeline.
Preliminary Tasks/ Data Required	A description of tasks and information that should be complete before starting the listed project.
Advantages/Disadvantages	An analysis of the benefits and drawbacks of the proposed solution
Similar Project Examples	Examples of similar projects completed and identification of where information on the projects can be found.
Priority Rating	A qualitative ranking of the project's priority in the context of the entire Project Portfolio. Rankings of **High**, **Medium**, or **Low** are provided for each project.

Proposed Project Summary

Project Priority	Project Title	Description	Location	Anticipated Cost	NNBS Opportunity	Potential Funding Sources	Timeline	Needs Addressed	Pro/Con Assessment	Notes
1	Stormwater Facility Improvements	Improve stormwater facilities (ditches, storm drains) on multiple Town streets.	Prioritize improvements on the West End, including Knollwood Dr, Dogwood St, Pelican Dr, and Fairview St. Additional focus area should be the Bayview community.	Cost varies based on solution implemented and location needs. Cost estimated to be between $30,000 and $125,000 per site.	Yes	Federal sources may include EDA - Investment for Public Works, National Wildlife Federation, and Economic Development Facilities. State sources may include the Rural Grant Programs, EPA – Clean Water State Revolving Fund	Timeline varies based on solution implemented and location needs. Design and construction timeline expected to vary between 3 months and 1 year per site. This is an ongoing program, to be implemented at individual sites as needs are identified.	Stormwater Management, Flooding	Implementation of these improvements will address recurring flooding spots throughout the Town. However, some of these improvements will likely require acquisition of private property or permanent utility easements; the extent of private property needs will vary by location and improvement type.	Future phases of this project would require private property easements. The Fairview project is recommended for Phase 3 of the RCCP, but private property easements will be an issue.
2	Pump Stations	Install pumps at new locations or make improvements at existing pump locations.	Henderson Blvd/Asbury Ave, 100 Ocean Ridge Blvd/Tom Doe Beach Access, 208 Dunes Ave, 202 Glenn St, 312 East Boardwalk Blvd, 216 East Boardwalk Blvd/Greenville Ave Beach Access, 314 East Terminal Blvd/Wilson Ave, 314/315 Old Causeway, 301 West Boardwalk Blvd, 506 West Atlantic Blvd (507 W. Terminal Blvd), 105 South Durham Ave, 136 Hoop Pole Creek Dr, Forest Knoll Dr.	Cost varies based on amount of pump stations and location needs. Cost estimated to be between $500,000 and $1 million per site.	No	Federal sources may include EDA - Investment for Public Works, National Wildlife Federation, and Economic Development Facilities. State sources may include the Rural Grant Programs, EPA – Clean Water State Revolving Fund	There is currently no proposed timeline for this project. It is considered a long-term need and a high priority project.	Stormwater Management, Flooding	Continued maintenance and expansion of the current pump system will help alleviate the worst flooding that occurs during extreme weather events and other events that cause excess flooding. However, private property acquisition or permanent easements may be required for new pump stations; in addition, these facilities require continued maintenance.	This project can be combined with other improvements on the list as a part of comprehensive localized area improvements.

3	Dune Infiltration	System would act as sand filter for stormwater diverted to ocean outfalls. May include pumps or catch basins to move stormwater from roadways into the system.	Existing public beach access points.	Cost varies based on solution implemented and location needs. Cost estimated to be between $50,000 and $250,000 per site.	Yes	Potential funding sources: Federal sources may include NOAA – National Coastal Resilience Fund (NCRF), National Wildlife Federation, DOI National Coastal Wetlands Conservation, and USFWS National Coastal Wetlands Conservation Grants. State sources may include NCDCM Planning and Management Grants, NCDEQ Clean Water State Revolving Fund	There is currently no proposed timeline for this project. It is considered a long-term need and a high priority project.	Stormwater Management	Dune infiltration systems can help reduce stormwater runoff and protect beaches from polluted water. Construction of these systems will need to consider appropriate siting in order to minimize the extent of new easement or property needed, utilizing existing public infrastructure right-of-way (beach access points, etc.) where possible.	Atlantic Beach has several successful dune infiltration systems in place, including Lift Stations 5 and 6.
4	Stormwater Pre-treatment	Construct stormwater treatment facilities (bioswales, infiltration systems, other green infrastructure) to minimize water quality impacts at multiple locations.	Recommended location is the Shore Drive area.	Cost varies based on solution implemented and location needs. Costs are expected to be $30,000 to $150,000 per site.	Yes	Federal sources may include EDA - Investment for Public Works, National Wildlife Federation, and Economic Development Facilities and FEMA – BRIC. State sources may include Rural Grant Programs, EPA – Clean Water State Revolving Fund	Timeline varies based on solution implemented and location needs. Design and construction timeline expected to vary between 3 months and 1 year per site. This is an ongoing program, to be implemented at individual sites as needs are identified.	Stormwater Management, Flooding	Stormwater pretreatment reduces the number of pollutants entering waterways by filtering sediment and debris before it reaches larger stormwater systems, potentially mitigating flooding risks by slowing down runoff, and improving water quality in receiving bodies of water. However, these options can have high installation costs, ongoing maintenance needs, and limitations in treating certain types of pollutants depending on the chosen pretreatment method.	Stormwater is currently pretreated before it is released into the sound via the pump system. Pretreating the water before it enters the pump system may not be warranted.

5	Stormwater Infrastructure Mapping	Map all stormwater infrastructure within Town limits to determine service gaps and needs.	Townwide	Mapping effort is expected to be low cost, depending on the level of survey effort. Cost is expected to be between $75,000 and $300,000.	No	Federal sources may include EDA - Investment for Public Works and Economic Development Facilities and FEMA – BRIC. State sources may include the Rural Grant Programs, EPA – Clean Water State Revolving Fund, NCDEQ Asset Inventory and Assessment Grant Program	No proposed timeframe; may take between six months to a year to complete.	Stormwater Management, Flooding	Infrastructure mapping offers several advantages such as improved visibility into system dependencies, efficient planning for maintenance and upgrades, risk mitigation by identifying vulnerabilities, and better decision-making capabilities. However, the cons include the initial cost of data collection, ongoing maintenance to keep the map updated, potential inaccuracies due to incomplete information, and the need for specialized expertise to interpret the data effectively.	This project would provide very beneficial information to understand where to expand and/or improve stormwater facilities. The Town currently has maps of all stormwater infrastructure, but it has not been mapped in GIS.
6	Education Materials	Materials for homeowners and business owners on what can be done to address flooding on private property.	Townwide	Primary costs are expected to include the publication/ distribution of online and printed education materials. Expected cost would be between $10,000 and $50,000.	No	Partnerships with non-governmental organizations may provide opportunities to fund the education effort. The NC Office of Environmental Education website provides information on potential education grants.	Intended as ongoing program as funding is available.	Stormwater Management, Flooding, Infrastructure Deficiency or Capacity, Increased Extreme Weather	Community outreach can give members a sense of purpose and empowerment. This is an opportunity for open discussion and identification of community needs and resources that could help with future discussions of infrastructure improvements and future emergency scenarios.	Educational materials are recommended on emergency preparedness topics, reasons why stormwater problems are increasing (results of increase in impervious surface, etc.). Any outreach materials should be written in layman's terms.

Project Name	**Stormwater Facility Improvements**
Project Description	Improve stormwater facilities (ditches, storm drains, etc.) on multiple Town streets.
Location	Prioritize improvements on the West End, including Knollwood Dr, Dogwood St, Pelican Dr, and Fairview St. Additional focus area should be the Bayview community.
Hazard(s) addressed by project	Stormwater Management/ Flooding.
Type of Solution	Infrastructure improvements. Construction/replacement of stormwater infrastructure at key locations throughout the Town. Natural and nature-based solutions (NNBS) options will be implemented as practicable.
Natural and Nature Based Solution Opportunity? 	**Yes**
Project Estimated Cost	Cost varies based on solution implemented and location needs. **Cost Level: $**
Potential Implementation Funding Sources	Federal sources may include EDA - Investment for Public Works, National Wildlife Federation, and Economic Development Facilities. State sources may include the Rural Grant Programs, EPA – Clean Water State Revolving Fund.
Project Estimated Timeline	Timeline varies based on solution implemented and location needs. Design and construction timeline expected to vary between 3 months and 1 year per site. This is an ongoing program, to be implemented at individual sites as needs are identified.
Preliminary Tasks/ Data Required	While a comprehensive stormwater mapping and assessment can inform a prioritized approach and schedule, an initial priority list of improvement locations can be generated from public feedback and the 2021 Watershed Restoration and Stormwater Resilience Plan.
Advantages/Disadvantages	Implementation of these improvements will address recurring flooding spots throughout the Town. However, some of these improvements will likely require acquisition of private property or permanent utility easements; the extent of private property needs will vary by location and improvement type.

Similar Project Examples	Stormwater Facility Improvements - Cape Carteret Resilience Strategy (2022).
Priority Rating	**High**. The project was identified as top priority by the Resilient Coastal Communities Program CAT.

Stormwater Pipes After Restoration Project in New Hanover County

Source: Coastal Review (https://coastalreview.org/2017/04/tournament-puts-spotlight-on-conservation/)

Project Name	**Pump Station Construction**
Project Description	Install pumps at new locations or make improvements at existing pump locations.
Location	Henderson Blvd/Asbury Ave, 100 Ocean Ridge Blvd/Tom Doe Beach Access, 208 Dunes Ave, 202 Glenn St, 312 East Boardwalk Blvd, 216 East Boardwalk Blvd/Greenville Ave Beach Access, 314 East Terminal Blvd/Wilson, 314/315 Old Causeway, 301 West Boardwalk Blvd, 506 West Atlantic Blvd (507 W. Terminal Blvd), 105 South Durham Ave, 136 Hoop Pole Creek Dr, Forest Knoll Dr.
Hazard(s) addressed by project	Stormwater Management/ Flooding.
Type of Solution	Infrastructure improvements. Construction/replacement of stormwater infrastructure at key locations throughout the Town.
Natural and Nature Based Solution Opportunity?	No
Project Estimated Cost	Cost varies based on amount of pump stations and location needs. **Cost Level: $$$**
Potential Implementation Funding Sources	Federal sources may include EDA - Investment for Public Works, National Wildlife Federation, and Economic Development Facilities. State sources may include the Rural Grant Programs, EPA – Clean Water State Revolving Fund
Project Estimated Timeline	There is currently no proposed timeline for this project. It is considered a long-term need and a high priority project.
Preliminary Tasks/ Data Required	Drainage inventory and assessment will inform a prioritized approach and schedule.
Advantages/Disadvantages	Continued maintenance and expansion of the current pump system will help alleviate the worst flooding that occurs during extreme weather events and other events that cause excess flooding. However, private property acquisition or permanent easements may be required for new pump stations; in addition, pumps require continued maintenance.
Similar Project Examples	Stormwater Pump Stations – 2022 Currituck County Resilience Strategy
Priority Rating	**High**

Cape Canaveral Center Street Pump Station

Source: Cape Canaveral Town X Account (City of Cape Canaveral - Government on X: "On August 19, 2024, the Center Street Pump Station (the City's first-ever permanent pump station) was successfully activated/tested by Staff, engineers, and contractors for the first time. Learn more about this major flood mitigation project via the link: https://t.co/Z7Gr6jdSiW https://t.co/bVcUE7hQZ4" / X)

Project Name	**Dune Infiltration**
Project Description	System would act as sand filter for stormwater diverted to ocean outfalls. May include pumps or catch basins to move stormwater from roadways into the system.
Location	Existing public beach access points.
Hazard(s) addressed by project	Stormwater Management.
Type of Solution	Infrastructure improvements. Construction/replacement of stormwater infrastructure at key locations throughout the Town. NNBS options will be implemented as practicable.
Natural and Nature Based Solution Opportunity? 	**Yes**
Project Estimated Cost	Cost varies based on solution implemented and location needs. **Cost Level: $$**
Potential Implementation Funding Sources	Potential funding sources: Federal sources may include NOAA – National Coastal Resilience Fund (NCRF), National Wildlife Federation, DOI National Coastal Wetlands Conservation, and USFWS National Coastal Wetlands Conservation Grants. State sources may include NCDCM Planning and Management Grants, NCDEQ Clean Water State Revolving Fund.
Project Estimated Timeline	There is currently no proposed timeline for this project. It is considered a long-term need and a high priority project. Dune infiltration systems can be installed in about a week.
Preliminary Tasks/ Data Required	Mapping and preliminary research to get information on areas of concern. Preliminary design.
Advantages/Disadvantages	Dune infiltration systems can help reduce stormwater runoff and protect beaches from polluted water. Construction of these systems will need to consider appropriate siting in order to minimize the extent of new easement or property needed, utilizing existing public infrastructure right-of-way (beach access points, etc.) where possible.
Similar Project Examples	Proactive Dune Stabilization and Protection Program – 2022 Pine Knoll Shores Resilience Strategy.
Priority Rating	**High**

Dune Infiltration System at Kure Beach

Source: https://content.ces.ncsu.edu/dune-infiltration-systems-for-reducing-stormwater-discharge-to-coastal-recreational-beaches

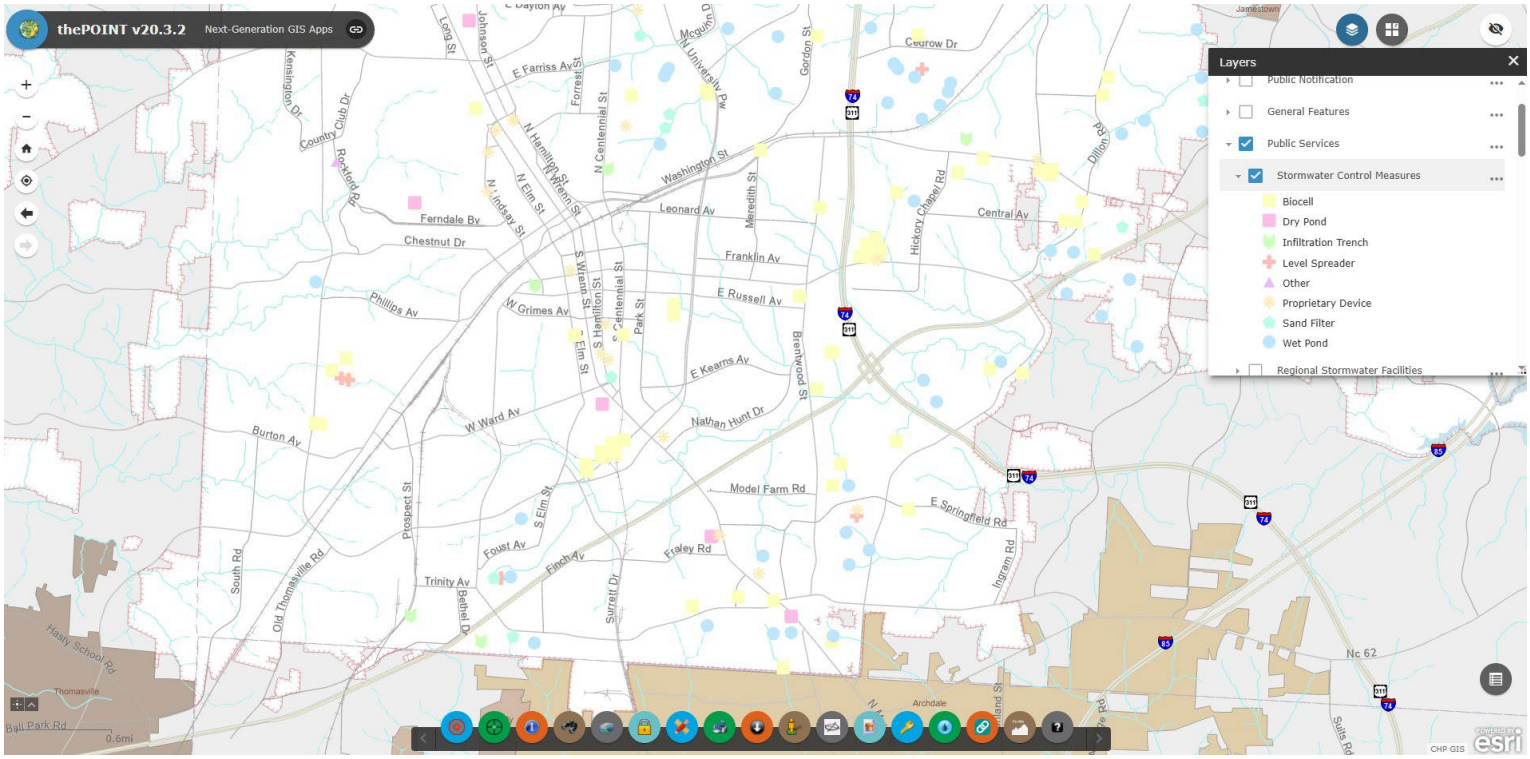
Project Name	**Stormwater Pre-treatment**
Project Description	Construct stormwater treatment facilities (bioswales, infiltration systems, other green infrastructure) to minimize water quality impacts at multiple locations.
Location	Recommended location is the Shore Drive area. More locations are desired but more public feedback and mapping is needed.
Hazard(s) addressed by project	Stormwater management, flooding.
Type of Solution	Infrastructure improvements. Construction/replacement of stormwater treatment infrastructure at key locations throughout the Town. NNBS options will be implemented as practicable.
Natural and Nature Based Solution Opportunity? 	**Yes**
Project Estimated Cost	Cost varies based on solution implemented and location needs. **Cost Level: $$**
Potential Implementation Funding Sources	Federal sources may include EDA - Investment for Public Works, National Wildlife Federation, and Economic Development Facilities and FEMA – BRIC. State sources may include Rural Grant Programs, EPA – Clean Water State Revolving Fund, NCDEQ American Rescue Plan Act, and Golden Leaf Foundation Flood Mitigation Program
Project Estimated Timeline	Timeline varies based on solution implemented and location needs. Design and construction timeline expected to vary between 3 months and 1 year per site. This is an ongoing program, to be implemented at individual sites as needs are identified.
Preliminary Tasks/ Data Required	Preliminary design.
Advantages/Disadvantages	Stormwater pretreatment reduces the number of pollutants entering waterways by filtering sediment and debris before it reaches larger stormwater systems, potentially mitigating flooding risks by slowing down runoff, and improving water quality in receiving bodies of water. However, these options can have high installation costs, ongoing maintenance needs, and limitations in treating certain types of pollutants depending on the chosen pretreatment method.

Similar Project Examples	Stormwater Pretreatment – 2022 Cape Carteret Resilience Strategy
Priority Rating	**Medium**

Town of Duck Bioretention Cell

Source: Dare County 'Community Projects' Webpage (https://www.darenc.gov/departments/planning/soil-and-water/community-projects)

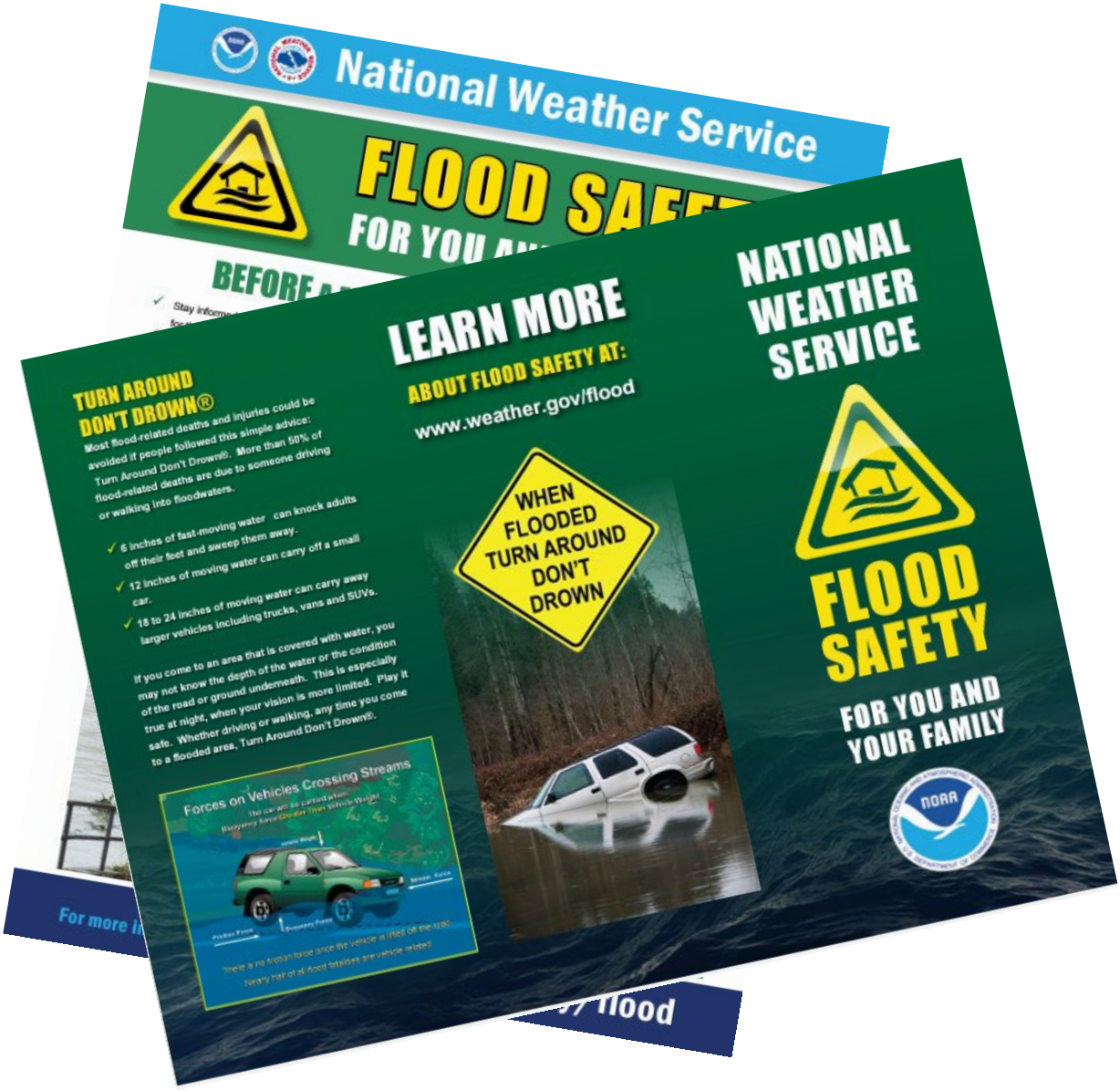
Project Name	**Stormwater Infrastructure Mapping**
Project Description	Map all stormwater infrastructure within Town limits to determine service gaps and needs.
Location	Townwide.
Hazard(s) addressed by project	Stormwater Management/ Flooding.
Type of Solution	Mapping effort that is intended to lead to future infrastructure improvements.
Natural and Nature Based Solution Opportunity?	No
Project Estimated Cost	Mapping effort is expected to be low cost, depending on the level of survey effort. **Cost Level: $**
Potential Implementation Funding Sources	Federal sources may include EDA - Investment for Public Works and Economic Development Facilities and FEMA – BRIC. State sources may include the Rural Grant Programs, EPA – Clean Water State Revolving Fund, NCDEQ Asset Inventory and Assessment Grant Program.
Project Estimated Timeline	There is currently no proposed timeframe for this plan. Depending upon the level of detail to be provided, this mapping effort is expected to take between six months to a year to complete.
Preliminary Tasks/ Data Required	CAT and community feedback are needed to get preliminary information on areas of concern.
Advantages/Disadvantages	Infrastructure mapping offers several advantages such as improved visibility into system dependencies, efficient planning for maintenance and upgrades, risk mitigation by identifying vulnerabilities, and better decision-making capabilities. However, the cons include the initial cost of data collection, ongoing maintenance to keep the map updated, potential inaccuracies due to incomplete information, and the need for specialized expertise to interpret the data effectively.
Similar Project Examples	Stormwater Infrastructure Mapping – 2022 Cape Carteret Resilience Strategy
Priority Rating	**Medium**



City of High Point GIS Stormwater Control Measures

Source: https://gisweb10.highpointnc.gov/JS/ThePoint/?_gl=1*19s9cbe*_gcl_au*MzA1NjU3ODU4LjE3NDE5Nzg1MTk.

Project Name	**Education Materials**
Project Description	Materials for homeowners and business owners on what can be done to address flooding on private property.
Location	Townwide
Hazard(s) addressed by project	Stormwater Management, Flooding, Infrastructure Deficiency or Capacity, Extreme Weather Preparation.
Type of Solution	Non-regulatory program, specifically an ongoing public engagement and education program for community residents and business owners.
Natural and Nature Based Solution Opportunity?	No
Project Estimated Cost	Primary costs are expected to include the publication/ distribution of online and printed education materials. **Cost Level: $**
Potential Implementation Funding Sources	Partnerships with non-governmental organizations may provide opportunities to fund the education effort. The NC Office of Environmental Education website provides information on potential education grants.
Project Estimated Timeline	There is currently no proposed timeframe for this effort but is recommended to begin in the next year to encourage continued engagement. The program would be an ongoing effort.
Preliminary Tasks/ Data Required	Public involvement planning and design of materials.
Advantages/Disadvantages	Community outreach can give members a sense of purpose and empowerment. This is an opportunity for open discussion and identification of community needs and resources that could help with future discussions of infrastructure improvements and future emergency scenarios.
Similar Project Examples	Public Engagement and Education Campaign - Cape Carteret Resilience Strategy
Priority Rating	**Low**



Source: NOAA Flood Brochures (https://www.weather.gov/owlie/publication_brochures#floods)