

NORTH CAROLINA FLOOD RESILIENCY BLUEPRINT

Cape Fear River Basin Action Strategy



NORTH CAROLINA
Flood Resiliency
BLUEPRINT

Carvers Creek State Park, Spring Lake,
Cumberland County, North Carolina



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Cape Fear Memorial Bridge, Wilmington

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EXECUTIVE SUMMARY

Flood Risk, Vulnerability, and Capacity

The Cape Fear River Basin Action Strategy (Cape Fear RBAS) was developed as part of the North Carolina Flood Resiliency Blueprint (Blueprint) to identify flood resilience actions that address current and future flood risk throughout the basin. The Cape Faear RBAS was developed through the integration of basin-wide flood risk and vulnerability analyses, local and regional priorities, existing planning efforts, and implementation considerations. The result is an RBAS that supports flood resilience planning, investment, and decision-making across the Cape Fear River Basin.

Flooding affects communities, infrastructure, economies, and natural systems throughout North Carolina and remains a recurring challenge across the Cape Fear River Basin. The basin encompasses more than 9,010 square miles across 26 counties and includes a diverse range of geographic, hydrologic, and community conditions ([see Basin Overview](#)). Flood hazards within the basin are influenced by riverine flooding, stormwater flooding, coastal processes, land use patterns, and future development. These characteristics result in varying levels and kinds of flood risk and resilience needs across the basin.

The Cape Fear RBAS evaluates current and future flood conditions using advisory flood modeling from the NC Emergency Management, exposure analyses, and vulnerability assessment methods supported by the Blueprint Tool. The Cape Fear RBAS vulnerability assessment identified locations where flooding impacts people, structures, and systems today and estimates changes to risk into the future ([see Flood Risk Planning & Analysis](#)). Flood exposure is projected to increase throughout the basin over time as changes in precipitation patterns, land use, development, and coastal influences impact the number of people, assets, and systems exposed to flooding.

Under current conditions, approximately 16% of the basin’s land area and more than 7, 600 households are exposed to flooding during a 1% Annual Exceedance Probability event (commonly referred to as 100-year storm). By mid-century, the exposed population is projected to exceed 22, 576 households. Increases in exposure and impacts are also projected for residential structures, critical facilities, and infrastructure.

Flood risk varies across the basin. The communities in the upper portion of the basin contain the highest concentrations of population, development, and critical infrastructure impacted by flooding. The communities in the middle portion include areas where future exposure is projected to increase alongside continued development and growth. In the lower portion of the basin, riverine, tidal, and coastal processes all contribute to community flood risk. These differing conditions highlight the need for resilience actions that reflect local circumstances while supporting basin-wide resilience objectives.

The Cape Fear RBAS also considers local and regional capacity to support flood resilience planning and implementation ([see Actionable Data, Modeling, & Analysis](#)). There is variation in the administrative, technical, and financial capacity of communities across the basin. While some jurisdictions have established resources and programs to support flood resilience activities and involvement in the Blueprint program, other communities face staffing, funding, technical expertise, and other related challenges. These differences in capacity influence the ability of communities to pursue, implement, and sustain resilience projects.

Prioritized Actions

The Cape Fear RBAS establishes a prioritized portfolio of actions intended to reduce flood risk and support long-term flood resilience ([see Priority Action List](#)), organized in five major goals and 21 supporting strategies.

The portfolio opens with a clear vision of flood resilience developed with Cape Fear stakeholders: *Communities across the Cape Fear River Basin will be safe, connected, and thriving—able to prosper while minimizing flood impacts to people, infrastructure, and the economy. The basin will use data-driven planning, include nature-based solutions, and direct equitable investment so all communities can adapt to and recover from heavy rainfall, hurricanes, and coastal flooding.*

- Reflecting this vision, the Prioritized Actions present a basin-wide framework for reducing flood risk and strengthening resilience across communities of very different sizes, geographies, and capacities. Organized around five goals:
- protecting people and life safety,
 - strengthening critical systems,
 - restoring natural systems,
 - reducing flood risk through land use and development,
 - and building a pathway to implementation.

The strategy translates regional analysis, stakeholder input, and existing local plans into a coordinated set of 179 actions. Together, these actions provide a practical roadmap for advancing flood resilience through both near-term projects and long-term planning.

A central emphasis of the strategy is reducing flood impacts through a balanced mix of infrastructure upgrades, natural systems restoration, and smarter land-use decisions. The plan supports drainage improvements, roadway retrofits, utility and dam resilience, floodplain and wetland restoration, green infrastructure, buyouts, conservation, and resilient development practices. It also highlights the importance of directing investments toward the communities and places most vulnerable to repeated flooding, where the greatest benefits can be achieved and future losses can be reduced.

The Cape Fear RBAS used a structured process for creating, reviewing, and selecting actions ([See RBAS Development Process](#)). Local governments and partners contributed many actions through the Blueprint Tool. Additional actions were added from existing plans to improve geographic coverage and ensure attention to high-vulnerability areas. All actions were screened to confirm a clear flood-resilience purpose, then scored using four equally weighted factors: flood resilience benefits, local support, feasibility and technical readiness, and alignment with basin-specific guiding principles developed from stakeholder input. The highest-scoring actions were designated as high priority, creating a focused set of projects that can move into implementation while remaining flexible enough to be updated as local plans and conditions change.



Jordan Lake Dam

Implementation Considerations

Successful implementation of the Cape Fear RBAS will require continued coordination among local governments, regional organizations, state and federal agencies, nonprofit organizations, and private-sector partners ([see Community Engagement & Discovery](#)). The Cape Fear RBAS provides information about some potential funding sources and implementation pathways that may support advancement of prioritized actions ([see Review of Funding Sources](#)).

Through coordinated implementation of prioritized actions, communities and partner organizations can work to reduce flood risk, support resilient community development, protect critical assets and infrastructure, and improve preparedness for future flood conditions. Continued investment in resilience planning, project development, and implementation can help reduce future flood-related damages, support more resilient infrastructure systems, and improve community preparedness for future flood conditions.

Key Takeaways

The Cape Fear River Basin has an above average risk of flood exposure.

Flood exposure in the Cape Fear River Basin is significant and is expected to increase by more than 40% by mid-century (2050), with additional increases by 2100.

The 177 actions listed in the RBAS are estimated to have implementation costs in the range of \$350 million to \$425 million.

Based on the actions listed in the RBAS, the information gathered about local stormwater improvement needs from the Data Collection phase, and input from the RBAG and Blueprint partners, the total mitigation need for the Cape Fear River Basin likely exceeds \$1 billion.

High-priority actions identified by local communities are focused on:

- Improving stormwater management and drainage infrastructure
- Protecting and strengthening critical infrastructure
- Preserving and restoring floodplains, wetlands, streams, and other natural systems that protect against flooding
- Property-based risk reduction through buyouts, elevation and retrofitting.

The RBAG and Cape Fear Rever partners also identified the need to advance flood resilience through flood studies, hazard data collection, dam inventories, vulnerability assessments, and floodplain management. These activities will strengthen the pathway from project identification to implementation, a key need in the region, with particular focus on additional planning.



Flooding at the Jordan Lake Eagle Deck



Autumn foliage reflects in the waters of the Cape Fear River



TERMS & ACRONYMS

AAL	Average Annualized Loss	DOT	U.S. Department of Transportation
Action	A flood mitigation or resilience measure that can be implemented by a local government or a set of partners; may be a capital project, policy/planning measure, or other defined effort that reduces flood risk; may be local, regional, or basin-wide and may require coordination across jurisdictions or sectors.	DRF	Disaster Relief Fund
		DRMF	Disaster Relief and Mitigation Fund
		DWR	Division of Water Resources
		DWSRF	Drinking Water State Revolving Fund
		EAPs	Emergency Action Plans
		ECL	End of Century Higher
ACS	American Community Survey	EDA	Economic Development Administration
ADA	Americans with Disabilities Act	EEG	Environmental Enhancement Grant
ASCP	Agricultural Stream Cleanup	EPA	U.S. Environmental Protection Agency
Blueprint	North Carolina Flood Resiliency Blueprint	EQIP	Environmental Quality Incentives Program
Blueprint Tool	North Carolina Flood Resiliency Blueprint Tool	ER	Emergency Relief
BPP	Blueprint Partners	EWP	Emergency Watershed Protection
BRIC	Building Resilient Infrastructure and Communities	FEMA	Federal Emergency Management Agency
CAMA	Coastal Area Management Act	FIRM	Flood Insurance Rate Maps
CDBG DR	Community Development Block Grants Disaster Recovery	Flood Resilience	The capacity of individuals, a community, business, or natural environment to reduce, withstand, respond to, and recover from flooding by positively mitigating the impacts of changing conditions and challenges including climate change, increasing rain fall, and sea level rise, and adapting to those conditions.
CDBG MIT	Community Development Block Grants Mitigation		
CDC ATSDR SVI	Place-based database and mapping tool designed by the Centers for Disease Control and Prevention (CDC) and the Agency for Toxic Substances and Disease Registry (ATSDR)	Floodwise	Understanding flood risks and taking practical steps to prepare for, reduce, and recover from flooding.
CIP	Capital Improvement Plan(s)		
COG	Council of Government	FMA	Flood Mitigation Assistance
CPF	Community Project Funding	GIS	Geographic Information System
CWSRF	Clean Water State Revolving Fund	HMGP	Hazard Mitigation Grant Program
DCM	Division of Coastal Management	HMP	Hazard Mitigation Plan
DEQ	Department of Environmental Quality	HMRRP	Hurricane Matthew Resilient Redevelopment Plan

HUD	U.S. Department of Housing and Urban Development	NOAA	National Oceanic and Atmospheric Administration
L-PDM	Legislative Pre-Disaster Mitigation	NPDES	National Pollutant Discharge Elimination System
Local Action Plan	Plans submitted through the Blueprint Tool that consist of flood resilience action(s) submitted by local governments or delegated authorities of local governments	NRCS WFPO	Natural Resources Conservation Service Watershed and Flood Prevention Operations
		O&E Plan	Outreach and Engagement Plan
LMI	Low and Moderate Income	PARTF	Parks and Recreation Trust Fund
Locally Prioritized Actions	Actions where local governments know specific actions are needed; inductively collected from direct outreach with local government stakeholders; prioritized and vetted through community engagement and have greater public support.	Priority Actions	Actions that met defined standards for flood risk reduction and appropriateness
		PUBG	Potentially Underserved Block Group
		RISE	Regions Innovating for Strong Economies and Environment
MCB	Marine Corps Base	RCCP	Resilient Coastal Communities Program
MCH	Mid Century Higher	RBAG	River Basin Advisory Group
MJHMPs	Multi-jurisdictional Hazard Mitigation Plans	RBAS	River Basin Action Strategy
MPO	Metropolitan Planning Organization	REDD	Rural Economic Development Division
MS4	Municipal Separate Storm Sewer System	Representative Actions	Actions that showcase a balanced, illustrative suite of flood resilience solutions across the river basin.
NBS	Nature-Based Solutions	Resilience	Capacity of individuals, a community, business, or natural environment to reduce, withstand, respond to, and recover from flooding by positively adapting and mitigating the impacts of changing conditions and challenges, including flooding and climate change.
NCEI	National Center for Environmental Information		
NCDA&CS	North Carolina Department of Agriculture and Consumer Services		
NCEM	North Carolina Emergency Management	RHMPs	Regional Housing Mobility Plans
NCFMP	North Carolina Flood Mapping Program	RPO	Rural Planning Organization
NFIP	National Flood Insurance Program	SRF	State Revolving Funds
NCGA	North Carolina General Assembly	USACE	U.S. Army Corps of Engineers
NCLWF	North Carolina Land & Water Fund	USDA	U.S. Department of Agriculture
NCOSBM	North Carolina Office of State Budget and Management	Vulnerability Assessment Based Actions	Actions compiled through a deductive process reflecting recommended actions to mitigate flood risks identified through the Action Strategy's Vulnerability Assessment results.
NIFMP	Natural Infrastructure Flood Mitigation Program		
NCDMS	Division of Mitigation Services		
NCDOT	North Carolina Department of Transportation	WRDG	Water Resources Development Grant Program
NFWF	National Fish and Wildlife Foundation		
NCORR	North Carolina Office of Recovery & Resilience		

INTRODUCTION

In 2021, the North Carolina General Assembly (NCGA) directed the North Carolina Department of Environment Quality (DEQ) to develop a statewide Flood Resiliency Blueprint (Blueprint). The Blueprint serves as the backbone of NC’s flood resiliency planning and is based on the best available science, stakeholder engagement, and sound decision-making to develop cost-effective flood resilience actions. Working closely with local governments and state agencies, the Blueprint supports coordinated, proactive investments that strengthen community resilience across North Carolina. At the heart of the Blueprint is an online decision-support tool to help local governments, agencies, and non-governmental partners develop, evaluate, and prioritize resilience actions as well as plan and marshal funding to implement those priorities. The Blueprint supports a wide array of potential actions such as floodplain restoration, stream debris removal, elevation of utilities, stormwater controls, and policy changes. The Blueprint will make North Carolina more resilient to flooding by funding projects that limit flood extent and severity, allowing communities to recover more quickly and limit future risk as storms become more frequent and severe.

Flood Resiliency Blueprint Overview

Over the past decade, North Carolina has experienced an increase in major flood events including Hurricanes Matthew (2016), Florence (2018), and Helene (2024). Recently, Hurricanes Helene and Debby (2024), Potential Tropical Cyclone Eight (2024), and Tropical Storm Chantal (2025) have had devastating impacts statewide in the Mountains, Piedmont, and Coastal Plain across the state. Flooding is not limited to tropical storms. Flash flooding from localized severe rain events has caused tremendous damage and loss of life across the state.

These events have demonstrated that flood risk is a statewide challenge that affects communities, infrastructure, economies, and natural systems across all of North Carolina’s 17 river basins, highlighting the need for coordinated, proactive investments to increase flood resilience statewide.

The Blueprint was established to address this need. The North Carolina General Assembly (NCGA) directed DEQ to develop the Blueprint through NC Session Law 2021-180, SB105. The Blueprint is North Carolina’s science-based and stakeholder-driven initiative designed to support the planning, evaluation, and implementation of flood resilience actions.

Flooding impacts North Carolina’s people, infrastructure, and systems in many ways. Building flood resilience and making proactive investments to reduce flood damage and disruption requires coordinated efforts across all levels of government. The Blueprint is working closely with local governments, organizations, and fellow state agencies to craft and implement resilience strategies throughout the six priority basins – Cape Fear, French Broad, Lumber, Cape Fear, Tar-Pamlico, White Oak (Figure 1) – to progress the program’s mission.

Blueprint Mission

To provide the data, tools, and capacity to support decision making at the local, regional, and state level, while also strategically implementing flood resilience projects by leveraging available funding and filling gaps left by existing programs.

North Carolina River Basins

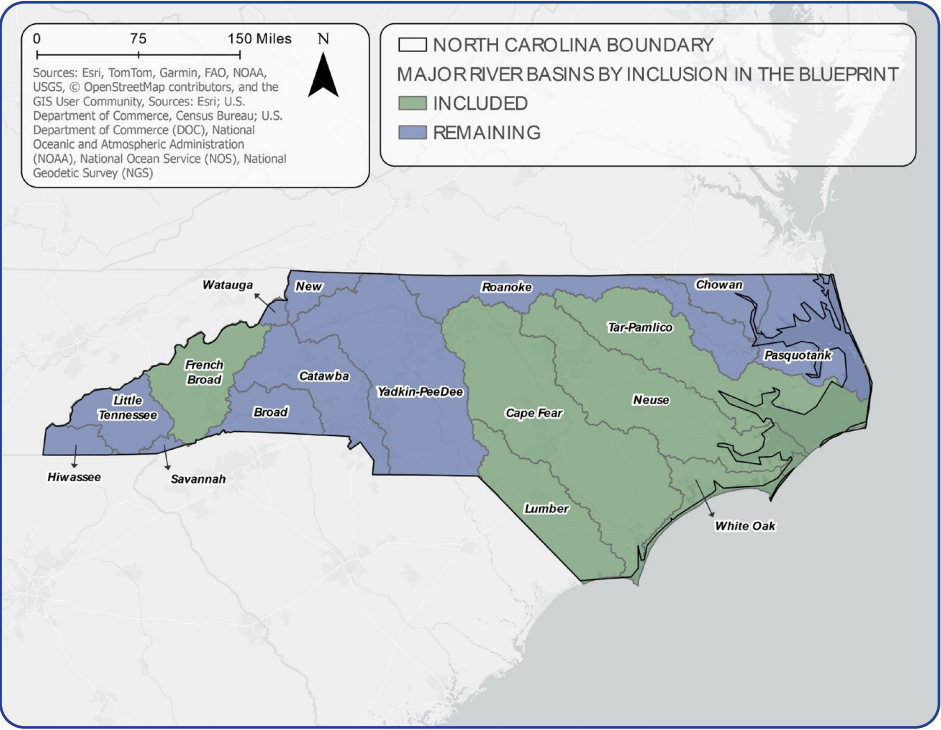


Figure 1. Map of North Carolina River Basins and Blueprint program status.

Objectives

As a first-of-its-kind comprehensive program for planning, modeling, and project development, the Blueprint unifies existing resources and knowledge, leveraging the best available science and tools in order to enhance North Carolina’s flood resilience in a cost-effective manner. The Blueprint consists of several components developed in three phases, each of which will be covered in more detail. Each component has been developed to achieve the Blueprint’s three legislative objectives.

Blueprint Objectives:

- Increase community resilience to flooding
- Serve as the backbone of State flood planning
- Reduce the cost and complexity for local governments in the planning and implementation of flood risk reduction projects

Blueprint Phases

Blueprint is being completed in three phases of development, each focused on a core program component:

1

Develop the
**Blueprint
Process**

2

Build and
launch the
**Blueprint
Tool**

3

Publish
**River Basin
Action
Strategies**

Blueprint in Action

These phases can be broken down into eight key steps (Figure 2) that guide communities through the development of River Basin Action Strategies (RBAS), including this Cape Fear RBAS.

The Blueprint process (Figure 2) is intended to move communities from shared understanding of flood risk to locally informed action identification, evaluation, implementation, and future updates. This structure is important for the Cape Fear RBAS because the basin includes varied flood sources, development patterns, community capacity, and infrastructure vulnerabilities. As such, recommended actions must be grounded in both technical analysis and local input. The steps shown in Figure 2 also help explain the organization of this document: the sections that follow summarize basin context, data and modeling, engagement, risk and vulnerability findings, action review and prioritization, funding considerations, and next steps for implementation – all critical components of the Blueprint.

Phase I established the Blueprint process by applying foundational resilience planning practices to create a structured, step-based framework (Figure 2). This framework reduces cost and complexity while supporting consistent RBAS development. A Draft Cape Fear RBAS was also developed in Phase I to serve as both a model and the foundation for later phases.

In Phase II, the Blueprint Tool was created, tested, and launched. The Blueprint Tool is an online decision support resource that enables a user to work through the Blueprint process steps. The Tool provides flood risk and vulnerability assessments, supports evaluation and prioritization of mitigation actions, and informs the development of Local Action Plans. Phase II also advanced a 2D Rain-on-Grid modeling approach which better represents exposure to flooding under current conditions. This also allows for the projection of future flooding in the Cape Fear River Basin that reflects expected changes in precipitation, sea level, and land use. These enhancements improve the accuracy and usability of flood risk information and are integrated into the Tool. Ongoing efforts focus on Tool refinement and expanding local adoption.

Flood Modeling, Mapping, and Risk

Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs) are official maps developed to support the National Flood Insurance Program (NFIP). They are a useful tool, but they have limitations. A study of eastern North Carolina found that 43% of flood damages between 1996 and 2020 occurred outside mapped FEMA floodplains (Garcia et al.,2025).¹ To address these limitations, DEQ partnered with North Carolina Emergency Management to develop improved 2D rain-on-grid models. This approach provides enhanced insight into flood depth, extent, and velocity across watersheds and can identify potential flood risk in areas that may not be fully captured by regulatory maps. The resulting flood maps and risk data underpin the Blueprint tool and the analysis presented in this RBAS.

¹ Garcia et al. (2025, July 14). Reconstructing Repetitive Flood Exposure Across 78 Events From 1996 to 2020 in North Carolina, USA. Retrieved from AGU: <https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2025EF006026>

Now, the Blueprint program is entering a critical stage as early investments in planning, modeling, and tool development are applied across the six priority basins. Phase III, launched in 2024, applies the Blueprint process and the Tool to develop RBAS for priority basins. During the Cape Fear RBAS development, local and regional government staff have been engaged and trained on the use of the Tool to submit Local Action Plans. 133 priority actions were identified from these Local Action Plans and other sources [\(for more about identifying and evaluating actions, see Cape Fear River Basin Action Strategy section\).](#)

The Blueprint Beyond RBAS Development

The completion of the Cape Fear RBAS is an important milestone toward flood resilience, but much work remains. Sustained technical support for local governments and other partners is critical to continuing the planning and implementation of flood resilience actions. DEQ and its partners will continue to provide targeted assistance to local governments to support planning, project development, and implementation while building local capacity. Through the implementation of the Cape Fear RBAS, DEQ will work to align efforts across local, state, and federal levels, resulting in more impactful and efficient investments in flood resilience.

The Blueprint process calls for each RBAS to be updated on a 5-year cycle, contingent on funding. In each update, River Basins will integrate newly available data and review updated Local Action Plans within the Tool to revise the RBAS priority action list. These are just some of the reasons continued investment in the Blueprint by the NCGA and NC DEQ leadership will enable broader implementation, support resilient recovery, and advance prioritized projects, strengthening flood resilience across North Carolina.

Combined, these phases can be broken down into eight key steps (Figure 2).

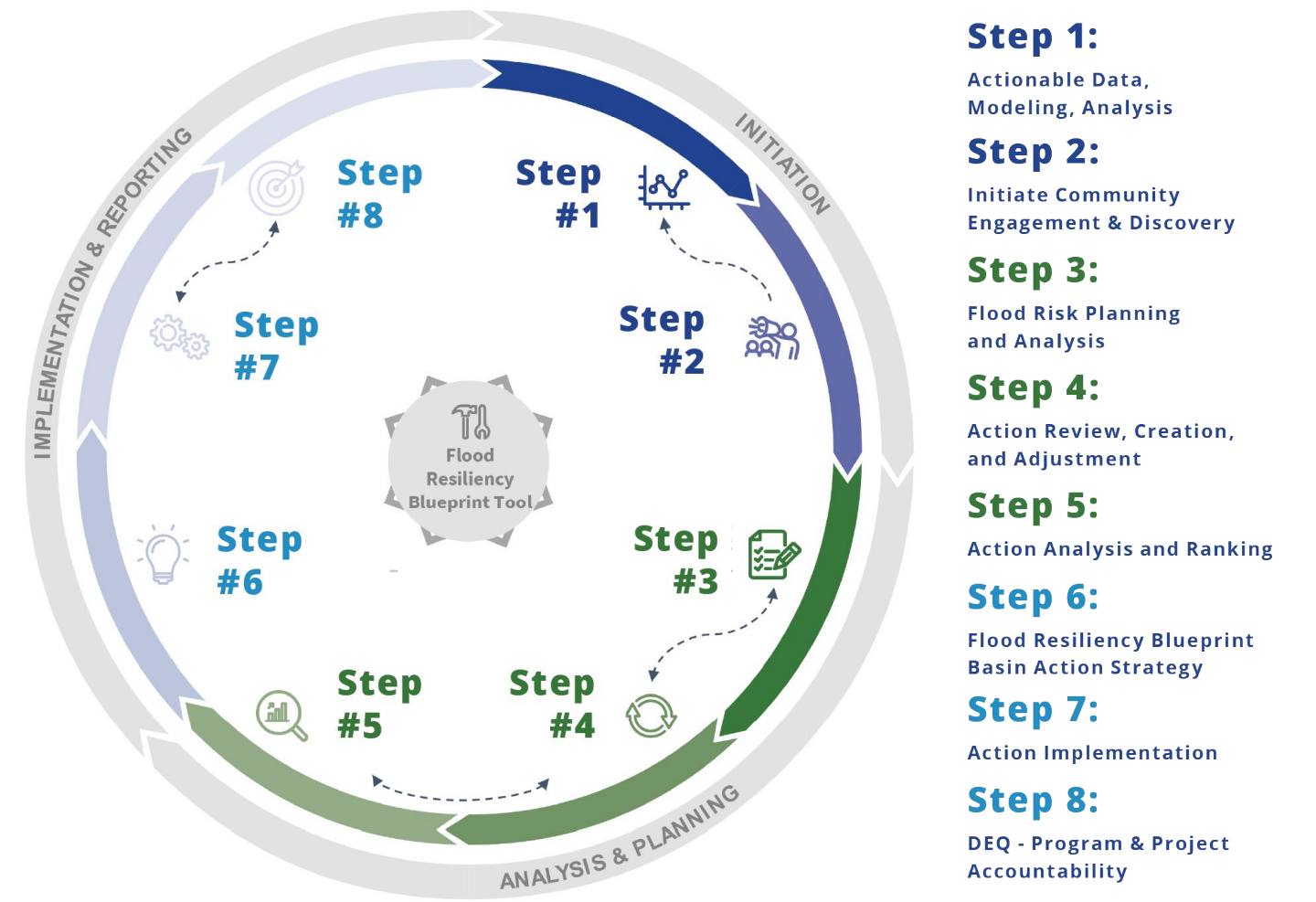


Figure 2. North Carolina Department of Environmental Quality (DEQ) Flood Resiliency Blueprint Tool and Process (DEQ, 2024b).

Purpose of RBAS

Within this broader Blueprint framework, the RBAS applies the statewide process to basin-specific flood risks, needs, and priorities. DEQ’s objective for each RBAS is to identify priority regions and mitigation actions within the basin. The RBAS also documents data needs and limitations to highlight areas where continued refinement may be needed. Development of an RBAS uses detailed flood modeling datasets for both current and future conditions to produce a detailed vulnerability assessment and support long-term planning. The RBAS process also features a capacity assessment to understand local governments’ ability to plan, fund, and implement flood resilience actions. The capacity and vulnerability assessments help the State focus support and resources. Stakeholder engagement is also a central component of the RBAS process, helping ensure that decisions and recommendations are informed by local and regional entities and the specific needs of the basin. Overall, the RBAS results in a prioritized list of flood resilience actions that provides a starting point for making the basin more resilient to flooding.



Flooding of the Cape Fear River in Fayetteville, NC



Downtown Greensboro



BASIN OVERVIEW

About the Basin

Location

The Cape Fear River Basin is the largest river basin in North Carolina. It spans over 9,100 square miles across 26 counties. The Cape Fear River flows from the headwaters in the Piedmont (Guilford and Alamance Counties with smaller portions of Rockingham and Caswell Counties), through the Coastal Plain, and into a 35-mile long coastal estuary, and finally empties into the Atlantic Ocean (New Hanover and Brunswick Counties). The head-waters (origin) of the basin include the Deep and Haw rivers. Major tributaries further downstream in the basin include the Black River, which flows into the Cape Fear River in Pender County, and the Northeast Cape Fear River, which flows into the Cape Fear at Wilmington. The Black and Northeast Cape Fear are both “blackwater” streams that drain the acidic soils of hardwood swamps. (North Carolina Office of Environmental Education and Public Affairs, 2018).

The Cape Fear River Basin encompasses diverse ecosystems, supports local economies, is home to the State Port, key military installations, and serves as a source of water for communities across the basin. The basin has a long history of flooding, and these events have repeatedly affected infrastructure, natural resources, and public safety.

For the purposes of developing the Cape Fear RBAS, including data collection and literature review, the vulnerability analysis, and community engagement, the basin was divided into three regions (Figures 3, 4, 5, and 6) -- the Upper Cape Fear, Middle Cape Fear, and Lower Cape Fear. This allowed for more detailed analysis and identification of the needs and priorities of the communities within each region.

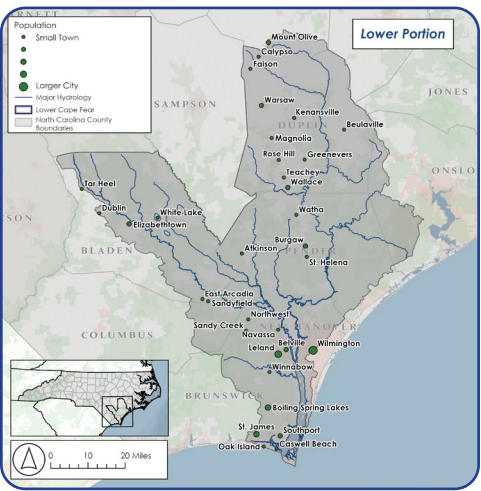


Figure 4: Cape Fear Lower Portion

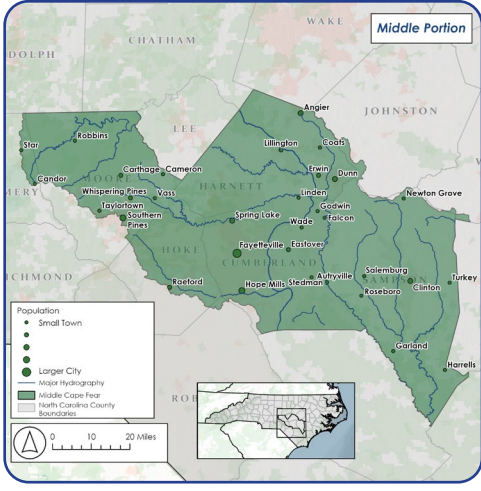


Figure 5: Cape Fear Middle Portion

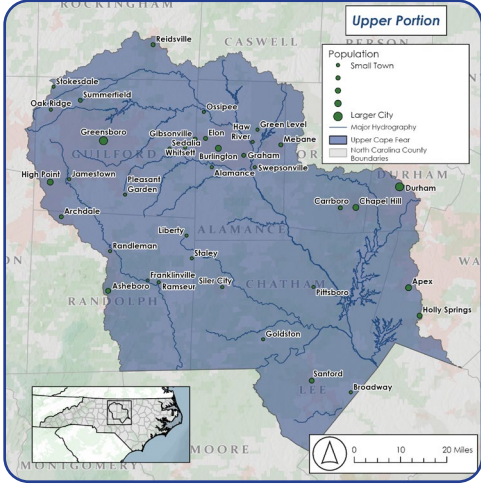


Figure 6: Cape Fear Upper Portion

Flood Risk

The Cape Fear River Basin experiences a variety of flood risks ranging from localized and flash flooding from frequent, small-scale events to high impact events. Long-term flood risk in the Cape Fear River Basin will be influenced by changes in climate that are expected to increase the frequency and magnitude of flooding over time. Population growth and rapid development can lead to increases in impervious surfaces and altered hydrology.

Under current conditions, approximately 16% of the basin’s land area and more than 7,600 households are exposed to flooding during a 1% Annual Exceedance Probability event (commonly referred to as the 100-year storm). By midcentury, the exposed population is projected to exceed 22,576 households (nearly 200% increase). Increases in exposure and impacts are also projected for residential structures, critical facilities, the economy, the environment, and infrastructure.

Flood mitigation actions developed using historical conditions alone may not fully account for future precipitation patterns, coastal influences, or development trends. Considering historic, current, and future flood conditions can help support more effective and adaptable mitigation investments that strengthen long-term resilience. For more information on flood risk and vulnerability in the Cape Fear River Basin, [see the Flood Risk Analysis and Planning section](#) of this document.

Flood Drivers

In the Upper Cape Fear region, intense rainfall can produce flash flooding, urban runoff, and localized tributary flooding even when the mainstem Cape Fear River remains within its banks. Flooding is primarily driven by fluvial (riverine) processes as major headwater streams, including the Haw and Deep Rivers, overflow their banks following extreme rainfall events. Additionally, intense downpours generate localized pluvial (stormwater) flooding in heavily urbanized Piedmont centers like on the I-40/I-85 Corridor including Greensboro and Durham, where high concentrations of impervious surfaces prevent natural ground infiltration. Based on FEMA Flood Insurance Studies², low-lying areas in the upper portion of the basin are subjected to periodic flooding from Haw and Deep Rivers and their tributaries. The most severe flooding on the rivers and large tributaries is usually the result of heavy rains from tropical storms, while flooding on small tributaries results from local thunderstorms and frontal systems. The USACE’s B. Everett Jordan dam and lake provides flood storage on the upper Cape Fear River system and helps reduce downstream peak flows during major storms, although flood risk remains in tributary and downstream areas.

In the middle Cape Fear region, flood risk is primarily driven by upstream flows as the Haw and Deep Rivers converge below Jordan Lake to form the main stem of the Cape Fear River. Severe rainfall events push high volumes of cumulative runoff downstream through major tributaries like the Little River and Rockfish Creek, causing prolonged riverine inundation in Fayetteville, Spring Lake, Erwin, Lillington, and surrounding areas. Additionally, localized stormwater pooling (pluvial flooding) and groundwater saturation frequently impact surrounding low-lying residential areas and agricultural lands across Cumberland, Harnett, and Hoke Counties.

In the Lower Cape Fear region, flood risk is generally defined by the convergence of heavy upstream riverine discharges coupled with ocean-driven coastal processes. Mainstem river flooding remains a concern but is increasingly affected by downstream water levels in the Cape Fear estuary and Atlantic Ocean. This interaction is especially important near Wilmington, near where the Black and Northeast Cape Fear Rivers joins the Cape Fear and high river flows, elevated estuary levels, storm surge, and heavy rainfall can combine to create compound flooding. Because of the flatness of the terrain, many inland areas are characterized by shallow flooding during heavy rainfalls.

Extreme hurricane rainfall and high cumulative runoff compound with coastal storm surge, lunar high and king tides, and sea-level-rise-driven groundwater inundation, creating severe backwater effects across low-lying estuaries. These complex flooding dynamics drive chronic and acute inundation in coastal, estuarine, and downstream communities including the aforementioned Wilmington as well as Leland, Burgaw, Elizabethtown, Southport, and across low-lying barrier island areas.

² FLOOD INSURANCE STUDY FEDERAL EMERGENCY MANAGEMENT AGENCY A Report of Flood Hazards in GUILFORD COUNTY, NORTH CAROLINA AND INCORPORATED AREAS REVISED: 6/10/2026 Federal Emergency Management Agency State of North Carolina

History of Flooding

Over the past several decades, tropical storms and hurricanes have caused extensive flooding, loss of life, and significant economic damage across North Carolina. Flooding associated with Hurricanes Fran (1996), Bonnie (1998), and Floyd (1999) highlighted limitations in existing floodplain management, hazard mitigation planning, and preparedness efforts. Flooding from Hurricanes Matthew (2016) and Florence (2018) reinforced the need for approaches that better account for future conditions and changing flood behavior. More recent events, like Hurricane Dorian (2019) and Tropical Storm Chantal (2025), further demonstrate the basin’s continued exposure to flood hazards and have highlighted the need for continued improvements in forecasting, planning assumptions, and flood resilience strategies (Davis, 2024).³

Significant flooding is also experienced throughout the basin during unnamed storm events. Events such as high tide flooding, flash flooding, and intense rainfall events cause considerable impacts to communities, causing road closures and damage to homes and businesses. These events can also cause fatalities, especially when the intensity of a storm is unexpected.

³ Davis, C. (2024, September 5). Five Years Ago, Dorian Tested Our Post-Florence Preparedness. Retrieved from North Carolina State Climate Office: <https://climate.ncsu.edu/blog/2024/09/five-years-ago-dorian-tested-our-post-florence-preparedness/>



Mesic Longleaf Savanna, Millis Road



Three Sisters Swamp, Bladen County





Cape Fear River Bank

Basin Dynamics

Weather and Climate

The Cape Fear River Basin experiences a humid subtropical climate characterized by warm, humid summers, generally mild winters, and precipitation throughout the year. Tropical storms and hurricanes have played a significant role in some of the basin's most damaging flood events, while seasonal thunderstorms and prolonged rainfall can also contribute to flooding. North Carolina's climate has warmed by more than 1°F since the beginning of the 20th century, and climatic conditions across the basin contribute to a range of flood hazards, including flash, riverine, coastal, and compound flooding (NOAA NCEI, 2022).⁴

Projections from downscaled climate models (NDEQ, 2026) indicate increasing frequency and intensity of heavy rainfall, greater coastal and tidal influences, and higher potential for compound flooding events. These drivers interact with development patterns, infrastructure conditions, and land modifications, increasing flood risk in some areas of the basin.

The 2023 North Carolina Enhanced State Hazard Mitigation Plan anticipates increased flood hazards due to climate trends, including increases in extreme precipitation, storm intensity, and sea level rise.

Population Shifts

The Cape Fear River Basin is home to approximately 2.3 million people, with significant portions of the basin population living in the Upper Cape Fear around Greensboro and High Point, and in Orange, Durham, and Wake Counties. The basin has experienced significant population growth over the past two decades and now represents approximately one-fifth of North Carolina's total population. In addition to the Triad and Triangle, the growth includes development along the I-40/I-85 corridor and growth near the coast in New Hanover and Pender counties. Figure 7 shows projected county-level population change across the basin between 2025 and 2060 (North Carolina Office of State Budget and Management, 2025)⁵, illustrating some counties are projected to continue growing, while others are projected to remain relatively stable.

Projected population growth is relevant to Cape Fear RBAS development and strategic flood resilience planning because growth can influence where land use and development changes occur. In communities with limited growth or population decline, capacity constraints may affect the ability to plan for, fund, and implement flood risk management actions. The population changes shown in Figure 4 provide context for interpreting future population exposure, local capacity needs, and the types of actions that may be needed across different parts of the basin.

Land Use Changes and Development

Land use changes, combined with increasing flooding under mid-century (2050) projects, leads to increased exposure across all land use types (e.g., developed, agricultural, and natural areas) in the basin. These patterns indicate that potential flood impacts may extend across residential development, economic assets, and natural systems under future conditions. Changes in land use and land cover can also impact flooding by altering surface runoff, soil permeability, water storage capacity, and the availability of natural flood mitigation features. The increase in impervious surfaces associated with population growth and development can prevent water from infiltrating the soil and increase surface runoff during rainfall events. These three factors – more frequent and severe flooding, population growth, and land use changes -- have collectively influenced the frequency, intensity, and spatial distribution of flooding events within the Cape Fear River Basin.

⁴ National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI). North Carolina State Climate Summary 2022. Asheville, NC: NOAA National Centers for Environmental Information, 2022.

⁵ North Carolina Office of State Budget & Management (NC OSBM), Vintage 2024 Population Estimates & Vintage 2025 Population Projections

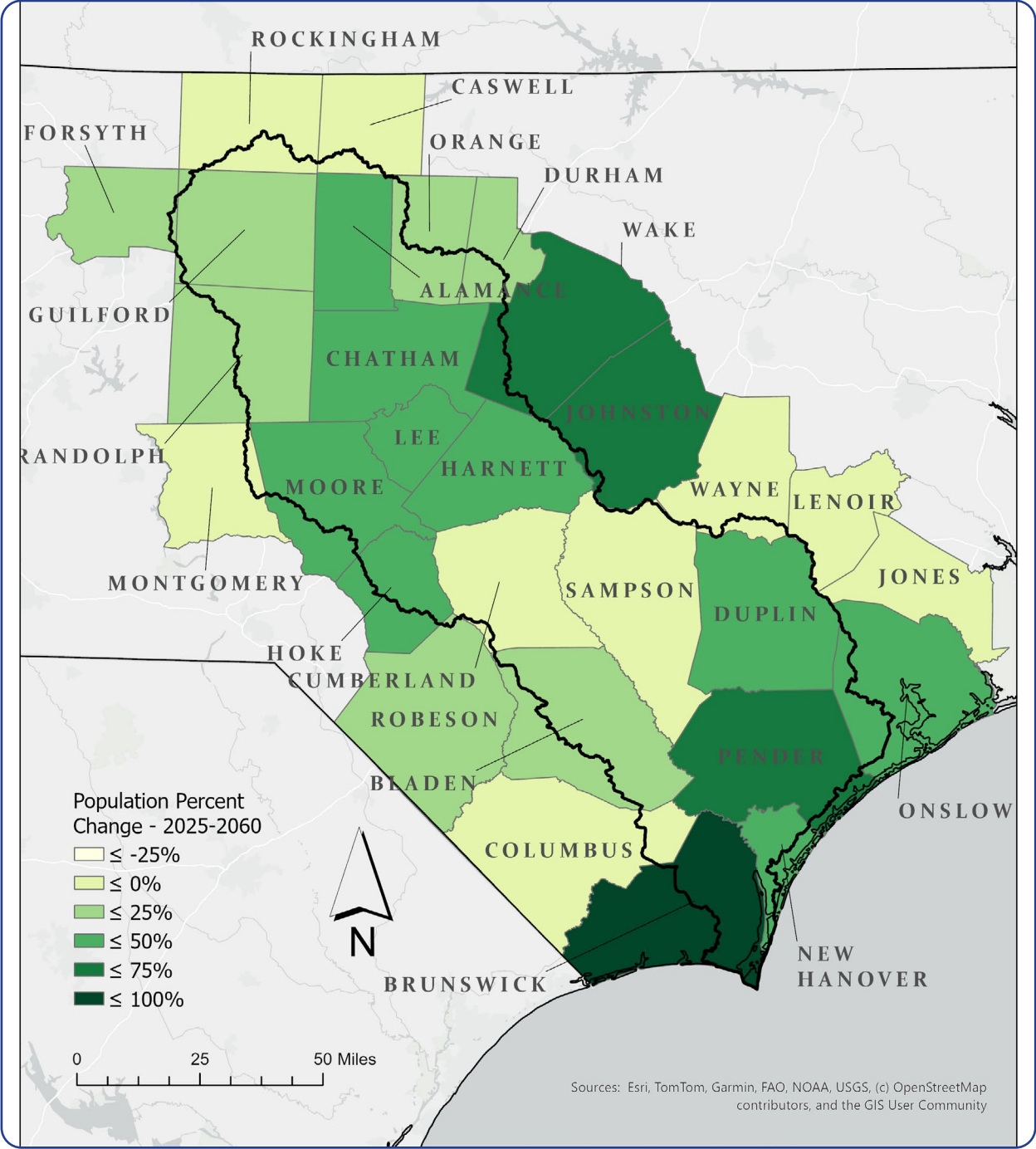


Figure 7: Projected Percent Change in County Population, 2024 to 2060. Source: North Carolina Office of State Budget & Management, Vintage 2025 Population Projections.

RIVER BASIN ACTION STRATEGY DEVELOPMENT PROCESS

The Cape Fear RBAS was developed through a multi-step process (Figure 2). The first step in that process involved a literature review to identify existing plans, data, and programs in the Cape Fear River Basin (Figure 5). This review was done to document previous and current flood resilience efforts in the basin and compile a list of pre-identified flood resilience actions. The resulting list of 1,012 pre-identified actions was then used as a resource during Blueprint engagement with local and regional governments.

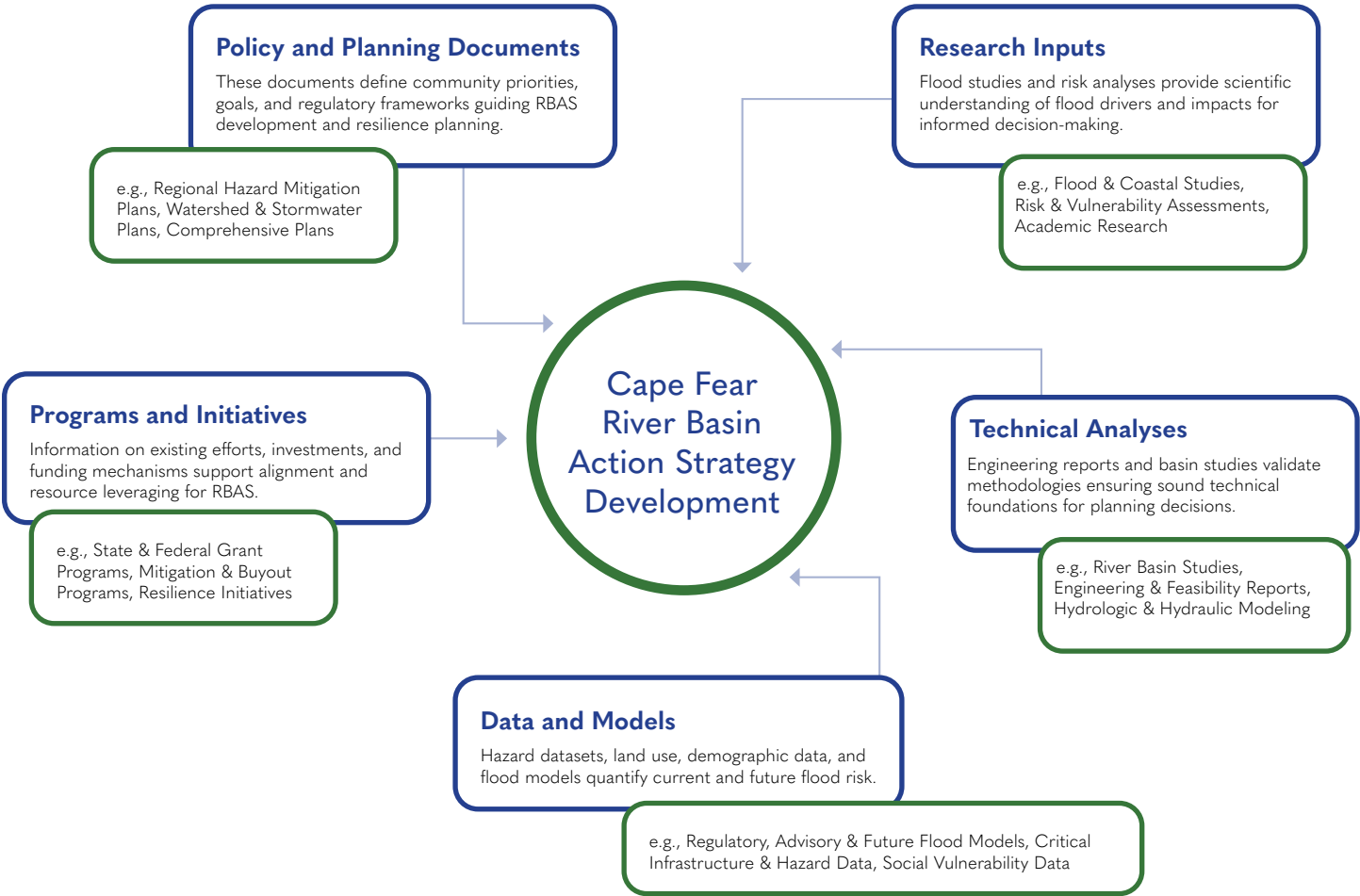


Figure 8. Resource types informing the Cape Fear River Basin Action Strategy Development Process

The Cape Fear River Basin Flood Risk and Vulnerability Analysis Report (Appendix E) provides a clear understanding of current and potential future flood risk across the basin. Using outputs from the NCEM 2D advisory data created for the Blueprint Tool, new insights were made into flood risk locations and magnitudes; these insights informed the identification and selection of several priority actions (Table 2) across the river basin. Stakeholders and the public were engaged throughout the Cape Fear RBAS development process to gather key insights and perspectives on flood resilience needs and community priorities.

ACTIONABLE DATA, MODELING, & ANALYSIS

Inventory of Existing Data, Programs, & Studies

Historical and ongoing flood hazard challenges in the Cape Fear River Basin have resulted in an array of resilience efforts and investments at the federal, state, and local level. A review of existing data, programs, and studies produced an inventory of up-to-date and credible flood resilience efforts. This inventory includes a wide variety of information types as shown in Figure 5. These resource types served complementary purposes: plans and strategies identified documented priorities, research projects provided technical insight, programs outlined implementation pathways, and datasets are relevant to modeling, screening, and action evaluation.

Figure 8 summarizes the major resource types reviewed during development of the Cape Fear RBAS, including plans and strategies, research projects, programs, and datasets. These resources collectively help to update the inventory of existing flood resilience efforts in the basin, identify previously documented actions and needs, and inform later steps in modeling, engagement, action development, and prioritization. The range of resource types also reflects the purpose of the Blueprint process: to build from existing local, regional, and state knowledge rather than duplicating prior efforts.

Resources included in the literature review and data inventory met the following criteria:

- Regional or smaller geographic scope: The basin-wide geographic area spans all or part of 26 counties and 121 municipalities.
- Credible and vetted: Resources have federal, state, or agency support and/or have been reviewed by subject matter experts.
- Up-to-date, latest version: Generally, state resources were published in 2019 or later, in response to NC 2018 Executive Order 80. For resources updated annually, the latest version was reviewed.
- Importantly for the development of the Cape Fear RBAS, this inventory provided a starting point for identifying pre-existing flood resilience actions to support the development of Local Action Plans. Actions documented in plans, studies, programs, and related datasets were compiled and used to inform stakeholder discussions. It also allowed for the pre-population of actions in the Tool, potentially streamlining the development of Local Action Plans and reducing capacity demands on local governments in the Blueprint process.

As flood resilience related planning, research, and other efforts continue, this inventory should be revisited in collaboration with local and regional governments to ensure that relevant advancements are integrated into the updated RBAS (currently planned for a 5-year update cycle, contingent on funding). Additional detail about the resource inventory and update process is compiled in the Appendix A: Actionable Data Collection, Modeling, and Analysis Report. State-scale resources reviewed during earlier Blueprint phases are summarized in the RBAS Strategy.

Plans and Strategies

Primary plan and strategy types with Cape Fear River Basin-relevant flood resilience efforts include Hurricane Matthew Resilient Redevelopment Plans (HMRRP), Regional Resilience Portfolios, and Hazard Mitigation Plans (HMP). Some local municipal plans, such as the City of Fayetteville Resiliency Element, were included in the literature review as well.

State and Local Programs

Four state and local programs were identified within the Cape Fear River Basin. DEQ Division of Coastal Management (DCM) administers the Resilient Coastal Communities Program (RCCP) providing technical and financial assistance for coastal resilience efforts. DEQ Division of Mitigation Services (NCDMS) was authorized by the NC General Assembly to incorporate flood storage capacity enhancement under the Natural Infrastructure Flood Mitigation Program (NIFMP). Several projects within the Cape Fear River Basin are underway under both programs. The North Carolina Flood Mapping Program (NCFMP) also supports projects within the basin by providing flood hazard data and mapping products.



⁶ The Environmental Finance Center (EFC) at UNC-Chapel Hill. (2021). Flood resilience and NC water and wastewater utilities. Retrieved from <https://collaboratory.unc.edu/wp-content/uploads/sites/476/2021/05/flood-resilience-and-nc-water-and-wastewater-utilities.pdf>

⁷ Thomson, H., Zeff, H. B., Kleiman, R., Sebastian, A., & Characklis, G. W. (2021, May 1). Financial Risk of Flood Events in Eastern North Carolina. Retrieved from <https://collaboratory.unc.edu/wp-content/uploads/sites/476/2021/05/financial-risk-of-flood-events-in-eastern-north-carolina.pdf>

⁸ Doll, B., Line, D., Kurki-Fox, J., & Page, J. (2020, June). Flood Abatement Assessment for Cape Fear River Basin (NCDOT Project RP-2018-32). Retrieved from <https://connect.ncdot.gov/projects/research/RNAProjDocs/Final%20Report%20RP2018-32.pdf>

⁹ National Oceanic and Atmospheric Administration (2021). Improving North Carolina's Resilience To Coastal Riverine Flooding. Retrieved from <https://repository.library.noaa.gov/view/noaa/49651>

Research Projects

Two (2) major university or research institution projects were identified within the Cape Fear River Basin.

The Collaboratory Flood Resiliency Study was submitted as a final report to the North Carolina General Assembly in June 2021, as a product of the NC Policy Collaboratory at The University of North Carolina at Chapel Hill. The primary legislative charge of the report was to conduct research related to flood resiliency in eastern North Carolina, including the Cape Fear River Basin.

The North Carolina Climate Science Report was published by the North Carolina Institute for Climate Studies in September 2020 (revised). The report is a scientific assessment of historical climate trends and potential future climate change and includes an overview of the physical science of climate change, detailed information on observed and projected changes in temperature and precipitation averages and extremes, hurricanes and other storms, sea level, and other relevant climate metrics. The report also includes chapters on sea level rise, trends involving interactions of multiple aspects of the climate system (including inland flooding, wildfire, forest ecosystem changes, urban heat island effects, and air pollution), and findings relevant to engineering design standards.

Data Sets

Data sets inventoried for the Cape Fear RBAS are classified in six distinct groups: Hazards and Engineering, Foundational, Natural Environmental, Built Environment, Demographic, and Mitigation Support Datasets. The data is sourced from different federal, state, and local agencies and is used to support modeling and action development.

Local & Regional Capacity

A Local and Regional Government Blueprint Capacity Assessment (Appendix C) was completed as part of the Cape Fear RBAS development process. The purpose of the capacity assessment is to better understand each community's ability to plan, assign staff resources, and provide the administration needed to identify and implement actions. This includes consideration of whether or not the community has a planner or engineer on staff with specific knowledge of local hazards and risks; and whether the community has an established planning department. The assessment complements capacity scores in the Blueprint Tool and is not intended as a definitive measure; rather, it provides a baseline understanding of relative capacity across communities and helps identify where additional support may be needed.

The assessment was conducted through a desktop review of publicly available information from municipal and county websites, regional planning councils and Councils of Government, state databases, regional hazard mitigation plans, resilient redevelopment plans, and other relevant sources. Each jurisdiction was scored across three assessment domains, which were combined into a composite score. Where information was missing or could not be interpreted, the relevant indicator was scored as zero, which may understate capacity in some cases. Additional information on the assessment domains is provided below, with full methods and results included in Appendices A (Actionable Data Collection, Modeling, and Analysis Report) and C (Blueprint Capacity Results Spreadsheet).

Capacity Assessment Domains

Previous determinations from HMPs: community capability rankings from existing, locally adopted Regional Hazard Mitigation Plans (RHMPs) and Multi-jurisdictional Hazard Mitigation Plans (MJHMPs) were used to pull summary designations of “High,” “Moderate,” or “Low” capability (or their equivalent) for each jurisdiction.

Example of previous determinations derived from an HMP: Alamance County was identified as having high capability for hazard mitigation, with its nine incorporated municipalities having separate capability rankings ranging from low and moderate to high.

Previous determinations from other regional plans: Hurricane Matthew Resilient Redevelopment Plans (RRP), NC Office of Recovery and Resiliency (NCCORR) Regions Innovating for Strong Economies and Environment Program (RISE) Regional Resilience Portfolios, and NC RCCP plans were used for references to local capacity.

Example of previous determination from a Hurricane Matthew RRP: Pender County was identified as having high capacity for flood resilience, with its five incorporated municipalities having separate capacity rankings ranging from limited to high.

Vulnerable populations and overall support indicators: vulnerable populations based on CDC ATSDR SVI data; past trends and future projections in population growth derived from US Census Bureau and State of North Carolina data; existence of a community planner or engineer with specific knowledge of local hazards; and existence of local planning departments were used in conjunction with the previous determinations to establish an overall assessment of capacity.

Example of determination based on vulnerable populations: Cumberland County has a high determination of vulnerable populations, with its nine incorporated municipalities having separate vulnerable population rankings ranging from low to medium-high and high.

Higher-capacity jurisdictions are generally better positioned to manage activities such as planning, engineering and design, procurement, grant administration, program management, and long-term operations and maintenance. Smaller jurisdictions often have fewer dedicated stormwater staff, planning tools, and local funding sources, increasing reliance on county services, Councils of Governments (COG), Blueprint staff, or other regional partners. Assessment results indicate a concentration of higher-capacity jurisdictions in the Upper Cape Fear, more variation in the Middle Cape Fear, and the widest range of capacity in the Lower Cape Fear. Lack of a full-time community planner, lack of an established planning department, and/or lack of a planner or engineer with knowledge of local hazards and risks were most common among the smaller jurisdictions, highlighting where follow-up and targeted assistance may be warranted.

These findings have direct implications for implementation. Capacity constraints can affect a jurisdiction's ability to identify needs, develop projects, secure funding, and manage implementation over time. Existing support from Blueprint staff, COG partnerships, and programs such as RCCP can help supplement local capacity, but additional recurring resources and sustained technical assistance will be needed to address gaps more comprehensively over time.

COMMUNITY ENGAGEMENT & DISCOVERY

People and places in the Cape Fear River Basin are best protected when communities understand flood risks, share ideas about how flood risks can be reduced, and actively participate in resilience planning. To create a community-informed River Basin Action Strategy (RBAS), an Outreach and Engagement Plan (Appendix B) was developed. The Outreach and Engagement Plan (O&E Plan) established a framework for connecting with local governments and other organizations that play direct roles in flood resilience planning throughout the Cape Fear River Basin. It served as a roadmap of intent to direct specific engagement activities.

The O&E Plan supports the Blueprint program’s mission: to provide local governments, state agencies, and partners with the data, tools, and processes to guide investments that minimize the cost and disruption of future flooding. The plan follows established guidance from the [NCDEQ Public Participation Plan](#) to promote transparency and address the changing diversity of North Carolina’s population and culture.

Building on the valuable information gathered during these engagement efforts, the Cape Fear RBAS reflects the flood resilience needs of communities across the river basin.

Engagement with Local Communities & Agencies

River Basin Action Stakeholders

During Phase I of the Blueprint Framework development in 2024, NCDEQ piloted the Blueprint approach in the Neuse River Basin, engaging over 150 subject matter experts and key stakeholders through six Technical Advisory Groups, a Neuse Regional Advisory Group, and a Principal Advisory Group. The structure and approach used in the Neuse River Basin informed the stakeholder engagement model later established for the Cape Fear River Basin, adapting lessons learned from the pilot to support effective participation and input.



Building on Phase I pilot efforts, the project team formed a River Basin Advisory Group (RBAG) to advise the overall RBAS development and a Blueprint Partners group focused on broad participation for the Cape Fear Basin. These groups served as key forums for stakeholder engagement, facilitating coordination, information sharing, and feedback. Each group provided critical perspective for the Action Strategy development and will be discussed in more detail on the following pages.

In addition to formalized outreach activities, NCDEQ also engaged stakeholders in the Cape Fear and other river basins through other programs, events, and networks working on flood resilience. This included presentations at the:

- NC Chapter of the American Planning Association Resilience Committee
- Southeastern NC Community Rating System Users Group,
- North Carolina Beach, Inlet & Waterway Association conference,
- NC Foundation for Soil & Water Conservation Floodwise Project.

The Cape Fear River Basin project manager served as an advisor with the City of Wilmington, New Hanover County, and Pender County’s Phase I & II development through the Resilient Coastal Communities Program and attended regular meetings and workshops held by stakeholder groups within the Cape Fear River basin including the UNCW-led Lower Cape Fear River Program, the Cape Fear River Partnership, Cape Fear Arch, the Coastal Society, Pender County Long Term Recovery Group, and the Cape Fear Rural Transportation Planning Organization. Numerous public meetings were also held to address concerns in the Cape Fear River Basin including the Interbasin Transfer Request by the Town of Fuquay-Varina, Superfund Site clean-up in the Town of Navassa and dredging of the Wilmington Harbor.

NCDEQ and the project team in the Cape Fear River basin had numerous direct contact outreach meetings, collaborated with the Nature Conservancy Sustainable Rivers Program and their team working in the Cape Fear River basin through NOAA Transformational Habitat and Coastal Resilience funding under the Infrastructure Investment and Jobs Act.

NCDEQ also provided weekly virtual office hours for Blueprint Tool walk-through and questions. This effort reflects the state’s commitment to connecting with those who can share local knowledge and technical expertise, ensuring that the needs and context of Blueprint communities are at the center of the RBAS.

Blueprint Stakeholder Participants

For the Cape Fear River Basin, stakeholders were identified and engaged from across the basin’s communities. The stakeholder identification process sought to include representatives from local, regional, state, tribal, academic, nonprofit, military, and private-sector organizations to ensure that planning efforts incorporated a wide range of technical knowledge, community priorities, and implementation considerations. This approach helped create a balanced and inclusive forum for collaboration, supporting the development of strategies that are both locally informed and regionally relevant. Emphasis was placed on local governments because of their critical role in developing and executing flood risk reduction actions.



Cape Fear Partners

Cape Fear River Basin Advisory Group

The Cape Fear RBAG was created to provide subject-matter knowledge and local insights throughout Action Strategy development milestones. The RBAG was composed of subject matter experts from state agencies, local and regional governments, nongovernmental organizations, academic institutions, and technical fields. Members pointed to research on flooding impacts, best practices for flood resilience actions, and creative problem-solving for the most challenging flooding problems. This input helped to shape the key topics assessed in the Vulnerability Assessment as well as the Cape Fear River Basin Vision and Guiding Principles, which guided development of the Action Strategy. The RBAG also sourced community resources for action identification. RBAG members provided continual support to ensure that the RBAS is practical, effective, and responsive to the needs and priorities of the Cape Fear River Basin communities.

Blueprint Partners

The Blueprint Partners included a broad and diverse range of stakeholders—including governmental agencies, non-profit organizations, and others—to capture locally distinct information about flooding within their community. Among other topics, the Blueprint Partners provided input on the development of the guiding principles, the Vulnerability Assessment, and project identification and prioritization.



Cape Fear Partners

Cape Fear RBAG Meetings Summary

The Cape Fear RBAG met five times over the course of Action Strategy development: March 2025, June 2025, October 2025, June 2026, and August 2026. The first meeting (March 2025) focused on gathering input from RBAG members on the planned Action Strategy development process. The second meeting (June 2025) focused on flood concerns in the river basin that included literature review results, findings from the Community Capacity Assessment, overview of the Blueprint Tool, and breakout groups to solicit input on identified actions. During the third meeting (October 2025), RBAG members identified priorities and needs within the basin to inform the development of the vision statement and guiding principles for the RBAS. The fourth meeting (June 2026) reviewed the preliminary results of the Vulnerability Assessment and provided walk through of the Blueprint Tool to demonstrate how to submit actions for inclusion in the RBAS. The final meeting (August 2026) presented the draft RBAS and provided details on how to provide comments and feedback.



Blueprint Partners Meetings Summary

The Blueprint Partners met five times over the course of Action Strategy development: May 2025, July 2025, October 2025, June 2026, and August 2026. The first meeting (May 2025) provided overview of Blueprint program, including the planning effort and the Blueprint Tool. The meeting also reviewed expectations and role of partners, provided overview of the RBAG and RBAS, and reviewed findings from the literature review. The second meeting (July 2025) focused on flood concerns in the river basin that included literature review results, actions identified to-date, gap analysis, findings from the Community Capacity Assessment, overview of the Blueprint Tool, and breakout groups to solicit input on identified actions. During the third meeting (October 2025), Blueprint Partners identified priorities and needs within the basin to inform the development of the vision statement and priorities to guide the development of the RBAS. The final meeting (June 2026) reviewed the preliminary results of the Vulnerability Assessment and provided walk through of Blueprint Tool to demonstrate how to submit actions for inclusion in the RBAS.

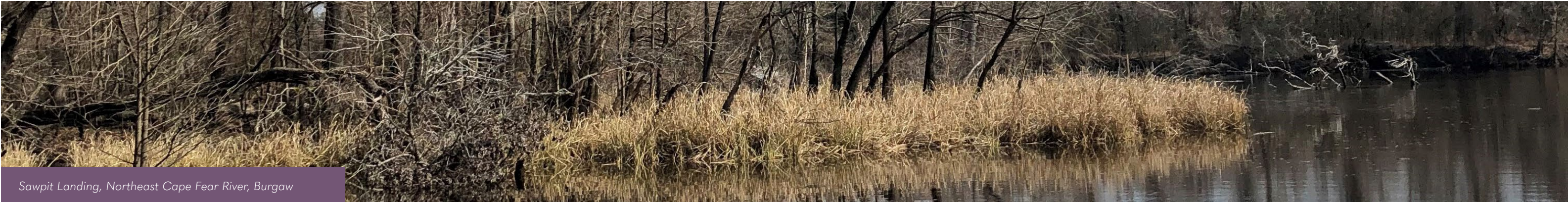


RBAG Meeting



Local Government Survey

In December 2025, the project team launched a dynamic local government survey to capture feedback on the large inventory of pre-existing flood resilience actions. These actions, captured in the *Cape Fear River Basin Actionable Data Collection, Modeling, and Analysis Report*, came from diverse sources such as hazard mitigation plans, comprehensive plans, stormwater plans, regional resilience plans, and others. This survey allowed local government users to display only actions identified for their jurisdiction and provide feedback on the relevance of those actions. Users indicated for each action whether it was completed, underway, not started but still desired, or no longer relevant. The survey captured feedback from 28 communities, providing feedback about 428 actions. Actions described as “not started but still desired,” or “underway” with notes about needing additional resources, were add to the prioritization list.



FLOOD RISK PLANNING & ANALYSIS

Flood risk planning in the Cape Fear River Basin identifies where flooding occurs and the extent to which people, buildings, and systems are exposed under both current and future conditions. For this Action Strategy, a basin-wide Vulnerability Assessment (Appendix E: Flood Risk and Vulnerability Analysis Report) was conducted to provide a data-driven view of how flood hazards, development patterns, and assets interact and influence flooding impacts across the Upper, Middle, and Lower Cape Fear River Basin portions of the basin.

The assessment considered both flood risk and flood vulnerability across the basin. Flood risk focuses on the magnitude and distribution of exposure, including people, structures, assets, and more, associated with a 100-Year Storm event and how outcomes are expected to change over time. Flood vulnerability reflects how that exposure translates into impacts on people, housing, infrastructure, and essential services.

While flood risk describes where flooding occurs and what is exposed, vulnerability helps characterize where flooding is more likely to disrupt daily life and affect populations facing greater challenges preparing for, responding to, and recovering from flood events. Across the basin, vulnerability varies based on several characteristics including development patterns, infrastructure concentration, and the distribution of potentially underserved block groups (PUBGs). Assessing vulnerability as part of this Action Strategy helps support and inform targeted flood resilience actions across the Cape Fear River Basin.

Explore Flood Data in the Blueprint Tool

Detailed flood maps and risk data can be explored through the Blueprint Tool (see the Tool’s [quick start guide](#)). The Tool also includes impact assessments and community-scale vulnerability information for communities throughout the Cape Fear River Basin. This vulnerability assessment and additional flood risk data can be viewed within the Tool for local governments and organizations to explore, craft, analyze, and evaluate flood resilience actions. This advisory data can help support communities in their long-term flood resilience planning, as the data available includes flood risk extents based on future conditions (2050 and 2100).

Flood Risk

Flood risk in the Cape Fear River Basin is shaped by multiple flood sources that vary across the basin and, in some cases, combine to produce compound flooding. Riverine flooding remains the dominant driver, though flood hazards are changing over time as flood extents expand under future conditions, heavier rainfall increases runoff, continued development adds impervious cover, and coastal influences intensify flooding in downstream communities.

Across the basin, flood behavior reflects differences in topography, land use, and other location and vulnerability-based characteristics (for more information on geographic influences on flood risk see Appendix E. Flood Risk and Vulnerability Report). While there is considerable variation in flooding hazards and impacts across the basin, there are some themes that are helpful in characterizing risk and vulnerability in different community contexts.

In the more urbanized and rapidly developing metropolitan areas (including Greensboro, Fayetteville, Wilmington, and surrounding communities), flood risk is also influenced by urban stormwater and flash flooding. In those areas, concentrations of cement and other types of impervious cover can overwhelm drainage systems and increase localized flooding. In the lower relief inland portions of the basin, broader floodplains and slower drainage contribute to extended inundation durations and slower recovery. This kind of disruption from flooding can particularly affect agricultural lands, as well as transportation corridors and access to population centers.

Closer to the estuary and Masonboro Sound, flood hazards are shaped not only by riverine flow but also by tidal processes, storm surge, elevated base water levels,

and backwater effects, creating compound flooding conditions in communities such as Wilmington, Wrightsville Beach, Carolina Beach, Kure Beach and in low-lying areas around Masonboro Island.

Since the 1990s, the Cape Fear River Basin has experienced repeated, devastating impacts from major hurricanes, beginning with Hurricane Fran (1996), which made landfall directly at the mouth of the Cape Fear River with an 8 to 13-foot storm surge and torrential inland rains. Subsequent storms, notably Hurricanes Floyd (1999) and Matthew (2016), delivered multi-day downpours that overwhelmed main river tributaries, submerging critical transportation corridors like I-40 and I-95 for weeks. Hurricane Florence (2018) became the state’s wettest tropical cyclone on record, depositing more than 35 inches of rain near Elizabethtown, pushing river gauges past 500-year flood thresholds, driving a massive storm surge, and temporarily isolating Wilmington from access.

Additional systems like Hurricane Dorian (2019) and tropical rainfall events have exposed these disruptions through recurring coastal storm surge, severe wind damage, and prolonged freshwater inundation across the basin’s residential, agricultural, and municipal infrastructure.

These flood sources may occur independently or concurrently and can affect human safety, residential and commercial structures, transportation systems, utilities, critical facilities, and natural systems. Understanding the different sources and locations of flooding across the Cape Fear River Basin provides important context for the current and future flood risk results presented in the following pages.



Current Conditions - Risk

Under current conditions, approximately 16% of the Cape Fear River Basin’s land area is exposed to flooding during a 100-Year Storm event. Additionally, flooding exposure includes more than 7,600 of the basin’s 963,000 households, or approximately 1% of the basin-wide housing stock totaling \$287 million in at-risk residential property values. Figure 9 shows the modeled existing and mid-century 100-Year Storm flood extents and provides spatial context for how exposure varies across the basin. The counties with the greatest exposure to floodwater are Pender, Duplin, Sampson, Bladen, Brunswick, and Chatham. While coastal exposure dominates three of the top five counties, both Sampson and Chatham Counties are inland. Within the Cape Fear Basin, the municipalities with the greatest area in the 100-Year Storm flood extent include Greensboro, Fayetteville, Durham, Wilmington, and Burlington.

Population exposure to the 100-Year Storm event is highest in the Upper Cape Fear, particularly in Guilford, Alamance, and Orange Counties. This area also experiences the highest estimated damage costs under current conditions.

In the Middle Cape Fear, the largest concentrations of people exposed to the 100-Year Storm event are located in Cumberland County in the Fayetteville area. The transition from steeper Piedmont landscapes to the lower-relief Coastal Plain in the Middle Cape Fear results in broader floodplains and slower drainage patterns contribute to exposure.

In the Lower Cape Fear, the largest concentration of people to the 100-Year Storm event are in New Hanover County, particularly in the Wilmington area. These differences in flood extents and exposure drive differing flood resilience approaches throughout the basin (see Cape Fear River Basin Action Strategy section for more details).

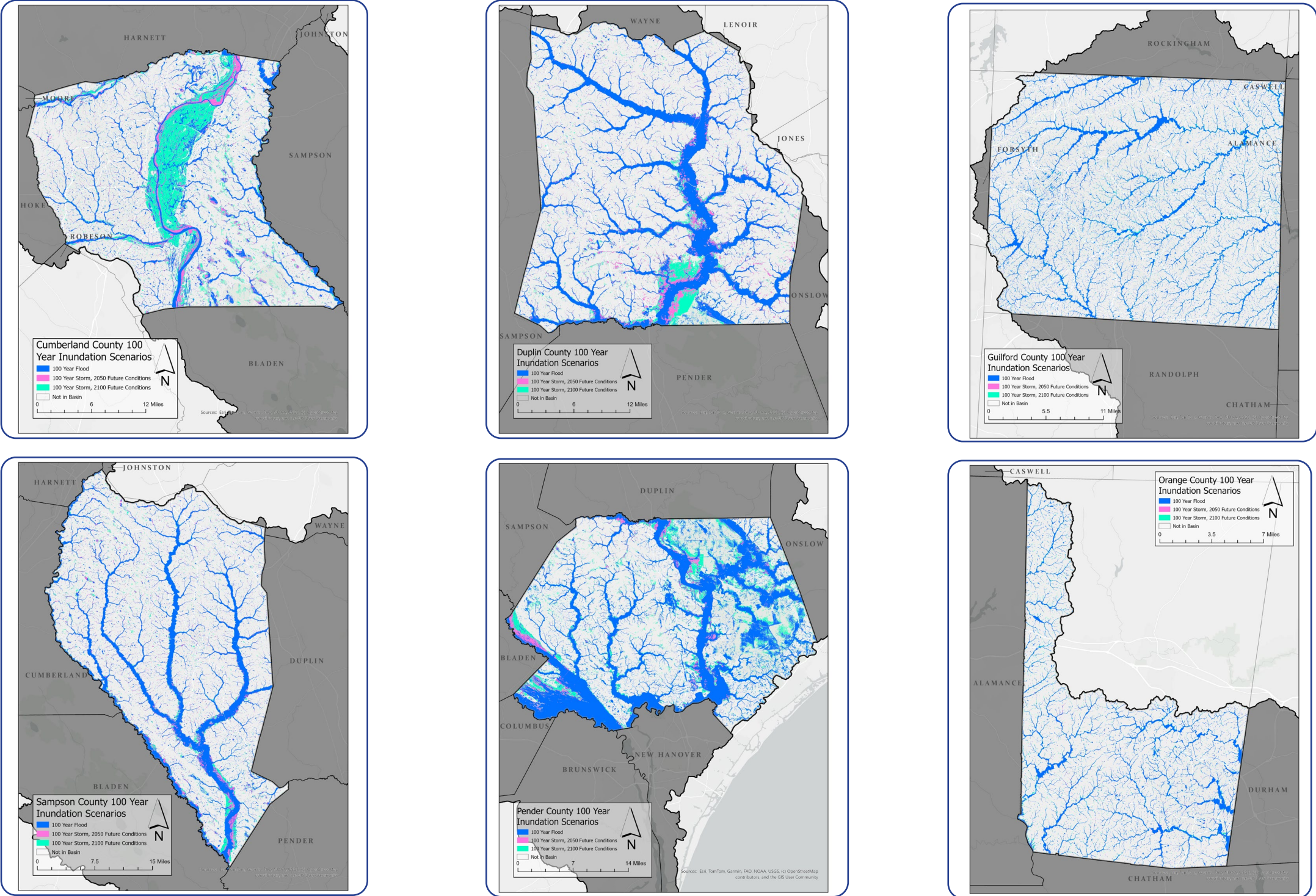
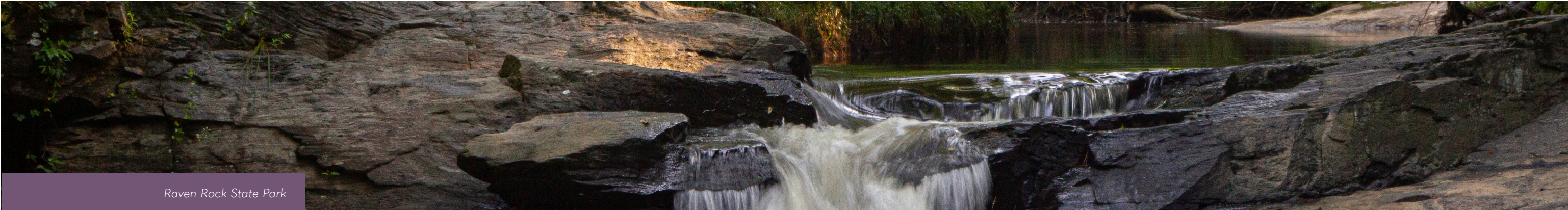


Figure 9. Flood Extents for the 100-Year Storm event



Future Conditions - Risk

Under mid-century future conditions (2050), flood exposure increases across the Cape Fear River Basin. Basin-wide land exposure is projected to reach approximately 19%, a 3% increase from current conditions. Population exposure is also projected to increase, rising from approximately 1% to 2.3%. The increases in future flood conditions result in more than 22,576 households projected to be exposed to flooding by 2050 during a 100-Year Storm, a 197% increase from current conditions.

Figure 10 shows where population exposure intersects with PUBGs, including communities with fewer resources to prepare for, respond to, or recover from flooding (see also Figure 6). These areas may warrant particular attention during action refinement, technical assistance, and implementation planning.

Future flood exposure increases across the basin, though implications vary by area. The Upper Cape Fear continues to have the largest absolute number of exposed residents, the Middle Cape Fear shows broad increases across all counties, and the Lower Cape Fear continues to have extensive land exposure and high relative exposure (see Figure 6). These patterns help explain why area-specific flood resilience approaches are needed.

Table 1 shows counts and damage estimates for anticipated building damages under current and future flood scenarios.

Table 1. Building Damage Estimates for Current and Future Flood Scenarios Across the Cape Fear River Basin

Buildings with flood damages	10-year, current	100-year, current	500-year, current	100-year, 2050	100-year, 2100
Count	3,529	8,791	17,996	26,536	33,635
Percent of Total	0.3%	0.8%	1.6%	2.4%	3.0%
Damage estimates (structures only)	\$120,973,696	\$370,858,451	\$886,117,771	\$1,577,169,063	\$2,328,468,683

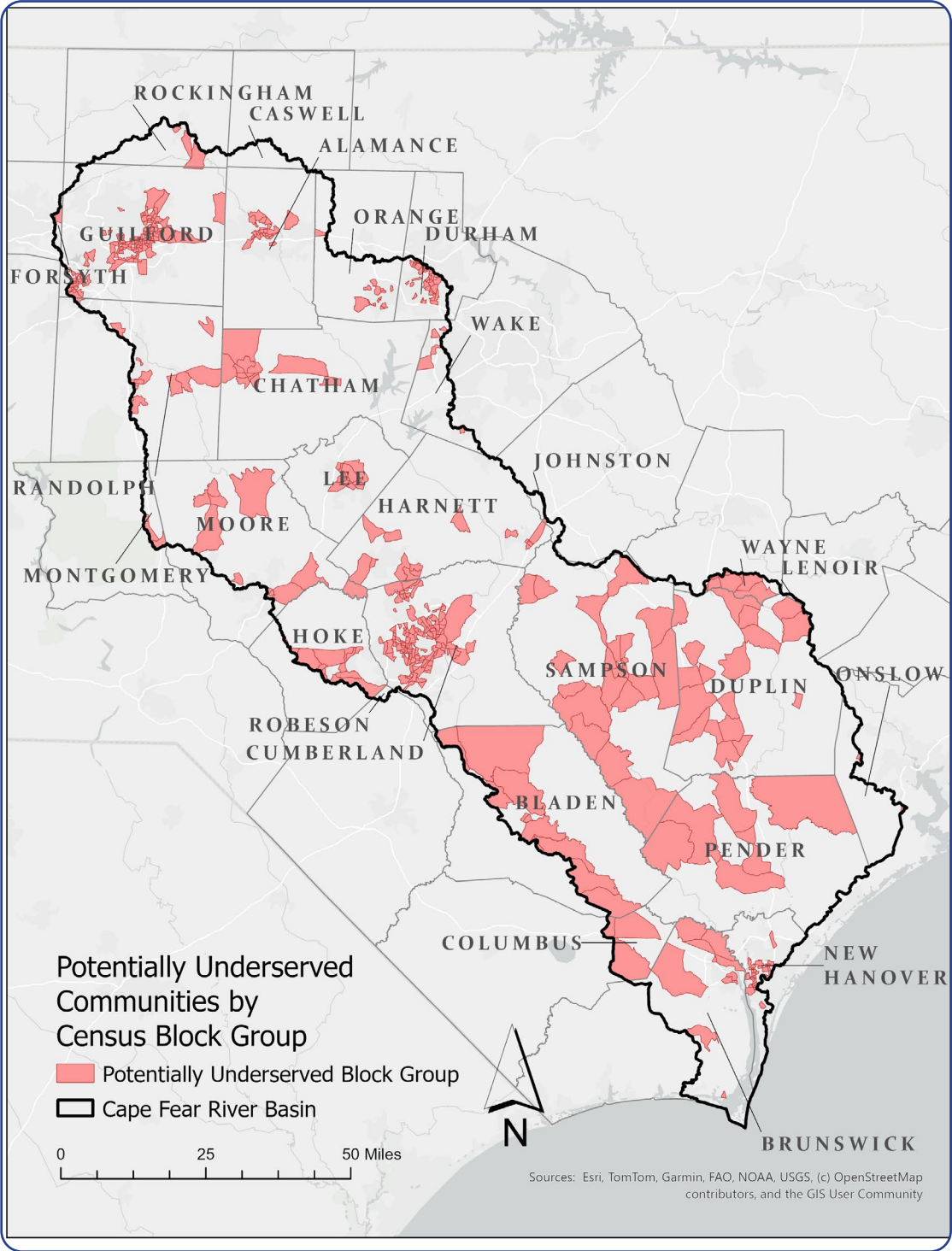


Figure 10: Population exposure based on potentially underserved block groups (PUBGs).



Flood Vulnerability Analysis

Current Conditions - Vulnerability

Under current conditions, flood vulnerability across the Cape Fear River Basin reflects the distribution of at-risk households, critical facilities, and transportation networks. As with flood risk, vulnerability is not uniform across the upper, middle, and lower regions of the basin.

Flood exposure may cause roadway inundation and impact exposed critical facilities, increasing the potential for service disruptions during flood events. Roadway exposure is already widespread, especially in coastal portions of the lower region of the basin, where riverine flooding, coastal flooding, storm surge, king tides, and heavy localized rainfall can combine to affect transportation corridors. Water and transportation infrastructure have notable exposure under current conditions. Flood impacts under current conditions extend beyond direct building damages to affect broader community function and mobility.

Residential structures comprise the largest share of exposed buildings basin-wide and remain the dominant contributor to damages under current conditions. Potentially underserved communities in Sampson, Duplin, and Bladen Counties may require flood resilience actions that are tailored to individual needs and vulnerabilities, such as elevation projects with custom ADA-compliant retrofits, accessible community resilience hubs, multilingual warning systems and risk

information, affordable replacement housing options, and neighborhood-specific infrastructure upgrades. To assess the potential vulnerability of housing stock in the Cape Fear River Basin, approximately 963,000 housing structures were analyzed. This included single-family dwellings, mobile/manufactured homes, duplexes, apartments, condominiums, hotels/motels, dormitories, and nursing homes. The number of vulnerable households ranges from approximately 3,100 during a 10-year storm to over 7,600 in a 100-year storm (a 145% increase), and 16,000 in a 500-year storm (a 111% increase). (Figure 11.)

Counties in the Cape Fear River Basin include low- and moderate-income (LMI) households exposed to the current 100-year floodplain, with the top two counties being Wake County with 2,028 out of over 460,000 households (0.4% of the total) and New Hanover County with 1,000 out of 98,000 households (1% of the total). The largest number of LMI households at the municipal level are located in the City of Durham (742 out of 115,000 or 0.7% of total households).

Table 2 shows how the top 19 communities rank based on anticipated impacts to population, infrastructure, environment, and economy under existing conditions.

Community	Overall Impact	Population Impact	Infrastructure Impact	Environmental Impact	Economic Impact
City of Durham	49	54	47	46	50
City of Greensboro	49	29	49	50	54
City of Wilmington	34	29	35	30	41
Town of Chapel Hill	17	18	9	20	23
Town of Carolina Beach	33	35	36	8	52
Town of Kure Beach	18	11	27	0	33
City of Fayetteville	23	30	24	12	27
City of Burlington	17	14	10	23	22
Town of Apex	12	12	11	7	18
Town of Cary	16	16	11	11	24
City of Dunn	11	10	9	9	15
Town of Morrisville	9	10	4	3	19
Town of Holly Springs	8	3	19	5	5
Town of Fuquay-Varina	8	7	11	6	9
Town of Erwin	10	14	0	10	15
Town of Surf City	25	29	35	2	34
Town of Jamestown	7	5	1	9	15
Town of Wallace	9	6	9	11	12
Town of Carrboro	6	6	4	3	9

Table 2. Community rankings by percent exposure for various categories under existing conditions.

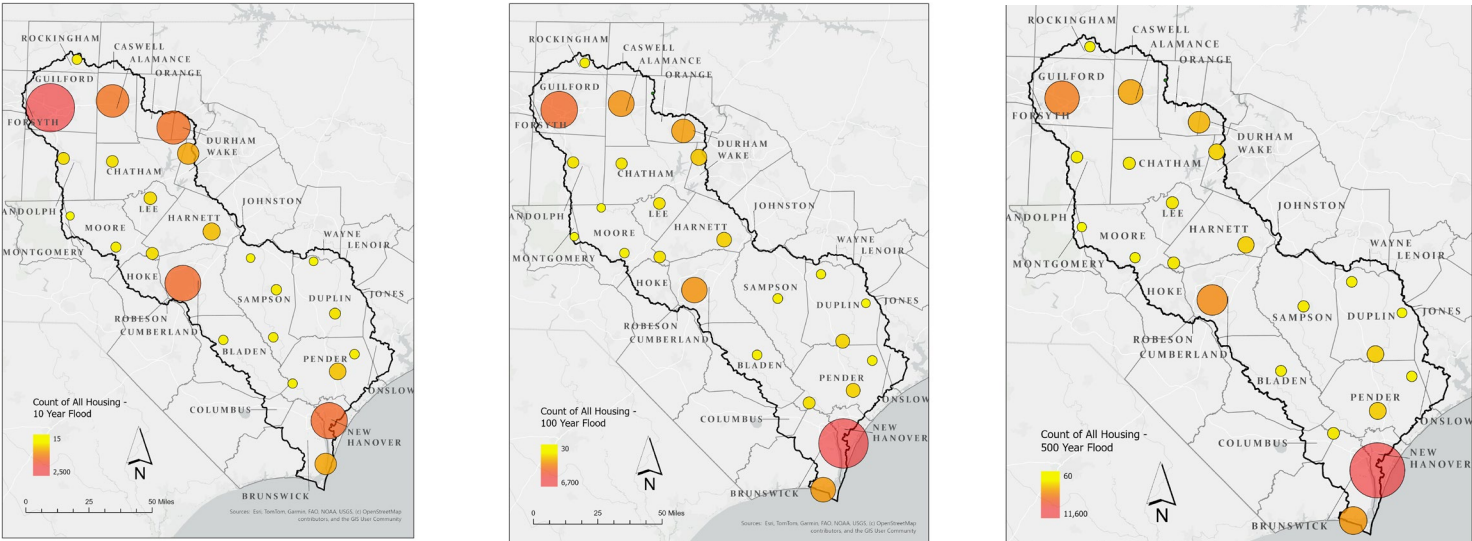


Figure 11. Count of all households exposed to the 100-Year Storm Total

Future Conditions - Vulnerability

Flood vulnerability is expected to increase across the Cape Fear River Basin affecting a greater share of residents, residential structures, critical facilities, and infrastructure systems. Increased exposure increases the potential for flooding to cause disruptions to housing, mobility, utility service, emergency response, and other essential community functions.

Counties in the Cape Fear River Basin are projected to experience a more than 28% increase in residential building exposure. The number of at-risk households ranges from approximately 22,600 during a 100-year storm under 2050 future conditions to nearly 29,000 during a 100-year storm under 2100 future conditions. This at-risk residential property value will increase from \$1.1 billion for the 100-year storm in 2050 to \$1.6 billion for the 100-year storm in 2100. Importantly, the numbers and values of at-risk housing units triples from the 100-year storm event under current conditions to the 100-year storm event under 2100 future conditions. (Figure 12.)

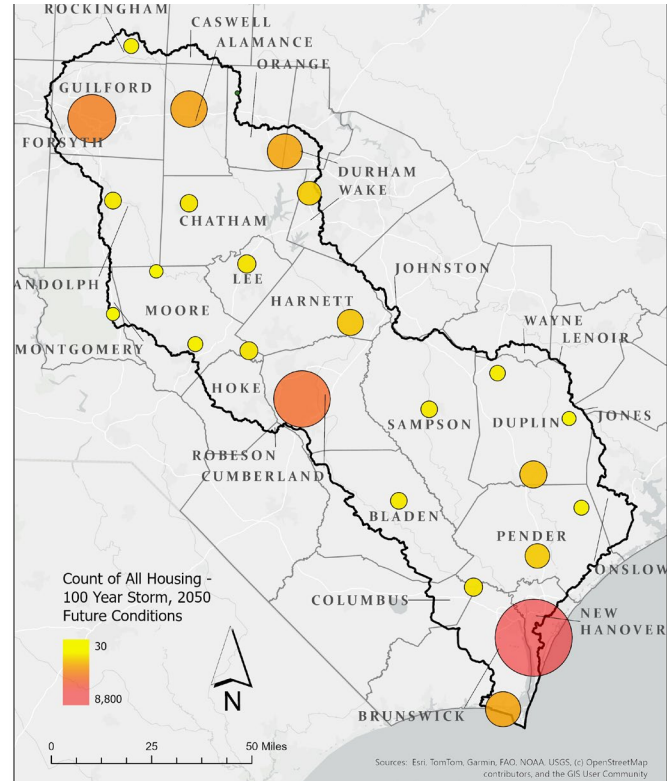


Figure 12. Count of housing units vulnerable to 100-Year Storm conditions in 2050 and 2100

Land exposure and damages are expected to increase, with flooded land area increasing from approximately 19% to 25%. Portions of Cumberland and Hoke Counties may exceed 40% inundation by mid-century. Total exposure in the basin is expected to increase with estimated building damages increasing from approximately \$371 million to about \$2.3 billion. Housing structures at risk is expected to increase from 7,600 under current conditions to 23,000 by 2050 and 29,000 by 2100.

Figure 13 shows building damages by occupancy class under existing and mid-century 100-Year Storm conditions for the Cape Fear River Basin. Commercial structures account for the highest exposure in the basin with nearly 5,000 commercial structures totaling approximately \$9.3 billion in value exposed by mid-century. Future flooding is expected to have increased implications across all sectors.

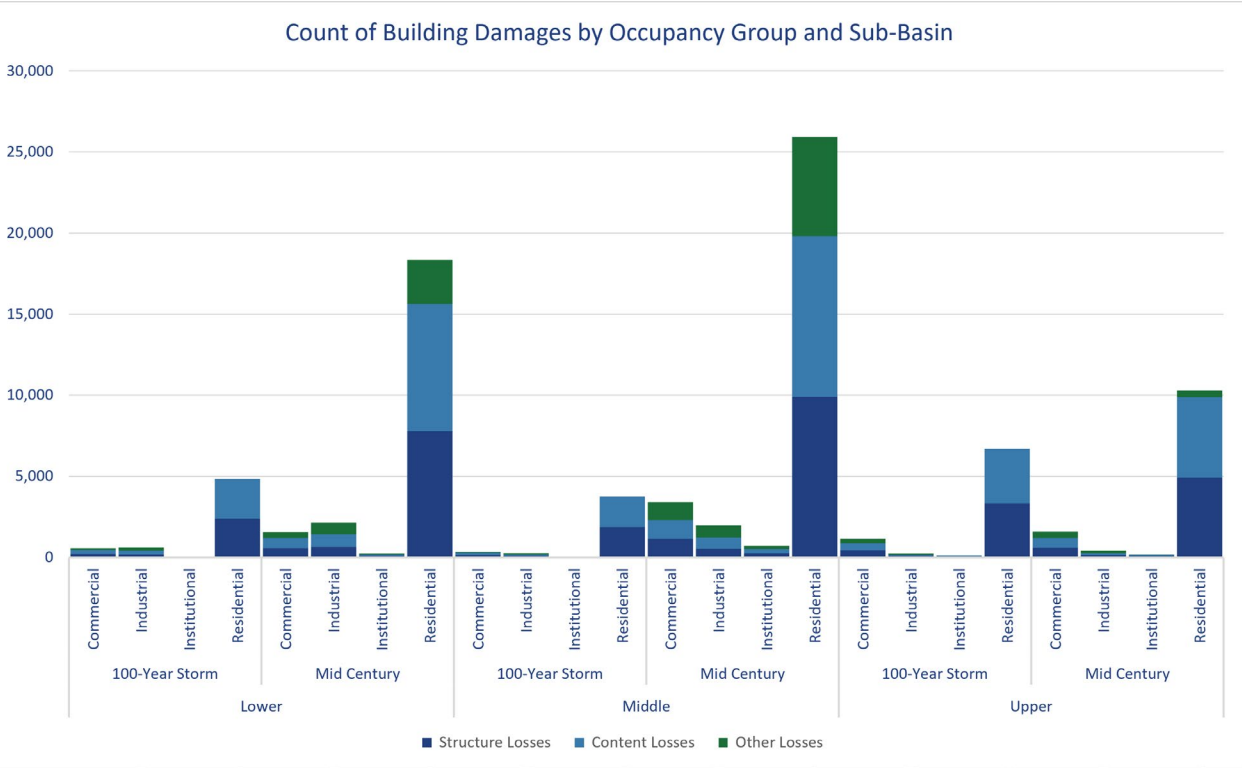


Figure 13. Building damages by occupancy group and sub-basin.



Flooding in Wilmington, NC

Fluvial, Pluvial, Coastal, and Urban and Stormwater - Current and Future

The Blueprint program included support for the NCEM's development of basin-wide 2D engineering hydrologic and hydraulic models. The modeling effort included building-level risk data for current land use and precipitation conditions, reported as risk scores, for all impacted buildings in the Cape Fear River Basin. The NCEM 2D models incorporate future land use and precipitation conditions for two climate scenarios and two buildout conditions scenarios that incorporate future land use (2050 Buildout and 2100 Buildout).

The Mid Century Higher (MCH) scenario represents estimated future conditions for the year 2050. The End of Century Higher (ECL) scenario represents estimated future conditions for the year 2100. The future land use dataset is created by the US Environmental Protection Agency (EPA) and utilizes future population data to create scenarios that predict land use through 2100 (US EPA, 2025). Further information on the modeling of the future and buildout conditions can be found in Appendix E (Flood Risk and Vulnerability Analysis Report).

The NCEM 2D modeling has basin-wide coverage and includes area within urban areas of communities. Since the 2D modeling includes urban areas, the modeling provides flooding extents, risk and vulnerability in areas generally referenced as stormwater flooding. For consistency, information included in the RBAS utilized data from the NCEM's 2D modeling and the Blueprint Tool for urban areas. Communities, especially those with National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) programs, may have more information regarding urban/stormwater flooding

in local stormwater master plans, CIPs, or stormwater modeling that is more detailed than the data provided by the NCEM 2D modeling. In communities with more detailed data, the local data will serve as better input than the 2D modeling for actions within the Blueprint Tool.

Based on information collected in the data collection and from RBAB and Blueprint Partners coordination, it is estimated the stormwater mitigation costs for the Cape Fear River basin could easily reach or exceed \$1billion. The total stormwater improvements and mitigation cost is difficult to summarize as improvement needs can vary significantly from community to community based on the extent of vulnerable assets, local resilience goals, the age of the stormwater program, and funding availability. The variability is highlighted in the following examples:

- Wilmington has a dedicated stormwater fee that contributes at least \$3.7 million annually to the City's CIP for stormwater improvements.
- Greensboro has a long-standing stormwater program that includes budgeting for \$82 million in stormwater related projects for the 2025-2034 planning period.
- Fayetteville has an active stormwater program that has identified significant improvement needs. The Beaver Creek 3 watershed has an area of only 3% of City's toral area and has stormwater improvements estimated to total \$44 million in 2021. If the Beaver Creek 3 watershed stormwater improvement needs are consistent with needs in other City watersheds, the total City need could reach \$1 billion.



Cape Fear River Trail in Fayetteville, NC

Residual Risk – Dams and Levees

Residual risk is exposure to risk in systems where safety features have been put in place. For flooding, this is generally associated with dams and levees, where and for these features residual risk is defined as the risk to flooding associated with failure of the dam or levee. In the Cape Fear River Basin, there are five levees included in the US Army Corps of Engineers (USACE) National Levee Database.

The Clinton Wastewater Treatment plant level system is a series of four earthen levees approximately 0.36 miles in length and approximately five feet in height. The system was constructed in 2000 to provide protection for the wastewater treatment plan from Williams Old Mill Branch. The USACE consider the level system to be very low risk because of no potential loss of life in the event of a breach.

The White Oak Dike is a primarily earthen feature that averages five feet in height in southeastern Bladen County and northwestern Pender County. The total length is

approximately 14.5 miles and was design to protect areas near Kelly from flooding from Buckle Swamp Creek and the Cape Fear River. The USACE indicates the dike has been overtopped twice. The USACE considers the dike to have low risk as the level has not been maintained and unrepaired breaches to allow for water to freely pass through the levee allowing reasonable response times for evacuation.

The NC Dam Safety Program indicates 1,770 dams in the basin, 381 of which are considered High Hazard, 89 are considered Intermediate Hazard, and the remaining 1,300 are Low Hazard. Most of the High Hazard dams are in the Piedmont portion of the basin, as shown in Figure 14 (Upper Cape Fear), Figure 15 (Middle Cape Fear) and Figure 16 (Lower Cape Fear). Hazard classifications are based on the height and total storage of a dam, as well as the potential for loss of life or damage to infrastructure in the event of a dam failure.

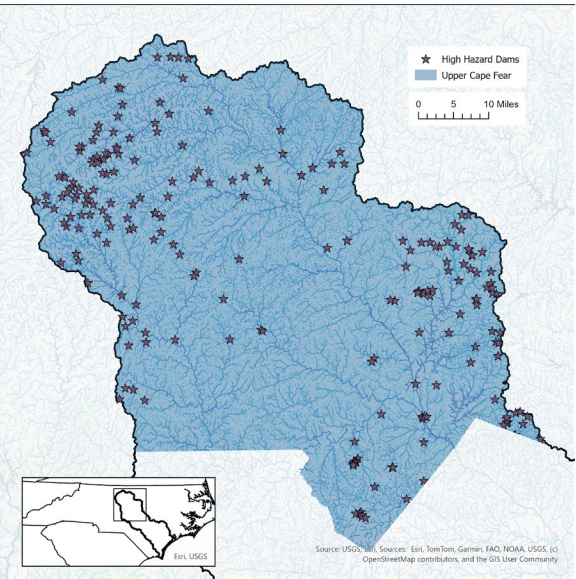


Figure 14. Upper Cape Fear High Hazard Dams

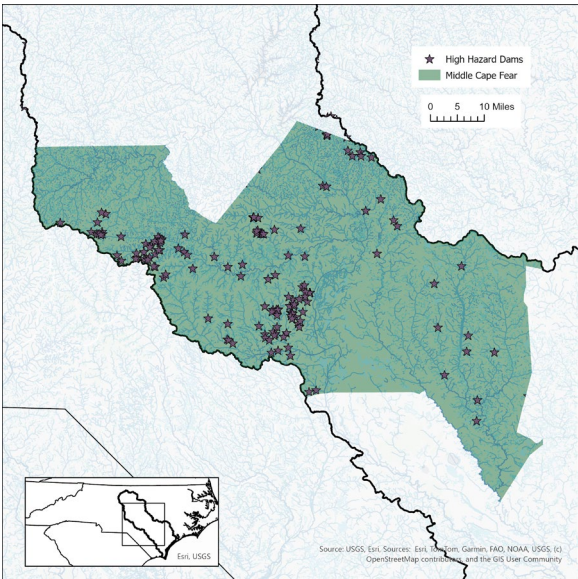


Figure 15. Middle Cape Fear High Hazard Dams

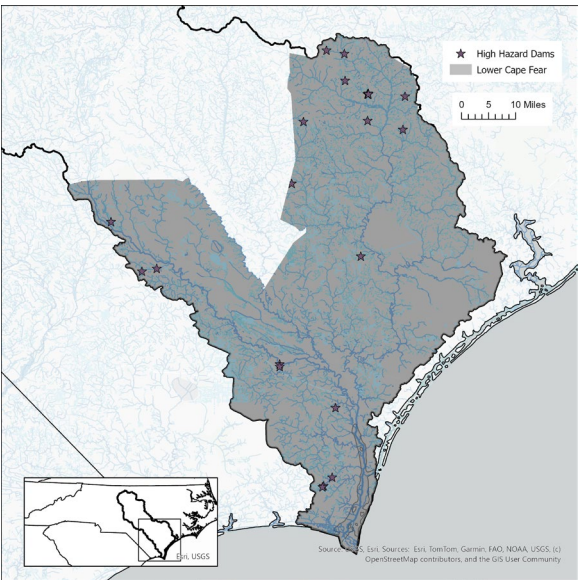


Figure 16. Lower Cape Fear High Hazard Dams

The USACE operates three locks and dams on the Cape Fear River originally constructed to aid in commercial traffic, but currently primarily provide protection for drinking water intakes.

The USACE operates B. Everette Jordan Dam and Lake located in Chatham, Durham, Orange and Wake Counties. The provides flood risk management, water supply, water quality flow and recreation. The project protects 200,000 acres of floodplain downstream, including Fayetteville and is estimated to have prevented nearly \$1.4 billion in flood damage¹⁰.

Dams have very low rates of failure, making comparisons to the flooding events included in the RBAS difficult or the comparison could result in potentially misleading information. Failure can occur from multiple factors, including overtopping of the dam, defects in construction, age of the dam, and maintenance. Additionally, failure can occur concurrently with other flooding events or independently, such as with a “sunny day” failure. As such, risk from residual risk is not included in the RBAS. Vulnerability information for dams with Emergency Action Plans (EAPs) is on file with NC Dam Safety. For more information about NC dams, please visit <https://www.deq.nc.gov/DamSafety>.

Implications for the Cape Fear River Basin Action Strategy

Current and future flood risk and vulnerability analyses inform the Cape Fear RBAS and why a mix of approaches is appropriate. Results from the Cape Fear River Basin Flood Risk and Vulnerability Analysis (Appendix E) were used to develop strategic, vulnerability assessment-based actions to be considered alongside locally prioritized actions, which were developed by Cape Fear River Basin communities. The results of this analysis demonstrate that in order for the Cape Fear RBAS to be effective, it needs to include a variety of action types that address the range of different flood risk conditions across the basin.



Cape Fear River



Snowy egret in the tidal wetlands along the Cape Fear River, Wilmington, NC.



ACTION REVIEW, CREATION, ADJUSTMENT, AND SELECTION

The Cape Fear RBAS translates flood vulnerability analyses and stakeholder engagement outputs into a set of flood resilience actions that can be advanced at the local, regional, or basin-wide scale. The RBAS documents a refined action set and summarizes the evaluation of actions against metrics to identify high priority actions. The flood resilience actions recommended in this RBAS include new actions as well as actions previously documented in locally adopted plans and other relevant documents.

Locally Prioritized Actions

Local governments and their closest partners have a critical understanding of flood resilience needs in their communities. Most of the actions in the RBAS were submitted by local governments as part of Local Action Plans in the Blueprint Tool (or through other communication channels when technology was a barrier). These actions reflect local support and local needs. Many of these actions have already been publicly identified, prioritized and vetted in the community. They may be specific or broad, developed or undeveloped, and they may have no funding, partial funding, or nearly complete funding.

Additional Actions

Additional actions were added from the pre-identified actions list to generate greater geographic balance in the RBAS. A geographic analysis of Tool submittals and review of the communities with the highest vulnerability identified communities where no resilience actions had been submitted. In these locations, actions were added based on:

- Responses to the local government survey
- RCCP plans where applicable, and
- Other pre-identified actions from existing plans in the literature review.

Emphasis was placed on identifying actions in highest vulnerability communities, where possible.

Action Prioritization Process

The action prioritization process used a structured screening and scoring approach to compare flood resilience actions in a consistent and practical way. The methodology was designed to evaluate actions based on their general intent, likely benefit, feasibility, local support, and alignment with the Basin’s guiding principles, which were developed during the community engagement process. The methodology does not require engineering or design-level detail. It was intended to work for a broad range of action types, including capital and non-capital actions such as projects, planning efforts, policy measures, preparedness actions, and other implementation strategies.

Action Screening

Before an action was scored, reviewers used a basin screen test to determine whether it addressed the reduction of flood risk or flood impacts. Actions advanced to scoring if they had a clear flood resilience purpose and / or were intended to reduce flooding, flood damages, exposure, disruption, or recovery burden. This approach allowed the review to include a wide range of action types while maintaining a focus on flood resilience. In general, the following actions passed screening:

- Flood mitigation,
- Buyouts,
- Elevation,
- Floodproofing,
- Floodplain or wetland restoration,
- Warning systems,
- Flood planning, and
- Preparedness or response outreach.

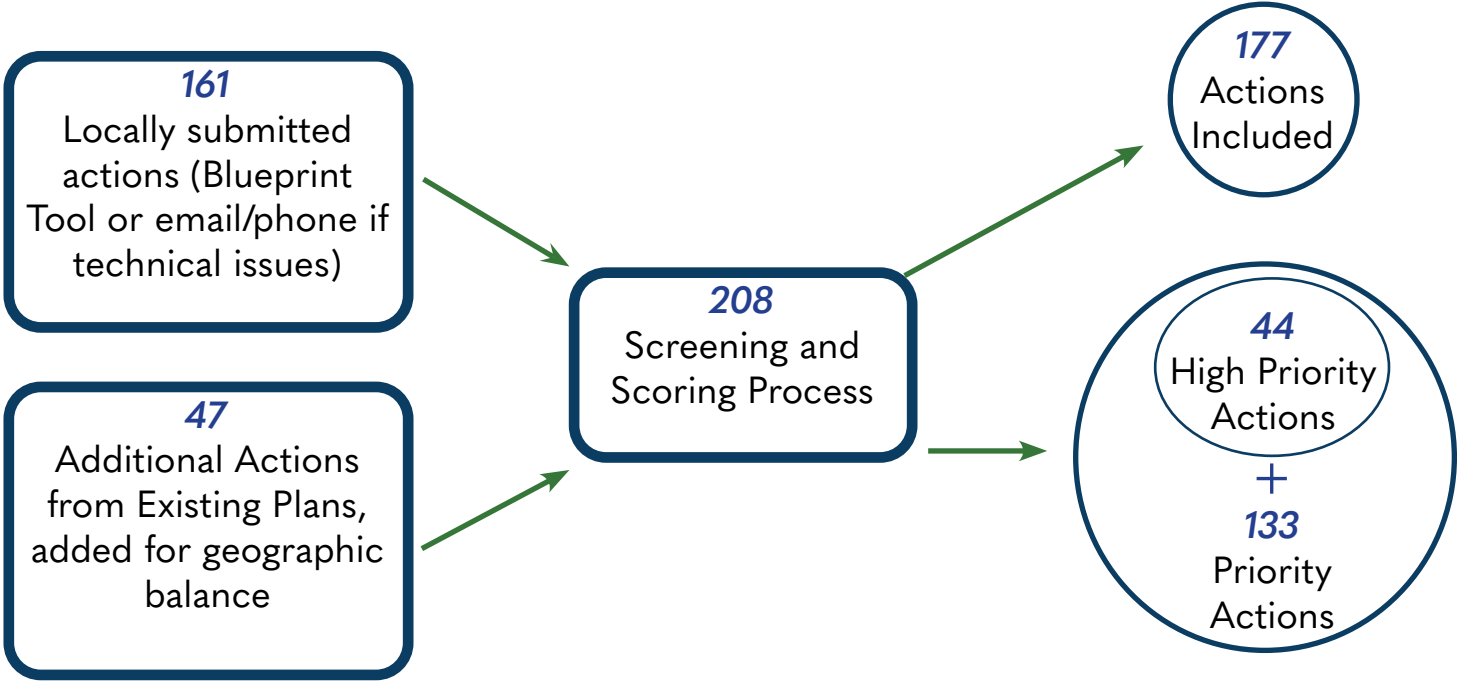
In total, 177 actions were included in the RBAS. All actions meeting the screening criteria were included in the RBAS, and are detailed in Appendix H (Prioritized Actions Profiles).

Action Scoring

After screening, actions were scored using four equally weighted factors: Flood Resilience Benefits, Local Support, Feasibility and Technical Readiness, and Advancement of Guiding Principles. Reviewers used all relevant, readily available information and the general intent of the action, which was especially important because many actions were early-stage or described with limited detail. Where supporting documentation was available, reviewers were encouraged to use it to inform scoring. Apart from the Feasibility and Technical Readiness factor, actions were not penalized simply because they were early stage if the intent was clear and relevant.

Each factor sought to capture key components of the Blueprint Program’s intent.

- The Flood Resilience Benefits factor assessed the extent to which an action reduced flood risk, flood damages, exposure, disruption, or recovery burden.
- The Local Support factor reflected community, local government, or implementing partner backing and whether the action appeared to reflect local priorities.
- The Feasibility and Technical Readiness factor captured whether the action appeared practical and ready to advance based on the information available.
- The Advancement of Guiding Principles factor assessed whether the action supported one or more basin-specific guiding principles in a clear and meaningful way. This last factor was evaluated through short narrative questions and a binary yes/no determination for each principle, allowing for a quick but direct connection to the basin framework.



High Priority Action Selection

To select high priority actions, actions were ordered by score and the highest scoring actions were marked as high priority. Approximately 25 percent of the scored projects were selected as high priorities, or 44 actions total. These actions are listed in the “Prioritized Basin Actions” section and marked in Appendix H (Prioritized Actions Profiles).

Local Action Plans

Local governments are strongly encouraged to continuously update their flood resilience actions within their Local Action Plans in the Blueprint Tool. Therefore, local governments can stay updated on projects that are being pursued and implemented to identify potential co-benefits, and DEQ can be aware of the potential technical and financial needs of communities throughout the basin. Projects prioritized through Local Action Plans are eligible for Blueprint funding.

Action List

The 177 actions in the Cape Fear River Basin Action Strategy include a diversity of action types, costs, and locations. The following list provides key characteristics for each action. The list is organized alphabetically by action type and then by cost. Some actions have a variable cost estimate based on yet-to-be-determined details such as potential participation level for buyouts or elevations, opportunities related to siting an action, or the action is a combination of planning and implementation. For these actions, the relative cost shown in the Action List may vary, potentially dramatically, given the final scale and scope of the action when implemented. For actions with more specific estimated costs, costs are included in Appendix H (Prioritized Actions Profiles).



Lock and Dam # 1 on the Cape Fear River



PRIORITY ACTION LIST

Action Name	Type	Relative Cost Estimate	Community Location
Bald Head Island - Open Space Preservation	Acquisition/Demolition/ Buyouts	\$	Bald Head Island
Coharie - Flood-prone Property Acquisition/Demolition and River Access Enhancement	Acquisition/Demolition/ Buyouts	\$-\$ \$	Clinton
New Hanover County - High-Risk Mitigation Properties	Acquisition/Demolition/ Buyouts	\$ \$-\$ \$ \$	New Hanover County
Carolina Beach - Buyout or Property Transition Exploration	Acquisition/Demolition/ Buyouts	\$ \$-\$ \$ \$	Carolina Beach
Guilford - Acquisition/Demolition of Repetitive Loss Properties	Acquisition/Demolition/ Buyouts	\$ \$ \$ \$	Guilford County
Carrboro - Weatherhill Point Repetitive Loss Acquisition/Demolition Projects	Acquisition/Demolition/ Buyouts	\$ \$ \$ \$	Carrboro
Harnett County - Country Walk Residential Property Mitigation (Elevation, Acquisition/Demolition)	Acquisition/Demolition/ Buyouts	\$ \$ \$ \$-\$ \$ \$ \$ \$ \$	Harnett County
Carrboro - Acquisition and Prioritization of Green Development in Flood-Prone Properties	Acquisition/Demolition/ Buyouts	\$ \$	Carrboro
Orange County - Resilience Hub Planning	Advanced Regulations (Enhanced Zoning)	\$	Orange County
Brunswick County - Flood-Prone Area Mapping	Advanced Regulations (GIS Capacity Building)	\$-\$ \$	Brunswick County
Moore County - Southeast Area Hydrologic and Hydraulic (H&H) Study	Advanced Regulations (GIS Capacity Building)	\$ \$	Moore County
Cumberland County - Resilience Plan Integration	Advanced Regulations (GIS Capacity Building)	\$	Cumberland County
Brunswick County - Public Facilities Location	Advanced Regulations (Land Use and Impervious Surface Restrictions)	\$	Brunswick County

*Actions that did not fit neatly into an action type are marked miscellaneous. Miscellaneous actions include outreach, planning, data collection, and other flood resilience steps not captured in the typology.

** Cost estimates are as follows: \$ < \$100,000; \$ \$ \$100,000 - \$500,000; \$ \$ \$ \$500,000 - \$1M; \$ \$ \$ \$ \$1M - \$5M; \$ \$ \$ \$ \$ \$ > \$5M. Some actions have a variable cost estimate based on yet-to-be-determined details such as potential participation level for buyouts or elevations, opportunities related to siting an action, or the action is a combination of planning and implementation. For these actions, the relative cost shown in the Action List may vary, potentially dramatically, given the final scale and scope of the action when implemented.



Action Name	Type	Relative Cost Estimate	Community Location
Navassa - Cultural Resources Preservation Ordinance Development	Advanced Regulations (Land Use and Impervious Surface Restrictions)	\$	Navassa
Navassa - Future Land Use Feasibility Study for Critical Community Assets	Advanced Regulations (Land Use and Impervious Surface Restrictions)	\$-\$	Navassa
Harnett County - Floodplain and Open Space Protection	Advanced Regulations (Land Use and Impervious Surface Restrictions)	\$	Harnett County
Lee County - Comprehensive Open Space/Reuse Planning	Advanced Regulations (Land Use and Impervious Surface Restrictions)	\$-\$	Lee
Carolina Beach - Carolina Beach Lake Nature-Based Stormwater Improvements	Bioretention	\$\$\$\$-\$\$\$\$\$	Carolina Beach
Eastover - Canal Dredging	Channel Dredging, Widening, Diversion	\$	Eastover
Navassa - Coastal Road Stream Crossing Feasibility and Construction	Coastal - Road Elevation/Modification	\$-\$	Navassa
Navassa - Cedar Hill Stream Crossing and Drainage Improvement	Coastal - Road Elevation/Modification	\$-\$	Navassa
Navassa - Indian Creek Stream Crossing and Drainage Improvement	Coastal - Road Elevation/Modification	\$-\$	Navassa
Carolina Beach - Shoreline and Bulkhead Improvements	Coastal - Road Elevation/Modification	\$\$\$\$	Carolina Beach
Brunswick County - NC-133 Upgrades	Coastal - Road Elevation/Modification	\$\$\$\$	Brunswick County
Carrboro - Real-Time Flood Early Warning System	Critical Infrastructure	\$	Carrboro
Coastal Counties - Water/Wastewater Emergency Generator Upgrades and Purchases	Critical Infrastructure	\$-\$	New Hanover County, Wrightsville Beach, Wilmington
Coastal Counties - Water/Wastewater Vulnerability Analysis	Critical Infrastructure	\$	New Hanover County, Wrightsville Beach, Wilmington

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Action Name	Type	Relative Cost Estimate	Community Location
Leland - Old Fayetteville Road Cross Pipe Replacement	Critical Infrastructure	\$\$\$\$	Leland
Cumberland County - Critical Infrastructure Vulnerability Analysis	Critical Infrastructure	\$-\$	Cumberland County
Mebane - Emergency Water Solutions	Critical Infrastructure	\$-\$	Mebane
Coastal Counties - Improve Water/Wastewater Redundancies	Critical Infrastructure	\$-\$	New Hanover County, Wrightsville Beach, Wilmington
Hoke County - Critical Infrastructure Vulnerability Assessment Program	Critical Infrastructure	\$-\$	Hoke County
Guilford County - Critical Infrastructure Vulnerability Analysis	Critical Infrastructure	\$-\$	Guilford County
Graham - Water Treatment Plant Utility Retrofits	Critical Infrastructure	\$-\$	Graham
Graham - Sewer Sliplining	Critical Infrastructure	\$-\$	Graham
Graham - Emergency Water Solutions	Critical Infrastructure	\$-\$	Graham
Graham - Cooper Road Pump Station Relocation	Critical Infrastructure	\$-\$	Graham
Raeford - Critical Infrastructure Vulnerability Analysis	Critical Infrastructure	\$-\$	City of Raeford
Brunswick County - Leland Sewer Resiliency	Critical Infrastructure	\$\$-\$\$\$	Brunswick County
Brunswick County - Water Main Resiliency	Critical Infrastructure	\$\$-\$\$\$	Brunswick County
Coastal Counties - Water/Wastewater Infrastructure Retrofits	Critical Infrastructure	\$\$-\$\$\$	New Hanover County, Wrightsville Beach, Wilmington
Pender County - Sewer Lift Station Elevations and Retrofits	Critical Infrastructure	\$\$\$-\$\$\$\$	Pender County
Leland - Old Fayetteville Road Cross Pipe Replacement	Critical Infrastructure	\$\$\$\$	Leland

*Actions that did not fit neatly into an action type are marked miscellaneous. Miscellaneous actions include outreach, planning, data collection, and other flood resilience steps not captured in the typology.

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Action Name	Type	Relative Cost Estimate	Community Location
Leland - Lanvale Road/Springstone Road/Old Lanvale Road Roadway Realignment and Drainage Conveyance Improvements	Critical Infrastructure	\$\$\$\$	Leland
Leland - Low Country Boulevard Cross Pipe Improvements	Critical Infrastructure	\$\$\$\$	Leland
Leland - Lanvale Road Cross Pipe Replacement	Critical Infrastructure	\$\$\$\$	Leland
Pender County - Backup Generators for Care Facilities	Critical Infrastructure	\$\$-\$\$\$	Pender County
New Hanover County - Sewer Service Expansion in Flood-Prone Areas	Critical Infrastructure	\$-\$\$\$	New Hanover County
Cumberland County - Little River and Gate Line Stream Debris Removal	Debris Removal	\$-\$\$	Cumberland County
Moore County - Stream Restoration and Debris Removal	Debris Removal	\$-\$\$\$	Moore County
Bladen County - Carolina Bay Wetland Restoration at Egg Bay	Flood Storage Wetlands	\$\$	Bladen County
Bladen County - Carolina Bay Wetland Restoration (Bushy Bay)	Flood Storage Wetlands	\$\$	Bladen County
Holly Shelter Game Land Wetland Restoration and Drainage Improvements	Flood Storage Wetlands	\$\$-\$\$\$	Pender County
Pender County - Angola Bay Game Land Wetland Restoration	Flood Storage Wetlands	\$\$\$\$	Duplin County
Raeford - Forest Conservation and Farmland Preservation	Floodplain Preservation	\$	City of Raeford
Raeford - Floodplain Preservation and Stormwater Management	Floodplain Preservation	\$-\$\$	City of Raeford
New Hanover County - Open Space Corridor Connectivity and Conservation Prioritization Study	Floodplain Preservation	\$-\$\$	New Hanover County

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** Cost estimates are as follows: \$ < \$100,000; \$\$ \$100,000 - \$500,000; \$\$\$ \$500,000 - \$1M; \$\$\$\$ \$1M - \$5M; \$\$\$\$\$ > \$5M. Some actions have a variable cost estimate based on yet-to-be-determined details such as potential participation level for buyouts or elevations, opportunities related to siting an action, or the action is a combination of planning and implementation. For these actions, the relative cost shown in the Action List may vary, potentially dramatically, given the final scale and scope of the action when implemented.



Action Name	Type	Relative Cost Estimate	Community Location
Kernersville - Ciener Botanical Gardens Stream Restoration	Floodplain Preservation	\$-\$\$	Kernersville
Coastal Counties - Floodplain Restoration Upstream of CFPUA Raw Water Intake	Floodplain Preservation	\$-\$\$\$	New Hanover County, Wrightsville Beach, Wilmington
Cape Fear River Floodplain Forest Protection Near Lock and Dam 1	Floodplain Preservation	\$\$-\$\$\$	Bladen County
Brunswick County - Voluntary Hazardous Land Transfer	Floodplain Preservation	\$	Brunswick County
Pender County - Cape Fear River Bottomlands Floodplain Protection	Floodplain Preservation	\$\$\$\$\$	Pender County
Highway 421 Corridor Floodplain Protection	Floodplain Preservation	\$\$\$\$\$	Pender County
Kernersville - Wetland and Open Space Preservation	Floodplain Preservation	\$-\$\$\$	Kernersville
Deep River Basin Floodplain Restoration	Floodplain Restoration	\$\$\$\$\$	Cumnock
Black River/Mingo Swamp Floodplain Restoration	Floodplain Restoration	\$\$\$\$	Falcon
Bakers Swamp Floodplain Restoration	Floodplain Restoration	\$\$-\$\$\$	Eastover
New Hanover County - Lehigh Road Stream Bank Restoration and Outfall Design	Floodplain Restoration	\$-\$\$	New Hanover County
Navassa - Miles Branch Stream Restoration and Debris Removal	Floodplain Restoration	\$-\$\$	Navassa
Navassa - Robin Court Branch Restoration and Debris Removal	Floodplain Restoration	\$-\$\$	Navassa
Navassa - Mill Creek Stream Crossing and Flood Mitigation	Floodplain Restoration	\$-\$\$	Navassa
Coharie - Nature-Based Agricultural Flood Control Measures	Floodplain Restoration	\$-\$\$	Clinton
Navassa - Stormwater and Riparian Restoration	Floodplain Restoration	\$\$-\$\$\$	Navassa

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** Cost estimates are as follows: \$ < \$100,000; \$\$ \$100,000 - \$500,000; \$\$\$ \$500,000 - \$1M; \$\$\$\$ \$1M - \$5M; \$\$\$\$\$ > \$5M. Some actions have a variable cost estimate based on yet-to-be-determined details such as potential participation level for buyouts or elevations, opportunities related to siting an action, or the action is a combination of planning and implementation. For these actions, the relative cost shown in the Action List may vary, potentially dramatically, given the final scale and scope of the action when implemented.



Action Name	Type	Relative Cost Estimate	Community Location
Falcon - Upper South River Tributary Stream and Floodplain Restoration	Floodplain Restoration	\$\$-\$\$\$	Falcon
Vass - Upper Little River Floodplain Restoration	Floodplain Restoration	\$\$-\$\$\$	Moore County near Vass
Bladen County - Black River Floodplain Restoration	Floodplain Restoration	\$\$-\$\$\$	Black River, exact location not captured in our information
Lillington - Collins Creek/Cape Fear Floodplain Restoration	Floodplain Restoration	\$\$\$-\$\$\$\$	Lillington
Fayetteville - Upper Cape Fear Floodplain Restoration	Floodplain Restoration	\$\$\$\$	Fayetteville
Linden - Little River Basin Floodplain Restoration	Floodplain Restoration	\$\$\$\$	Linden
Lee County - High Hazard Dam Inventory	Levee/Dike/Berm	\$\$-\$\$\$	Lee
Bald Head Island - Multi-Hazard Early Warning System	Miscellaneous	\$\$-	Bald Head Island
Wilmington - Resilient Coastal Communities Program (RCCP) Phases 1 & 2 Completion	Miscellaneous	\$\$-	Wilmington
Sanford - Little Buffalo Creak Stream Gauge Installation	Miscellaneous	\$	Lee
New Hanover County - Wastewater Pump Generators	Miscellaneous	\$\$-\$\$\$	New Hanover County
New Hanover County - Upper Smith Creek Watershed Resilient Coastal Communities Program (RCCP) Phases 1 & 2 Completion	Miscellaneous	\$\$-\$\$\$	New Hanover County
Moore County - Dam Monitoring and Warning System	Miscellaneous	\$\$-\$\$\$	Moore County
Harnett County - Hazard Data Collection	Miscellaneous	\$\$	Harnett
Onslow County - Flood Warning Signage and Stream Gauge Installation	Miscellaneous	\$\$-\$\$\$	Onslow County

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** Cost estimates are as follows: \$ < \$100,000; \$\$ \$100,000 - \$500,000; \$\$\$ \$500,000 - \$1M; \$\$\$\$ \$1M - \$5M; \$\$\$\$\$ > \$5M. Some actions have a variable cost estimate based on yet-to-be-determined details such as potential participation level for buyouts or elevations, opportunities related to siting an action, or the action is a combination of planning and implementation. For these actions, the relative cost shown in the Action List may vary, potentially dramatically, given the final scale and scope of the action when implemented.

CAPE FEAR RIVER BASIN ACTION STRATEGY DEVELOPMENT PROCESS



Action Name	Type	Relative Cost Estimate	Community Location
Central Pines Region - Privately Owned Dam and Stormwater Inventory	Miscellaneous	\$\$-\$\$\$\$	Chatham, Johnston, Lee, and Moore
New Hanover County - Floodplain Management Best Practices Implementation	Multi-use Floodplains	\$	New Hanover County
Kernersville Parks and Greenway Development and Stormwater Management	Multi-use Floodplains	\$	Kernersville
Dunn - Stoney Run Dam Removal and Wetland Restoration	New and Existing Dam Structures	\$\$-\$\$\$	Dunn
Vass - Crystal Lake Dam Repair/Retrofit	New and Existing Dam Structures	\$\$\$\$	Vass
Fayetteville - College Lakes Dam Retrofit	New and Existing Dam Structures	\$\$\$\$	Fayetteville
Fayetteville - Arran Lakes West Dam Upgrades	New and Existing Dam Structures	\$\$\$\$	Fayetteville
Broadway - Watson Lake Dam Rehabilitation (Phase 2)	New and Existing Dam Structures	\$\$\$\$	Broadway
Wilmington - Wrightsville Ave Enhancements and Drainage	Permeable Pavement	\$\$\$\$	Wilmington
Navassa - Church Street Stream Crossing and Drainage Improvement	Raingardens/Sand Filters/Bio-Swales	\$\$-	Navassa
Orange County - Rainwater Rewards Program Implementation	Raingardens/Sand Filters/Bio-Swales	\$\$-	Orange County
Cumberland County - Emergency Operations Center (EOC) Relocation	Relocation	\$\$\$\$	Cumberland County
New Hanover County - Evacuation Route Planning and Drainage Improvements	Roadway Elevation/Road Crossing Modification	\$	New Hanover County
Sandy Creek - Joe Baldwin Drive Culvert Replacement	Roadway Elevation/Road Crossing Modification	\$\$\$\$	Sandy Creek

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** Cost estimates are as follows: \$ < \$100,000; \$\$ \$100,000 - \$500,000; \$\$\$ \$500,000 - \$1M; \$\$\$\$ \$1M - \$5M; \$\$\$\$\$ > \$5M. Some actions have a variable cost estimate based on yet-to-be-determined details such as potential participation level for buyouts or elevations, opportunities related to siting an action, or the action is a combination of planning and implementation. For these actions, the relative cost shown in the Action List may vary, potentially dramatically, given the final scale and scope of the action when implemented.

CAPE FEAR RIVER BASIN ACTION STRATEGY DEVELOPMENT PROCESS



Action Name	Type	Relative Cost Estimate	Community Location
Vass - Culvert Improvements	Roadway Elevation/Road Crossing Modification	\$\$\$\$	Vass
Cumberland County - Roadway Elevation and Upgrades	Storm Water Management Activities	\$\$\$\$\$	Cumberland County
Brunswick County - Gauge Expansion	Storm Water Management Activities	\$	Brunswick County
Burgaw - West Wilmington Street Drainage Improvements	Storm Water Management Activities	\$\$-\$\$\$	Burgaw
Brunswick County - Gauge Installation	Storm Water Management Activities	\$\$-\$	Brunswick County
Fayetteville - Rockford Drive Drainage Improvements	Storm Water Management Activities	\$\$\$\$\$	Fayetteville
Brunswick County - Flood Elevation Awareness Signs	Storm Water Management Activities	\$\$-\$	Brunswick County
Fayetteville - Rhemish Drive Drainage Improvements	Storm Water Management Activities	\$\$\$\$\$	Fayetteville
Cumberland County - Stream Gauge Installation and Maintenance	Storm Water Management Activities	\$\$	Cumberland County
Brunswick County - Navassa Storm Drainage	Storm Water Management Activities	\$\$-\$	Brunswick County
Brunswick County - Bald Head Stormwater Outfall	Storm Water Management Activities	\$\$-\$	Brunswick County
Wilmington - Elisha Dr./Camberly Dr./Gregory Rd Drainage Enhancements	Storm Water Management Activities	\$\$-\$	Wilmington
Graham - Pomery/Travora/Marshall Street Culvert Replacements	Storm Water Management Activities	\$\$-\$	Graham
Graham - Harden/Franklin/Wilson/Ward Street Culvert Replacements	Storm Water Management Activities	\$\$-\$	Graham
Mebane - Brown Street Culvert Replacement	Storm Water Management Activities	\$\$-\$	Mebane

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Action Name	Type	Relative Cost Estimate	Community Location
Elon - Travis Creek Pump Station Upgrades	Storm Water Management Activities	\$\$-\$	Elon
Gibsonville - Joyner Street Culvert Replacement	Storm Water Management Activities	\$\$-\$	Gibsonville
Pleasant Garden - Stormwater Management Planning	Storm Water Management Activities	\$\$-\$	Pleasant Garden
New Hanover County - Daniel Boone/Daisy Lee Culvert Replacements	Storm Water Management Activities	\$\$-\$	New Hanover County
New Hanover County - 101 Colechester Place Ditch Improvements	Storm Water Management Activities	\$\$-\$	New Hanover County
New Hanover County - Pumpkin Creek Ditch and/or Culvert Upgrade	Storm Water Management Activities	\$\$-\$	New Hanover County
New Hanover County - Acorn Branch Ditch and/or Culvert Upgrade	Storm Water Management Activities	\$\$-\$	New Hanover County
New Hanover County - Upper Motts Creek Ditch and/or Culvert Upgrade	Storm Water Management Activities	\$\$-\$	New Hanover County
New Hanover County - Heritage Park Ditch and/or Culvert Upgrade	Storm Water Management Activities	\$\$-\$	New Hanover County
Burgaw - Hydrologic & Hydraulic (H&H) Study	Storm Water Management Activities	\$\$-\$	Burgaw
New Hanover County - Avalon Overflow Path Pipe and Ditch Installation	Storm Water Management Activities	\$\$-\$	New Hanover County
New Hanover County - Sapling Circle Ditch and Culvert Improvements	Storm Water Management Activities	\$\$-\$	New Hanover County
New Hanover County - Birds Nest Pipe Replacement	Storm Water Management Activities	\$\$-\$	New Hanover County
New Hanover County - Blue Clay Road Ditch and Culvert Improvements	Storm Water Management Activities	\$\$-\$	New Hanover County
New Hanover County - Bavarian/Brook-green Ditch and Outfall Improvements	Storm Water Management Activities	\$\$-\$	New Hanover County

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Action Name	Type	Relative Cost Estimate	Community Location
Burgaw - Osgood Canal Stream Restoration/Flood Mitigation Program	Storm Water Management Activities	\$-\$ \$	Burgaw
Raeford - Patterson Street and East Prospect Street Storm Drainage Improvements	Storm Water Management Activities	\$-\$ \$	City of Raeford
New Hanover County - Rockwell Street Pipe Replacement	Storm Water Management Activities	\$-\$ \$	New Hanover County
New Hanover County - Newry Way Ditch Improvements	Storm Water Management Activities	\$-\$ \$	New Hanover County
New Hanover County - Sago Palm Drive Pipe System Upgrade	Storm Water Management Activities	\$-\$ \$	New Hanover County
New Hanover County - Berkley Ditch Improvements and Tree Removal	Storm Water Management Activities	\$-\$ \$	New Hanover County
Bladen County - Comprehensive Stormwater Infrastructure Study	Storm Water Management Activities	\$-\$ \$	Bladen County
Duplin County - Stormwater Management Planning	Storm Water Management Activities	\$-\$ \$	Duplin County
Coharie - 2D Hydraulic Model/Study for Great Coharie Watershed	Storm Water Management Activities	\$-\$ \$	Clinton
Pender County - Drainage Improvements at 18 Pre-Identified Sites	Storm Water Management Activities	\$-\$-\$ \$	Pender County
Lillington - Pipe Upgrade/Replacement	Storm Water Management Activities	\$ \$	Lillington
Graham - GML Spillway Replacement	Storm Water Management Activities	\$ \$-\$-\$ \$	Graham
Pender County - Drainage Maintenance Implementation	Storm Water Management Activities	\$ \$-\$-\$ \$	Pender County
Fayetteville - Ashbrook Road Drainage Improvements	Storm Water Management Activities	\$ \$-\$-\$ \$	Fayetteville
Brunswick County - Sandy Creek Drive Roadway Enhancements	Storm Water Management Activities	\$ \$-\$-\$ \$	Brunswick County

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Action Name	Type	Relative Cost Estimate	Community Location
Wilmington - Clear Run Branch Phase 2 Stormwater and Restoration	Storm Water Management Activities	\$ \$-\$-\$ \$	Wilmington
Raeford - Stormwater System Upgrades	Storm Water Management Activities	\$ \$-\$-\$ \$	City of Raeford
Lillington - Roadway Infrastructure Repair and Replacement	Storm Water Management Activities	\$ \$ \$	Lillington
Lillington - 13th Street Stormwater Infrastructure Improvements	Storm Water Management Activities	\$ \$ \$ \$	Lillington
Lillington - James Street Stormwater Infrastructure Improvements	Storm Water Management Activities	\$ \$ \$ \$	Lillington
Lillington - 11th Street Stormwater Infrastructure Improvements	Storm Water Management Activities	\$ \$ \$ \$	Lillington
Lillington - Regional Stormwater Pond Development	Storm Water Management Activities	\$ \$ \$ \$	Lillington
Carolina Beach - Stormwater Function Improvements	Storm Water Management Activities	\$ \$ \$ \$-\$ \$ \$ \$ \$ \$	Carolina Beach
Cumberland County - NC 24 Corridor Connectivity Improvements	Storm Water Management Activities	\$ \$ \$ \$ \$	Cumberland County
Lillington - East Killiegrey Street Stormwater Infrastructure Improvements	Storm Water Management Activities	\$ \$ \$ \$	Lillington
Lee County - Digital Flood Risk Data Management	Stormwater, Water Quality, Floodplain Regulations	\$ \$-\$-\$ \$	Lee
Brunswick County - Floodprone Areas Protections	Stormwater, Water Quality, Floodplain Regulations	\$	Brunswick County
Brunswick County - Baseline Parcel Data for Flood	Stormwater, Water Quality, Floodplain Regulations	\$	Brunswick County
Durham County - Higher Standards Enforcement and Flood Retrofits	Stormwater, Water Quality, Floodplain Regulations	\$	Durham County

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Action Name	Type	Relative Cost Estimate	Community Location
Kernersville - Green Infrastructure Implementation for Water Quality and Stormwater Management	Stormwater, Water Quality, Floodplain Regulations	\$	Kernersville
Central Municipalities - High Density Stormwater Study for 10-Year Detention	Stormwater, Water Quality, Floodplain Regulations	\$	Graham, Mebane, Elon, & Gibsonville
Guilford County - Flood Response Plan Development	Stormwater, Water Quality, Floodplain Regulations	\$	Guilford
Durham County - Regional Stormwater Mapping Assessment	Stormwater, Water Quality, Floodplain Regulations	\$-\$	Durham County
Warsaw - Stormwater Study Completion	Stormwater, Water Quality, Floodplain Regulations	\$-\$	Sampson County
Kernersville - Low Impact Design Flood Mitigation Alternatives	Stormwater, Water Quality, Floodplain Regulations	\$-\$	Kernersville
Kernersville - Green Infrastructure Planning and Implementation	Stormwater, Water Quality, Floodplain Regulations	\$-\$	Kernersville
Central Municipalities - Local Flood Studies	Stormwater, Water Quality, Floodplain Regulations	\$-\$	Graham, Mebane, Elon, & Gibsonville
Central Municipalities - Localized Flood Areas Analysis	Stormwater, Water Quality, Floodplain Regulations	\$-\$	Graham, Mebane, Elon, & Gibsonville
Central Municipalities - 50/50 Stormwater Program	Stormwater, Water Quality, Floodplain Regulations	\$-\$	Elon & Gibsonville
Central Municipalities - Phase 2 Stormwater Project	Stormwater, Water Quality, Floodplain Regulations	\$-\$	Graham, Mebane, Elon, & Gibsonville
Orange County - Affordable Housing Retrofits	Structural Elevation	\$-\$	Orange County
Hoke County - Emergency Operations Center (EOC) Upgrade	Utility Elevation	\$\$\$-\$\$\$\$	Hoke County
Hoke County - County Assets Vulnerability Analysis	Utility Elevation	\$	Hoke County
New Hanover County - Floodplain Pump Station Elevations	Utility Elevation	\$-\$	New Hanover County

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CAPE FEAR RIVER BASIN ACTION STRATEGY

FLOOD RESILIENCY VISION & GUIDING PRINCIPLES

To guide development of the Cape Fear RBAS, stakeholders contributed to a vision and guiding principles that would reflect the unique characteristics, priorities, and values of the Cape Fear River Basin. An initial set of meetings was held in Fall 2025 to gather stakeholders around this topic. A follow-up survey was offered to RBAG and Blueprint Partners who were unable to attend meetings in person. During these engagements, stakeholders described the flood resilience strategies that have been most successful across the Basin. They also identified issues that are often overlooked when discussing flood resilience in their communities. These responses and other stakeholder insights were distilled into a single vision and set of guiding principles. Together with other Blueprint materials, local input, and stakeholder advice, the vision and guiding principles informed goal development, strategy development, and action prioritization.

Vision

Communities across the Cape Fear River Basin will be safe, connected, and thriving—able to prosper while minimizing flood impacts to people, infrastructure, and the economy. The basin will use data-driven planning, include nature-based solutions, and direct equitable investment so all communities can adapt to and recover from heavy rainfall, hurricanes, and coastal flooding.

Guiding Principles

Natural systems are the first defense

Protect and restore natural systems—healthy rivers, creeks, wetlands, and floodplains—as the first line of defense against flooding. Emphasize green stormwater practices which also improve water quality, recreation, and habitat, further reducing flood impacts.

Data driven, long range planning

Plan for the long term and use the best available data and science. Design for future conditions and base decisions on up-to-date modeling, mapping, and flood monitoring.

Plan regionally, implement locally

Coordinate across jurisdictions. Align multi jurisdictional efforts so upstream and downstream measures deliver shared basin wide benefits while enabling local implementation.

Prioritize vulnerable places and people

Prioritize funding, technical assistance, and actions for communities and residents most at risk. Secure staffing and technical assistance for smaller communities.

Protect critical infrastructure and services

Build and maintain resilience in transportation, water, wastewater, power, and health facilities so communities can continue to function during and after floods. Ensure that funding for long-term maintenance and operations is included.

Flood wise development

Protect property values, reduce future losses, and create marketable, durable assets through wise development. Mitigate existing at-risk properties; do not create new risky development that the next generation will have to mitigate. Discourage development that increases risk for current structures. Encourage clear guidance, model ordinances, incentives, and permitting predictability.

Measurable outcomes

Define clear metrics, monitor performance, and report progress so the plan demonstrates benefits and informs adaptive adjustments. Publish methods as well as prioritization criteria, costs, and expected lifespan of investments so stakeholders understand decisions.



Pilot, evaluate, and scale

Use demonstration projects with defined evaluation and maintenance plans to show benefits and expand successful approaches across the basin.

Preparedness, warnings, and public education

Strengthen gauge coverage, monitoring, real time alerts, mapping, and community outreach so people and institutions can act before, during, and after events.

GOALS AND STRATEGIES

To bridge the gap from the vision and guiding principles to specific actions, the Action Strategy uses a set of tailored goals and strategies. The goals and strategies are based on three sources of Cape Fear Blueprint input:

- All the projects submitted by local government or other stakeholders, regardless of score or whether they were deemed high priority
- Input from RBAG and Blueprint Partners, including Guiding Principles
- All pre-identified actions cataloged in the literature review. These are actions that appear in local, regional, or state plans that have flood resilience benefits

Goals and strategies organize actions within a repeatable framework of flood risk reduction tailored to the Cape Fear River Basin. They also ensure that the objectives of local communities and other stakeholders are captured in the RBAS, even if specific actions have not yet been identified.

Cape Fear River Basin Goals

- Goal 1. Protect people and life safety
- Goal 2. Strengthen critical systems
- Goal 3. Restore and use natural systems
- Goal 4. Reduce flood risk through land use and development
- Goal 5. Build a pathway to implementation

Three to five strategies for each goal are enumerated in the next section of the RBAS.

WHAT IS AN ACTION?

In the context of this Action Strategy, an action is a flood mitigation or resilience measure that can be implemented by a local government or a set of partners. Actions may be capital projects, policy and planning measures, or other defined efforts that reduce risk of flooding. Actions may be local, regional, or basin-wide in scale, and may require coordination across jurisdictions or sectors.

Actions are organized into five main categories within the Blueprint Tool: Building Level Mitigation, Channel Modification, Infrastructure & Control Structures, Nature Based Solutions, Policy & Planning, and others. Below, the action categories and action types are described. Action types featured in this Cape Fear RBAS reflect a variety of both flood mitigation best practices expected and approaches to addressing region-specific flooding concerns. Updates to the Cape Fear RBAS may result in the inclusion of additional action types as novel approaches and technologies continue to emerge.



Building Level Mitigation

ACTION TYPES

- Relocation
- Utility Elevation
- Acquisition/Demolition/Buyouts
- Dry Floodproofing
- Mitigation Reconstruction
- Wet Floodproofing
- Structural Elevation

The building level mitigation action category highlights targeted physical and policy measures implemented at the individual structure scale to reduce flood exposure and improve resilience. Action types include Relocation (moving a structure or people out of a high-risk area), Utility Elevation (raising critical mechanical, electrical, and plumbing systems), Acquisition/Demolition/Buyouts (buying and/or removing vulnerable structures), Dry Floodproofing (sealing a structure to prevent floodwaters from entering), Mitigation Reconstruction (rebuilding or retrofitting a structure to improved standards), Wet Floodproofing (designing a structure to allow controlled inundation while minimizing damage), and Structural Elevation (raising the structure above forecasted flood levels).

Building level mitigation delivers risk reduction where people live and work, providing a path to loss reduction and continuity of operations at the smallest scale. These actions protect life and property, lower insurance and recovery costs, and preserve community assets and economic recovery after flooding events. They also offer flexible, scalable options, from individual property upgrades to neighborhood-scale buyouts, which can be prioritized based on cost-effectiveness and environmental considerations. Since these actions operate at the individual structure scale, they can sometimes be faster to implement than projects at the local-government wide or interjurisdictional scale, but they can sometimes face funding and private property ownership challenges.

Channel Modification

ACTION TYPES

- Debris Removal
- Channel Dredging, Widening, Diversion

Channel modification actions include interventions designed to alter natural or manmade waterways to improve their capacity and functionality. Key Action types include Debris Removal (clearing blockages such as sediment, vegetation, and waste) and Channel Dredging, Widening, and Diversion (deepening, expanding, or redirecting channels to increase flow capacity and reduce bottlenecks).

Channel modification actions help manage flood risk by enabling water to flow more efficiently and predictably through vulnerable areas. By removing debris and altering channels, these interventions help prevent blockages and overflow, reducing the likelihood of disruptive and damaging floods. Channel modifications minimize property damage, protect critical infrastructure, and support rapid recovery by moving flood waters away from vulnerable areas to reduce disruptions. These actions can restore or enhance natural water movement.



Infrastructure & Control Structures

ACTION TYPES

- Storm Water Management Activities
- Levee/Dike/Berm
- Critical Infrastructure
- Quarries
- Roadway Elevation/Road Crossing Modification
- New and Existing Dam Structures

Infrastructure and control structures include a range of engineered systems that prevent or redirect water from reaching vulnerable areas. Action types include Storm Water Management Activities (such as retention basins and green infrastructure), Levee/Dike/Berm construction (earthen or structural barriers preventing overflow), Critical Infrastructure protection (safeguarding utilities and essential services), Quarries (used for temporary water storage), Roadway Elevation/Road Crossing Modification (raising or redesigning roads to prevent flooding), and New and Existing Dam Structures (controlling water flow and storage).

Infrastructure and control structure actions are a key part of flood resilience strategies because they block or redirect water, keeping it away from people, property, and essential services. Protecting critical infrastructure ensures that power, water, healthcare, communications, and other critical services remain operational during and after flooding events. Collectively, these actions are crucial for maintaining public safety, minimizing economic disruption, and quickly recovering after severe flooding events by preventing water from moving into areas where it can do the most harm.

Nature Based Solutions

ACTION TYPES

- Water Farming
- Permeable Pavement
- Bioretention
- Green Roofs
- Living Shorelines
- Raingardens/Sand Filters/Bio-Swales
- Afforestation
- Floodplain Preservation
- Flood Storage Wetlands
- Floodplain Restoration
- Riparian Buffers

Nature based solutions (NBS) actions leverage natural processes and green infrastructure to manage water while enhancing ecosystem services. Key action types include Water Farming (temporarily storing water on agricultural land), Permeable Pavement (allowing water to infiltrate through surfaces), Bioretention (using soil and plants to filter and store runoff), Green Roofs (vegetated rooftops that absorb and slow the release of rainfall), Living Shorelines (using natural materials to stabilize coasts), Raingardens/Sand Filters/Bio-Swales (landscape features that capture and treat runoff), Afforestation (planting trees to increase infiltration and reduce runoff), Floodplain Preservation (protecting existing floodplains that absorb water) and Floodplain Restoration (restoring floodplains to original or enhanced water absorbing capacities), Flood Storage Wetlands (areas that absorb and release floodwaters), and Riparian Buffers (vegetated zones along waterways).

Nature based solutions provide an array of benefits for flood risk reduction by harnessing the power of natural processes and landscapes. These solutions help to slow, absorb, and safely move excess water, reducing the intensity and frequency of flooding events. By increasing the capacity of soil and vegetation to capture and store rainfall, nature-based actions lower runoff and decrease the likelihood of overwhelming drainage systems. Restored wetlands, floodplains, and riparian buffers provide natural storage areas for floodwaters, protecting downstream communities from sudden surges. Additionally, nature-based solutions improve water quality, support biodiversity, and offer recreational and aesthetic value to local communities. They are often cost-effective, adaptable, and sustainable, making them a resilient approach to managing flood risks.



Policy & Planning

ACTION TYPES

- Advanced Regulations (Land Use and Impervious Surface Restrictions)
- Stormwater, Water Quality, Floodplain Regulations
- Advanced Regulations (GIS Capacity Building)
- Multi-Use Floodplains
- Advanced Regulations (Enhanced Zoning)

Policy and planning actions focus on the frameworks and regulatory tools that govern how communities prepare for and manage flood risks. Key action types include Advanced Regulations such as land use and impervious surface restrictions (limiting development and hard surfaces in vulnerable areas), Stormwater, Water Quality, and Floodplain Regulations (guiding how water is managed and protected), Advanced Regulations for Geographic Information System (GIS) Capacity Building (enhancing data-driven decision-making through geographic information systems), Multi-Use Floodplains (designating areas for recreation, habitat, and temporary water storage), and Enhanced Zoning (adapting land use codes to reflect flood risk).

Planners, policymakers, and local governments use these actions to inform which flood risk reduction measures are required, permitted, funded, prioritized, and implemented. By setting clear regulations and guidelines, these actions promote development that occurs in safer locations, that infrastructure is built to withstand flooding, and that natural landscapes are preserved for their protective benefits. Strong policy and planning frameworks create the foundation for coordinated, long-term flood risk management, ensuring that public resources are invested wisely and that communities become more resilient over time. Local governments have noted that current state statutes limit their ability to adopt many policies that would help prevent development that can increase future flood risk and damages.

Other

ACTION TYPES

- Coastal - Road Elevation/Modification
- Coastal - Building Mitigation
- Beaver Management

Some actions do not fit neatly into the other categories of actions. The actions in the 'other' category, however, are still critical to flood resilience and blend across action categories where special considerations are required. Coastal Road Elevation or Modification is the elevation of roadways that are impacted by coastal flooding. Coastal Building Mitigation is building level adaptation strategies that account for the periodic or enduring flooding that comes with coastal and tidal conditions, including storm surge, saltwater intrusion, and others. Beaver management includes actively managing beaver populations and removing beaver-made dams to restore the natural flow of waterways and prevent blockages that worsen flooding during heavy rainfall events.



PRIORITIZED BASIN ACTIONS



Aerial View of the Cape Fear River

A Diversity of Actions for Different Communities

This section presents the goals, strategies, and the 177 actions of the Cape Fear River Basin RBAS. Ideally, a local action aligns with the conditions of the area it is intended to serve. In the Cape Fear RBAS, those conditions include the physical, environmental, and policy context of a place, as well as the flood hazards it faces and the constraints that may affect whether an action is feasible. Action alignment also depends on a place’s vulnerability—that is, the people, structures, infrastructure, services, and natural systems most likely to be affected by flooding. Together, context and vulnerability help explain why the same action may be a priority for one community but less effective or infeasible in another.

As flood risk changes across the Cape Fear River Basin, the mix of resilience actions needed to address that risk may also change. In some cases, communities may need additional policy or decision-making flexibility to respond proactively to changing conditions. Future updates to the RBAS may also create opportunities to expand the range of action types, including emerging financial, policy, or structural approaches to improving flood resilience.

Goals, Strategies, Critical Needs, and Actions

The actions included in the RBAS are organized by goal. Each goal section provides recommendations about critical needs, a table of actions, and profiles for select actions to illustrate examples of flood resilience solutions across the basin. Some actions align with recommended critical needs, while others highlight locally supported or technically appropriate approaches. Some goals and strategies have many actions. Others reflect desires of Cape Fear stakeholders and needs identified by Basin-wide analysis that are not yet filled by a full suite of actions. The Blueprint Tool provides a mechanism for continual update of local action plans as actions to address needs continue to be identified.

Descriptions, maps, and supporting details for each profiled action are included within the relevant goal section. This structure is intended to show how basin-wide analysis, stakeholder input, and action screening translate into specific flood resilience priorities.

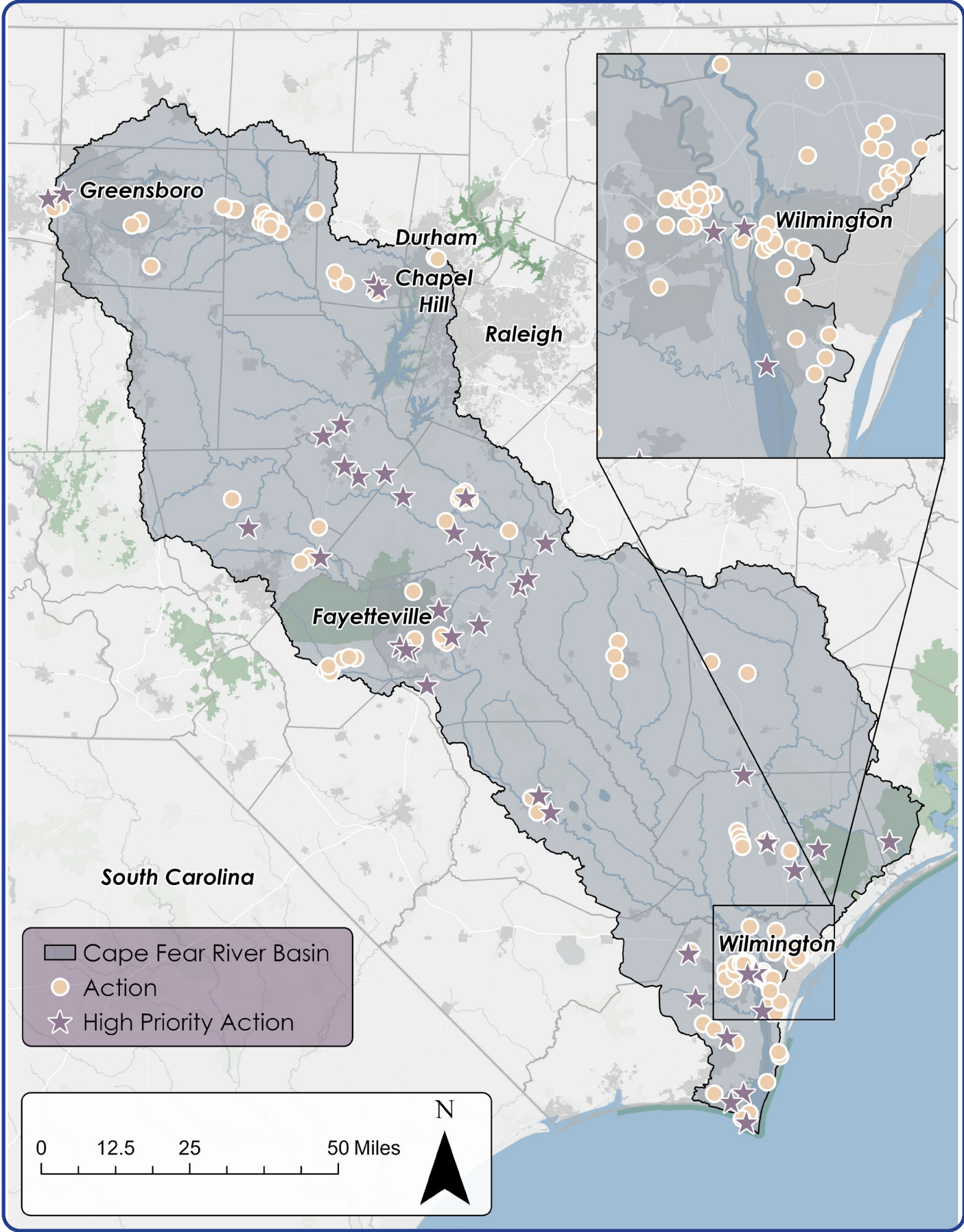


Figure 17: Basin-Wide Map with High Priority and Actions identified.

GOAL 1. PROTECT PEOPLE AND LIFE SAFETY

In the Cape Fear River Basin, protecting people and life safety means reducing the threat posed by riverine flooding, flash flooding, roadway overtopping, dam failure, and delayed emergency response across fast-changing urban, suburban, rural, and coastal areas. This goal is especially important in communities that are repeatedly impacted during storms. This goal calls for early warning systems, safe evacuation routes, public alert systems, and focused attention on vulnerable households that may have fewer resources to prepare or recover. Because many Basin communities rely on a limited number of critical access routes and low-water crossings, this goal supports actions that reduce the chance of isolation, stranded vehicles, and rescue operations. It also reinforces the need to prioritize life safety before, during, and after flood events.

Strategy 1.1: Protect Critical Facilities and Emergency Services

Critical facilities and emergency services are the backbone of flood response in the Cape Fear River Basin. To help safeguard public safety, fire stations, EMS hubs, EOCs, shelters, wastewater facilities, and other essential assets must remain functional during flood events. In many Cape Fear communities, these facilities are near flood-prone corridors, low-lying neighborhoods, or aging drainage systems that can fail under extreme conditions. Protecting these facilities means identifying flood exposure, improving access roads, elevating equipment, adding backup power, and reducing water intrusion risks. Safeguarding these assets helps preserve continuity of operations, public safety, and rapid recovery.

Strategy 1.2: Improve Evacuation Routes, Access, and Life Safety Systems

Evacuation routes and warning systems are critical in a basin where flooding can cut off neighborhoods, rural roads, and major transportation corridors. In the Cape Fear River Basin, this strategy supports safer movement during hurricanes, flash floods, and dam-related emergencies by improving road resilience, identifying alternate routes, and giving residents clearer, earlier warnings. It also supports technologies such as flood gauges, road-closure alerts, real-time mapping, and predictive notifications tied to water level thresholds. This strategy connects transportation, emergency management, and flood forecasting into a more coordinated basin-wide system that improves readiness, reduces confusion, and saves lives.

Strategy 1.3: Prioritize Most Vulnerable Communities

Flood risk in the Cape Fear River Basin is not experienced equally. Vulnerable communities and households may face greater exposure because of location, lower incomes, older housing, mobility limitations, language barriers, or limited access to transportation and insurance. This strategy focuses attention on people who are most likely to need assistance before, during, and after flood events. In practice, that means directing warning systems, evacuation support, mitigation investments, and recovery resources toward neighborhoods where impacts are most severe and where residents may have the fewest options. Additionally, social vulnerability should be considered alongside physical flood risk when ranking projects.

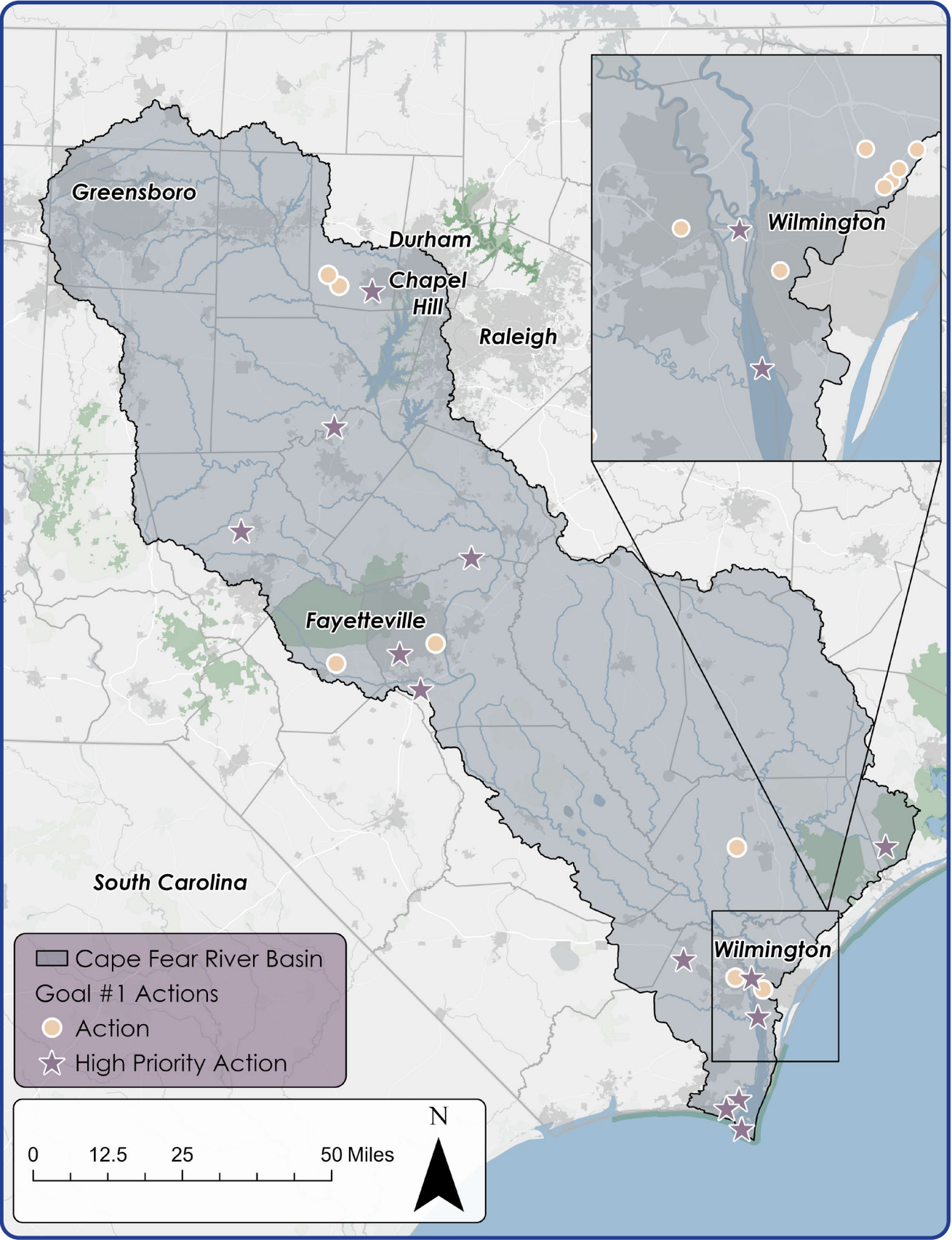


Figure 18: Basin-Wide Map with Goal 1 High Priority and Actions identified.



Goal 1. Protect People and Life Safety / Actions Descriptions

Goal 1. Protect people and life safety includes 20 actions focused on reducing the risks of emergency flooding for Cape Fear River Basin residents. Thirteen actions were identified as high priority actions, which include locally prioritized actions submitted by Carrboro, Fayetteville, Leland, Sandy Creek, Brunswick County, Lee County, New Hanover County, and Cape Fear Public Utility Authority. These actions reflect a range of action types, with a particular focus on infrastructure considerations. *Strategy 1.3: Prioritize Most Vulnerable Communities is an approach captured in many of the actions included in this and other goals, and two actions were selected to illustrate it.*

Recommended Critical Needs

- Add water level gauges at additional flood-prone locations
- Establish or improve early warning systems
- Improve flood depth signage and public warning information on low-water roads
- Protect critical facilities that must remain operational during floods
- Improve access to isolated or frequently flooded communities
- Use data and stakeholder input to ensure that most at risk or socially vulnerable communities are served by flood risk reduction actions

Profiled Actions

- Carrboro Real-Time Flood and Roadway Warning System
- Sandy Creek Joe Baldwin Drive Culvert Replacement Project
- Onslow County Flood Warning Signage and Stream Gauge Installation
- Moore County Dam Monitoring and Warning System

Priority Action List

**High priority actions are highlighted in blue.*

Action Name	Type*	Relative Cost Estimate*	Community Locations
Strategy 1.1 Protect critical facilities and emergency assets			
Orange County - Resilience Hub Planning	Advanced Regulations (Enhanced Zoning)	\$	Orange County
Pender County - Backup Generators for Care Facilities	Critical Infrastructure	\$\$-\$\$\$\$	Pender County
Coastal Counties - Water/Wastewater Emergency Generator Upgrades and Purchases	Critical Infrastructure	\$\$-\$\$\$\$	New Hanover County, Wrightsville Beach, Wilmington
Cumberland County - Emergency Operations Center (EOC) Relocation	Relocation	\$\$\$\$\$	Cumberland County

*Actions that did not fit neatly into an action type are marked miscellaneous. Miscellaneous actions include outreach, planning, data collection, and other flood resilience steps not captured in the typology.

** Cost estimates are as follows: \$ < \$100,000; \$\$ \$100,000 - \$500,000; \$\$\$ \$500,000 - \$1M; \$\$\$\$ \$1M - \$5M; \$\$\$\$\$ > \$5M. Some actions have a variable cost estimate based on yet-to-be-determined details such as potential participation level for buyouts or elevations, opportunities related to siting an action, or the action is a combination of planning and implementation. For these actions, the relative cost shown in the Action List may vary, potentially dramatically, given the final scale and scope of the action when implemented.

PRIORITIZED BASIN ACTIONS



Action Name	Type*	Relative Cost Estimate*	Community Locations
Hoke County - Emergency Operations Center (EOC) Upgrade	Utility Elevation	\$\$\$-\$\$\$\$\$	Hoke County
Strategy 1.2 Improve evacuation routes, access, and life safety systems			
Carrboro - Real-Time Flood Early Warning System	Critical Infrastructure	\$	Carrboro
Bald Head Island - Multi-Hazard Early Warning System	Miscellaneous	\$-\$\$	Bald Head Island
Onslow County - Flood Warning Signage and Stream Gauge Installation	Miscellaneous	\$\$-\$\$\$\$	Onslow County
Moore County - Dam Monitoring and Warning System	Miscellaneous	\$\$-\$\$\$\$	Moore County
Sanford - Little Buffalo Creak Stream Gauge Installation	Miscellaneous	\$	Lee County
New Hanover County - Evacuation Route Planning and Drainage Improvements	Roadway Elevation/ Road Crossing Modification	\$	New Hanover County
Brunswick Gauge Expansion	Storm Water Management Activities	\$	Brunswick County
Brunswick Flood Elevation Awareness Signs	Storm Water Management Activities	\$-\$\$	Brunswick County
Brunswick Gauge Installation	Storm Water Management Activities	\$-\$\$	Brunswick County
Cumberland County - Stream Gauge Installation and Maintenance	Storm Water Management Activities	\$\$	Cumberland County
Fayetteville - Rhemish Drive Drainage Improvements	Storm Water Management Activities	\$\$\$\$\$	Fayetteville
Cumberland County - Roadway Elevation and Upgrades	Storm Water Management Activities	\$\$\$\$\$	Cumberland County

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** Cost estimates are as follows: \$ < \$100,000; \$\$ \$100,000 - \$500,000; \$\$\$ \$500,000 - \$1M; \$\$\$\$ \$1M - \$5M; \$\$\$\$\$ > \$5M. Some actions have a variable cost estimate based on yet-to-be-determined details such as potential participation level for buyouts or elevations, opportunities related to siting an action, or the action is a combination of planning and implementation. For these actions, the relative cost shown in the Action List may vary, potentially dramatically, given the final scale and scope of the action when implemented.

PRIORITIZED BASIN ACTIONS



Action Name	Type*	Relative Cost Estimate*	Community Locations
Leland - Old Fayetteville Road Cross Pipe Replacement	Critical Infrastructure	\$\$\$\$	Leland
Strategy 1.3 Prioritize Most Vulnerable Communities			
Sandy Creek - Joe Baldwin Drive Culvert Replacement	Roadway Elevation/Modification	\$\$\$\$\$	Sandy Creek
Orange County - Affordable Housing Retrofits	Structural Elevation	\$-\$	Orange County

*Actions that did not fit neatly into an action type are marked miscellaneous. Miscellaneous actions include outreach, planning, data collection, and other flood resilience steps not captured in the typology.

** Cost estimates are as follows: \$ < \$100,000; \$\$ \$100,000 - \$500,000; \$\$\$ \$500,000 - \$1M; \$\$\$\$ \$1M - \$5M; \$\$\$\$\$ > \$5M. Some actions have a variable cost estimate based on yet-to-be-determined details such as potential participation level for buyouts or elevations, opportunities related to siting an action, or the action is a combination of planning and implementation. For these actions, the relative cost shown in the Action List may vary, potentially dramatically, given the final scale and scope of the action when implemented.



Greenfield Lake

PRIORITIZED BASIN ACTIONS



Aerial View of flooding in the Cape Fear River Basin after Hurricane Florence

PRIORITIZED BASIN ACTIONS





Downtown Wilmington along the Cape Fear River

Carrboro - Real-Time Flood and Roadway Warning System

Community:
Carrboro

Cost:
\$50, 000

Goal:
Protect people and life safety

Strategies:
1.2 Improve evacuation routes, access, and warning systems; 5.1 Ground actions in local data and watershed-scale analysis

Guiding Principles:
Prioritize vulnerable places and people; Preparedness, warnings, and public education

Source:
Locally prioritized

Category:
Infrastructure & Control Structures

Type:
Critical Infrastructure

Priority:
High

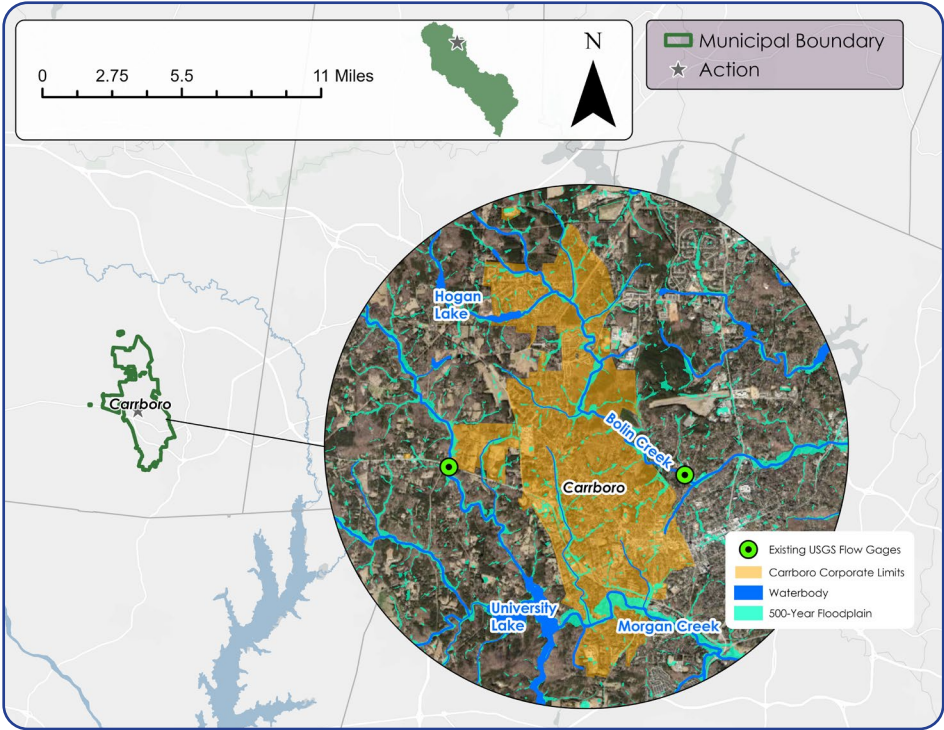


Figure 19: Carrboro Real-Time Flood and Roadway Warning System Action Map.

The Town of Carrboro is proposing a real-time flood and roadway warning system to improve life safety, evacuation decision-making, and access during flood events. Modeled after similar early warning systems used in other communities, this project would place low-cost sensors at strategic locations to monitor water levels at culverts and other vulnerable points in the roadway network. The system would provide alerts when roads may be flooding, helping residents and emergency managers make faster, better-informed decisions about when to evacuate or avoid travel.

In addition to sensor-based monitoring, the system would integrate streaming data sources such as roadway closures, transportation information, flood predictions, and other emergency notification tools to create a coordinated, real-time information network. This action is to be developed in coordination with County Operations and the County’s Ready, Set, Go emergency notification system.



Sandy Creek - Joe Baldwin Drive Culvert Replacement

Community:
Sandy Creek

Cost:
\$18,207,083

Goal:
Protect people and life safety

Strategies:
1.3 Prioritize vulnerable communities and households; 2.2 Upgrade drainage, stormwater, and conveyance systems; 2.3 Retrofit roads and streets

Guiding Principles:
Prioritize vulnerable places and people, Protect critical infrastructure and services

Source:
Locally prioritized

Category:
Infrastructure & Control Structures

Type:
Roadway Elevation/Rod Crossing Modification

Priority:
High

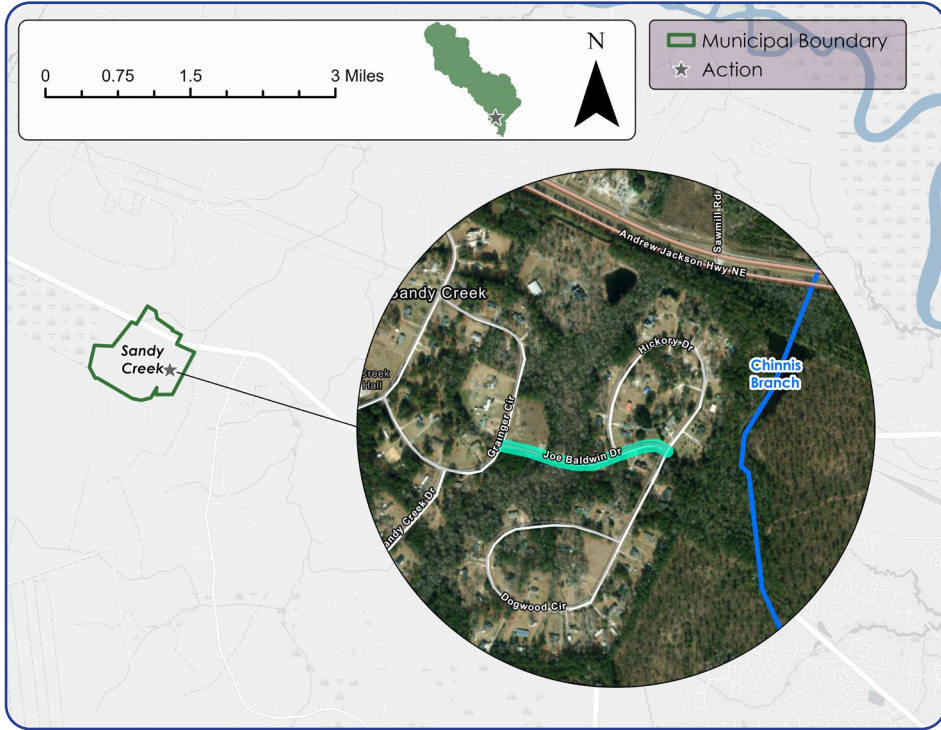


Figure 20: Sandy Creek - Joe Baldwin Drive Culvert Replacement Action Map.

The Joe Baldwin Drive Culvert Replacement action will address a critical access and evacuation vulnerability in Sandy Creek, a small town in Brunswick County. Joe Baldwin Drive serves as the only point of access for 46 homes, but the roadway frequently floods where it crosses Chinnis Branch, leaving the road impassable during storm events. In the past, residents beyond the crossing have been unable to evacuate safely, and emergency response has been delayed or unavailable because floodwaters blocked access. For this small rural community, maintaining reliable roadway access is essential for both day-to-day mobility and life safety during emergencies.

The Town is currently working with an engineering firm to design replacement of the existing 36-inch reinforced concrete pipe culvert, but implementation funding has not yet been secured. The proposed improvements, which may include upsizing the culvert and/or elevating the roadway, are necessary to keep this evacuation route open during flooding and reduce recurring roadway overtopping.





Port of Wilmington

Onslow County - Flood Warning Signage and Stream Gauge Installation

Community:
Onslow County

Cost:
\$500,000-\$1,000,000

Goal:
Protect people and life safety

Strategies:
1.2 Improve evacuation routes, access, and warning systems; 5.1 Ground actions in local data and watershed-scale analysis

Guiding Principles:
Prioritize vulnerable places and people, Protect critical infrastructure and services, Preparedness, warnings, and public education

Source:
Onslow County Hurricane Matthew Resilient Redevelopment Plan

Category:
Other

Type:
Miscellaneous

Priority:
High

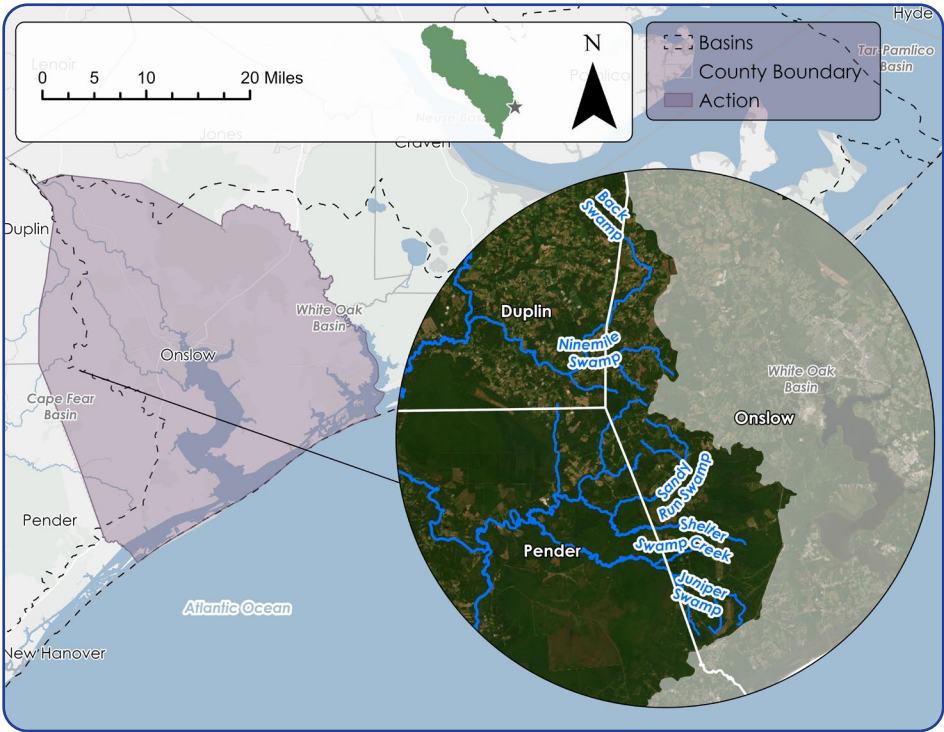


Figure 21: Onslow County Flood Warning Signage and Stream Gauge Installation Action Map.

The Onslow County Flood Warning Signage and Stream Gauge Installation action will strengthen public safety by improving both flood warning communication and real-time monitoring across the County. The project, submitted as part of the Onslow County Hurricane Matthew Resilient Redevelopment Plan, proposes installing flood depth warning signs at low-water priority locations where road blockages and drainage issues frequently create hazardous conditions. In many cases, drivers mistakenly believe a flooded road is passable, increasing the risk of vehicles becoming stranded and requiring dangerous swift-water rescues. By providing clearer warnings at vulnerable crossings, the County can reduce life safety risks for residents, passengers, and first responders.

The action also includes installing additional stream and river monitoring gauges to improve flood prediction capabilities for emergency managers. Proposed gauge locations include Marine Corps New River Air Station on the New River and Swansboro on the White Oak River, supplementing the County's existing gauge at Richlands. These additional gauges would provide more accurate stage information and help support earlier flood response and public communication. Together, the warning signs and monitoring network would improve countywide flood preparedness, situational awareness, and emergency decision-making.



Moore County - Dam Monitoring and Warning System

Community:
Moore County

Cost:
\$500,000-\$1,000,000

Goal:
Protect people and life safety

Strategies:
1.2 Improve evacuation routes, access, and warning systems; 2.5 Reduce shared risk related to dams and stormwater facilities

Guiding Principles:
Data-driven long range planning; Plan regionally, implement locally; Prioritize vulnerable places and people; Pilot, evaluate, scale; Preparedness, warnings, and public education

Source:
Moore County Hurricane Matthew Resilient Redevelopment Plan, continued interest confirmed by local government

Category:
Other

Type:
Miscellaneous

Priority:
High

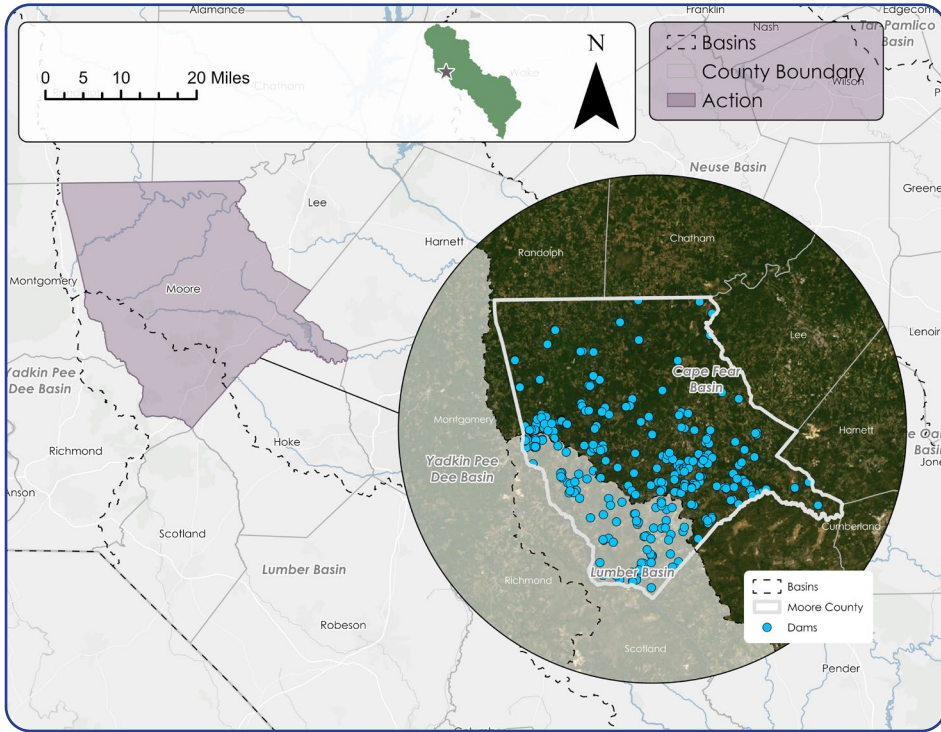


Figure 22: Moore County Dam Monitoring and Warning System Action Map.

Moore County is proposing a dam monitoring and early-warning system to improve flood safety and support more effective management of interconnected dam systems across the County. The action, proposed in the Moore County Hurricane Matthew Resilient Redevelopment Plan, would install gauges at priority locations to provide better real-time information on flow conditions, particularly in areas where high-risk dams may affect downstream structures and public safety. Because the County currently has no stream gauges in place, this effort would significantly improve situational awareness and give emergency managers better tools to anticipate and respond to changing conditions.

The County has identified several priority locations for monitoring, including areas north of Lake Surf, within the northern and central corridor of the County, and potentially near or south of Crystal Lake and Whispering Pines. The action also recognizes the importance of monitoring and possible repair needs at several high-risk dams, including Woodlake, Lake Auman, Seven Lakes, Pine Lake, Pine Valley Pond, and Thagards Lake. By building out an early-warning network and improving dam oversight, this action will help reduce downstream risk, strengthen emergency preparedness, and protect public safety across Moore County.



GOAL 2. STRENGTHEN CRITICAL SYSTEMS

The Cape Fear River Basin depends on interconnected critical systems that must function during storms, flooding, and recovery. Drainage networks, roads, utilities, wastewater facilities, and dams all influence how water moves through the Basin and how communities operate during emergencies. This goal recognizes that failures in one system can quickly cascade into others, causing disrupted access, contaminated water, power loss, and prolonged flooding. Strengthening critical systems means improving infrastructure condition, adding redundancy, and preparing for future conditions that may exceed past design standards. It also means understanding how systems interact across jurisdictional boundaries.

Strategy 2.1: Map infrastructure and assess system vulnerability

Mapping infrastructure and assessing system vulnerability is essential in the Cape Fear River Basin to identify where flooding impacts critical assets, how the assets are connected, and how the assets fail under stress. This strategy supports inventories and vulnerability analyses for roads, bridges, culverts, drainage systems, utilities, wastewater assets, dams, and public facilities. By combining floodplain data, topography, hydraulic modeling, and local knowledge, communities can identify weak points and locations where one failure could create cascading or widespread consequences. In rapidly developing areas, better mapping is also needed to keep pace with changing land use and flood conditions. This work helps governments move from reactive response to proactive planning, ensuring investments are based on actual exposure and system performance.

Strategy 2.2: Upgrade drainage, stormwater, and conveyance systems

Across the Cape Fear River Basin, many flooding problems are associated with undersized pipes, clogged ditches, culverts with inadequate capacity, and stormwater systems that cannot handle modern rainfall. This strategy focuses on physical improvements that move water more safely through developed areas. Projects often involve upsizing pipes, widening ditches, adding storm system collection inlets, improving outfalls, and redesigning stormwater routes so runoff stays within the right-of-way or reaches safer discharge points. These improvements are especially important where repeated flooding affects neighborhoods, major roads, and access to schools, shelters, or industrial areas.

Strategy 2.3: Retrofit roads and streets

Route connectivity and mobility is critical for everything from life safety to economic activity. In areas with a limited number of access points, even one flooded crossing can isolate homes or delay emergency response. In the Cape Fear River Basin, this mitigation may include roadway elevation, regrading, permeable pavement, green street design, roadside infiltration, and related drainage improvements. These actions can reduce ponding, support safe traffic circulation, and improve the reliability of evacuation and emergency access. Note that evacuation route improvements are included under *Goal 1. Protect People and Life Safety*. Roadway projects focused on hydraulics are listed under Strategy 2.2, but relevant here as well.

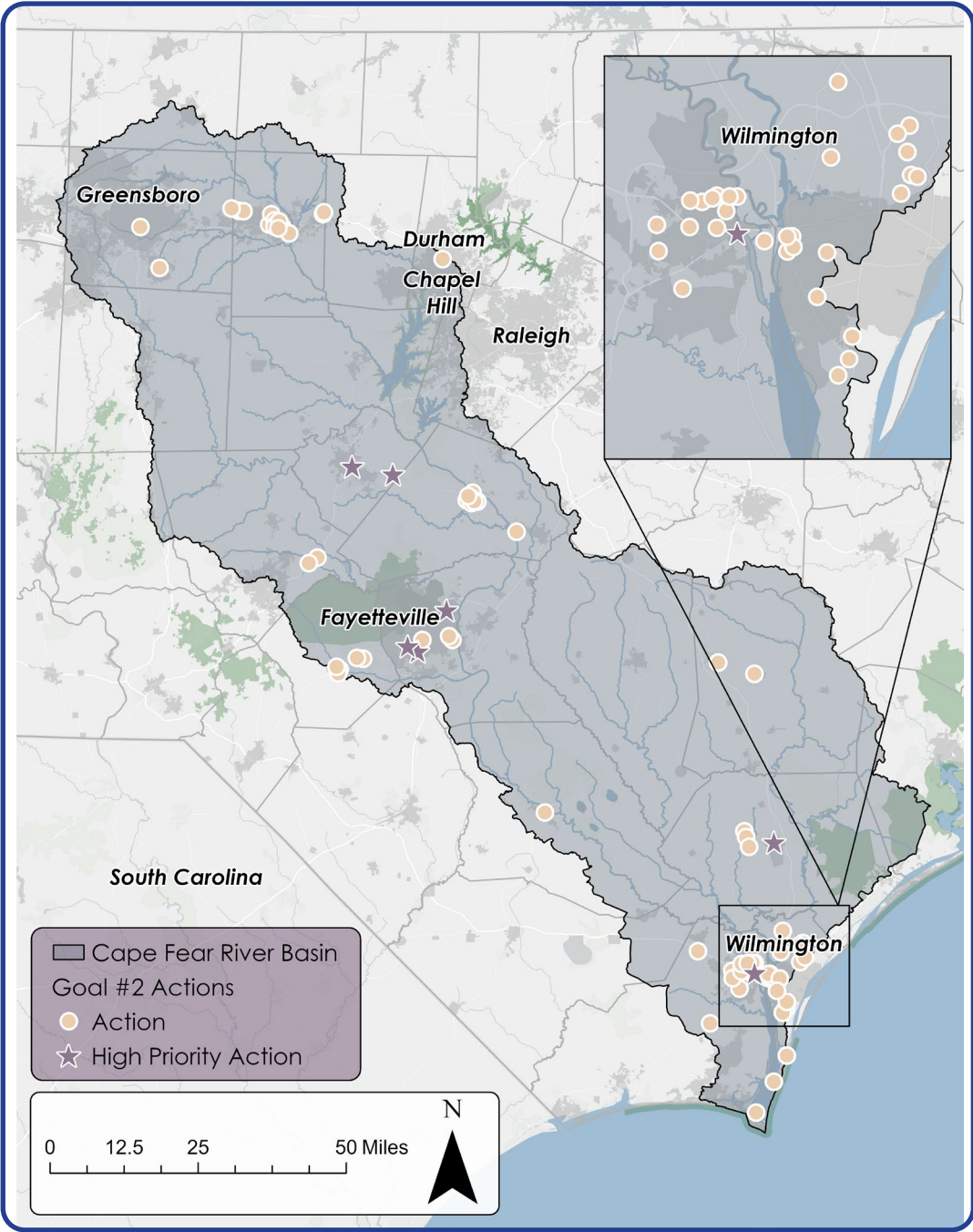


Figure 23: Basin-Wide Map with Goal 2 High Priority and Actions identified.

Strategy 2.4: Improve utility, wastewater, and backup power resilience

Utility and wastewater systems in the Cape Fear River Basin are vulnerable to flooding, storm surge inundation, and power outages that can disrupt daily life and public health. This strategy supports upgrades such as adding backup generators, redundant power sources, elevated or floodproofed equipment, and protection of vulnerable pump stations, wells, and collection systems. Building redundancy is a cost-effective way to preserve essential services during extreme weather and protect public health, environmental quality, and community resilience.

Strategy 2.5: Reduce residual risk related to dams and stormwater facilities

Dams and stormwater control measures in the Cape Fear River Basin are shared risks because their performance affects downstream neighborhoods, roads, emergency routes, and ecological systems. This strategy supports better inventorying, inspection, prioritization, rehabilitation, and coordination across public and private ownerships. It is particularly relevant in areas with high-hazard dams, aging stormwater ponds, and facilities that influence downstream flooding. Many dams are privately owned, so solutions need to engage both public and private parties.



Goal 2. Strengthen Critical Systems / Actions Descriptions

Goal 2. Strengthen critical systems includes 87 actions focused on the infrastructure systems that keep communities functioning during floods and support day-to-day life across the basin. Of these, 7 were identified as high priority actions. These high priority actions include locally prioritized actions submitted for Graham, Mebane, Elon, Gibsonville, Broadway, Carolina Beach, Leland, Bald Head Island, Navassa, Eastover, Vass, Burgaw, Fayetteville, Lillington, Guilford County, New Hanover County and Brunswick County. While including a diversity of action types, this goal had good representation from smaller stormwater capital projects from communities that had master plans or other assessments. This reflects the importance of Strategy 2.1 Map infrastructure and systematically assess vulnerability as a foundational component of strengthening critical systems.

Recommended Critical Needs

- Develop and update stormwater master plans, including asset inventories
- Map drainage in rural communities and develop master plans or other prioritized action strategies
- Replace, upsize, and repair undersized drainage infrastructure where there are no downstream adverse impacts
- Maintain and modernize drainage systems through routine maintenance
- Secure lifecycle maintenance funding
- Add backup power and redundancy for critical utility systems

Profiled Actions

- Broadway - Watson Lake Dam Rehabilitation Phase 2
- Burgaw West Wilmington Street Drainage Improvement
- Fayetteville Arran Lakes West Dam Project

Action List

*High priority actions are highlighted in blue.

Action Name	Type*	Relative Cost Estimate**	Community Location
2.1 Map infrastructure and assess system vulnerability			
Lee County - High Hazard Dam Inventory	Levee/Dike/Berm	\$-\$-\$-\$	Lee County
Coastal Counties - Water/Wastewater Vulnerability Analysis	Critical Infrastructure	\$	New Hanover County, Wrightsville Beach, Wilmington
Raeford - Critical Infrastructure Vulnerability Analysis	Critical Infrastructure	\$-\$-\$	City of Raeford
Cumberland County - Critical Infrastructure Vulnerability Analysis	Critical Infrastructure	\$-\$-\$	Cumberland County

*Actions that did not fit neatly into an action type are marked miscellaneous. Miscellaneous actions include outreach, planning, data collection, and other flood resilience steps not captured in the typology.

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PRIORITIZED BASIN ACTIONS



Action Name	Type*	Relative Cost Estimate**	Community Location
Hoke County - Critical Infrastructure Vulnerability Assessment Program	Critical Infrastructure	\$-\$-\$	Hoke County
Guilford County - Critical Infrastructure Vulnerability Analysis	Critical Infrastructure	\$-\$-\$	Guilford County
Bladen County - Comprehensive Stormwater Infrastructure Study	Storm Water Management Activities	\$-\$-\$-\$	Bladen County
Durham County - Regional Stormwater Mapping Assessment	Stormwater, Water Quality, Floodplain Regulations	\$-\$-\$	Durham County
Warsaw - Stormwater Study Completion	Stormwater, Water Quality, Floodplain Regulations	\$-\$-\$	Sampson County

Hoke County - County Assets Vulnerability Analysis	Utility Elevation	\$-\$	Hoke County
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2.2 Upgrade drainage, stormwater, and conveyance systems			
Burgaw - West Wilmington Street Drainage Improvements	Storm Water Management Activities	\$-\$-\$-\$	Burgaw
Fayetteville - Rockford Drive Drainage Improvements	Storm Water Management Activities	\$-\$-\$-\$	Fayetteville

Eastover - Canal Dredging	Channel Dredging, Widening, Diversion	\$-\$-\$	Eastover
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Navassa - Coastal Road Stream Crossing Feasibility and Construction	Coastal - Road Elevation/Modification	\$-\$-\$	Navassa
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Navassa - Cedar Hill Stream Crossing and Drainage Improvement	Coastal - Road Elevation/Modification	\$-\$-\$	Navassa
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Navassa - Indian Creek Stream Crossing and Drainage Improvement	Coastal - Road Elevation/Modification	\$-\$-\$-\$	Navassa
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PRIORITIZED BASIN ACTIONS



Action Name	Type*	Relative Cost Estimate**	Community Location
Carolina Beach - Shoreline and Bulkhead Improvements	Coastal - Road Elevation/Modification	\$\$\$\$\$	Carolina Beach
Leland - Lanvale Road/Springstone Road/Old Lanvale Road Roadway Realignment and Drainage Conveyance Improvements	Critical Infrastructure	\$\$\$\$	Leland
Leland - Low Country Boulevard Cross Pipe Improvements	Critical Infrastructure	\$\$\$\$	Leland
Leland - Lanvale Road Cross Pipe Replacement	Critical Infrastructure	\$\$\$\$	Leland
Navassa - Mill Creek Stream Crossing and Flood Mitigation	Floodplain Restoration	\$\$-\$	Navassa
Navassa - Stormwater and Riparian Restoration	Floodplain Restoration	\$\$-\$\$\$\$	Navassa
Navassa - Church Street Stream Crossing and Drainage Improvement	Raingardens/Sand Filters/Bio-Swales	\$\$-\$	Navassa
New Hanover County - Tesla Park Drive Ditch and Culvert Upgrade	Roadway Elevation/Road Crossing Modification	\$\$-\$	New Hanover County
Vass - Culvert Improvements	Roadway Elevation/Road Crossing Modification	\$\$\$\$	Vass
Brunswick - Navassa Storm Drainage	Storm Water Management Activities	\$\$-\$	Brunswick County
Brunswick Bald Head Stormwater Outfall	Storm Water Management Activities	\$\$-\$	Brunswick County
Graham - Pomery/Travora/Marshall Street Culvert Replacements	Storm Water Management Activities	\$\$-\$	Graham
Graham - Harden/Franklin/Wilson/Ward Street Culvert Replacements	Storm Water Management Activities	\$\$-\$	Graham

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PRIORITIZED BASIN ACTIONS



Action Name	Type*	Relative Cost Estimate**	Community Location
Mebane - Brown Street Culvert Replacement	Storm Water Management Activities	\$\$-\$	Mebane
Elon - Travis Creek Pump Station Upgrades	Storm Water Management Activities	\$\$-\$	Elon
Gibsonsville - Joyner Street Culvert Replacement	Storm Water Management Activities	\$\$-\$	Gibsonville
Pleasant Garden - Stormwater Management Planning	Storm Water Management Activities	\$\$-\$	Pleasant Garden
New Hanover County - Daniel Boone/Daisy Lee Culvert Replacements	Storm Water Management Activities	\$\$-\$	New Hanover County
New Hanover County - 101 Colechester Place Ditch Improvements	Storm Water Management Activities	\$\$-\$	New Hanover County
New Hanover County - Avalon Overflow Path Pipe and Ditch Installation	Storm Water Management Activities	\$\$-\$	New Hanover County
New Hanover County - Sapling Circle Ditch and Culvert Improvements	Storm Water Management Activities	\$\$-\$	New Hanover County
New Hanover County - Birds Nest Pipe Replacement	Storm Water Management Activities	\$\$-\$	New Hanover County
New Hanover County - Blue Clay Road Ditch and Culvert Improvements	Storm Water Management Activities	\$\$-\$	New Hanover County
New Hanover County - Bavarian/Brookgreen Ditch and Outfall Improvements	Storm Water Management Activities	\$\$-\$	New Hanover County
Raeford - Patterson Street and East Prospect Street Storm Drainage Improvements	Storm Water Management Activities	\$\$-\$	City of Raeford
New Hanover County - Rockwell Street Pipe Replacement	Storm Water Management Activities	\$\$-\$	New Hanover County

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PRIORITIZED BASIN ACTIONS



Action Name	Type*	Relative Cost Estimate**	Community Location
New Hanover County - Newry Way Ditch Improvements	Storm Water Management Activities	\$-\$ \$	New Hanover County
New Hanover County - Sago Palm Drive Pipe System Upgrade	Storm Water Management Activities	\$-\$ \$	New Hanover County
New Hanover County - Berkley Ditch Improvements and Tree Removal	Storm Water Management Activities	\$-\$ \$	New Hanover County
New Hanover County - Tesla Park Drive Ditch and Culvert Upgrade	Roadway Elevation/ Modification	\$-\$ \$	New Hanover County
Duplin County - Stormwater Management Planning	Storm Water Management Activities	\$-\$ \$	Duplin County
Wilmington - Elisha Dr./Camberly Dr./Gregory Rd Drainage Enhancements	Storm Water Management Activities	\$-\$ \$	Wilmington
Pender County - Drainage Improvements at 18 Pre-Identified Sites	Storm Water Management Activities	\$-\$ \$ \$	Pender County
Lillington - Pipe Upgrade/ Replacement	Storm Water Management Activities	\$ \$	Lillington
Raeford - Stormwater System Upgrades	Storm Water Management Activities	\$ \$-\$ \$ \$	City of Raeford
Fayetteville - Ashbrook Road Drainage Improvements	Storm Water Management Activities	\$ \$-\$ \$ \$	Fayetteville
Pender County - Drainage Maintenance Implementation	Storm Water Management Activities	\$ \$-\$ \$ \$	Pender County
Wilmington - Clear Run Branch Phase 2 Stormwater and Restoration	Storm Water Management Activities	\$ \$-\$ \$ \$	Wilmington
Lillington - Roadway Infrastructure Repair and Replacement	Storm Water Management Activities	\$ \$ \$	Lillington

*Actions that did not fit neatly into an action type are marked miscellaneous. Miscellaneous actions include outreach, planning, data collection, and other flood resilience steps not captured in the typology.

** Cost estimates are as follows: \$ < \$100,000; \$ \$ \$100,000 - \$500,000; \$ \$ \$ \$500,000 - \$1M; \$ \$ \$ \$ \$1M - \$5M; \$ \$ \$ \$ \$ \$ > \$5M. Some actions have a variable cost estimate based on yet-to-be-determined details such as potential participation level for buyouts or elevations, opportunities related to siting an action, or the action is a combination of planning and implementation. For these actions, the relative cost shown in the Action List may vary, potentially dramatically, given the final scale and scope of the action when implemented.

PRIORITIZED BASIN ACTIONS



Action Name	Type*	Relative Cost Estimate**	Community Location
Lillington - 13th Street Stormwater Infrastructure Improvements	Storm Water Management Activities	\$ \$ \$ \$	Lillington
Lillington - James Street Stormwater Infrastructure Improvements	Storm Water Management Activities	\$ \$ \$ \$	Lillington
Lillington - 11th Street Stormwater Infrastructure Improvements	Storm Water Management Activities	\$ \$ \$ \$	Lillington
Lillington - Regional Stormwater Pond Development	Storm Water Management Activities	\$ \$ \$ \$	Lillington
Lillington - East Killiegrey Street Stormwater Infrastructure Improvements	Storm Water Management Activities	\$ \$ \$ \$	Lillington
Carolina Beach - Stormwater Function Improvements	Storm Water Management Activities	\$ \$ \$ \$-\$ \$ \$ \$ \$	Carolina Beach
Central Municipalities - High Density Stormwater Study for 10-Year Detention	Stormwater, Water Quality, Floodplain Regulations	\$	Graham, Mebane, Elon, & Gibsonville
Central Municipalities - Localized Flood Areas Analysis	Stormwater, Water Quality, Floodplain Regulations	\$-\$ \$	Graham, Mebane, Elon, & Gibsonville
Central Municipalities - 50/50 Stormwater Program	Stormwater, Water Quality, Floodplain Regulations	\$-\$ \$	Elon & Gibsonville
Central Municipalities - Phase 2 Stormwater Project	Stormwater, Water Quality, Floodplain Regulations	\$-\$ \$	Graham, Mebane, Elon, & Gibsonville
2.3 Retrofit roads and streets			
Leland - Old Fayetteville Road Cross Pipe Replacement	Critical Infrastructure	\$ \$ \$ \$	Leland
Wilmington - Wrightsville Ave Enhancements and Drainage	Permeable Pavement	\$ \$ \$ \$ \$	Wilmington

*Actions that did not fit neatly into an action type are marked miscellaneous. Miscellaneous actions include outreach, planning, data collection, and other flood resilience steps not captured in the typology.

** Cost estimates are as follows: \$ < \$100,000; \$ \$ \$100,000 - \$500,000; \$ \$ \$ \$500,000 - \$1M; \$ \$ \$ \$ \$1M - \$5M; \$ \$ \$ \$ \$ \$ > \$5M. Some actions have a variable cost estimate based on yet-to-be-determined details such as potential participation level for buyouts or elevations, opportunities related to siting an action, or the action is a combination of planning and implementation. For these actions, the relative cost shown in the Action List may vary, potentially dramatically, given the final scale and scope of the action when implemented.

PRIORITIZED BASIN ACTIONS



Action Name	Type*	Relative Cost Estimate**	Community Location
Brunswick County - Sandy Creek Drive Roadway Enhancements	Storm Water Management Activities	\$-\$-\$-\$	Brunswick County
Cumberland County - NC 24 Corridor Connectivity Improvements	Storm Water Management Activities	\$-\$-\$-\$	Cumberland County
2.4 Improve utility, wastewater, and backup power resilience			
New Hanover County - Sewer Service Expansion in Flood-Prone Areas	Critical Infrastructure	\$-\$-\$-\$	New Hanover County
Brunswick County - NC-133 Upgrades	Coastal - Road Elevation/Modification	\$-\$-\$-\$	Brunswick County
Mebane - Emergency Water Solutions	Critical Infrastructure	\$-\$-\$	Mebane
Coastal Counties - Improve Water/Wastewater Redundancies	Critical Infrastructure	\$-\$-\$	New Hanover County, Wrightsville Beach, Wilmington
Graham - Water Treatment Plant Utility Retrofits	Critical Infrastructure	\$-\$-\$	Graham
Graham - Sewer Sliplining	Critical Infrastructure	\$-\$-\$	Graham
Graham - Emergency Water Solutions	Critical Infrastructure	\$-\$-\$	Graham
Graham - Cooper Road Pump Station Relocation	Critical Infrastructure	\$-\$-\$	Graham
Brunswick-Leland Sewer Resiliency	Critical Infrastructure	\$-\$-\$-\$	Brunswick County
Brunswick Water Main Resiliency	Critical Infrastructure	\$-\$-\$-\$	Brunswick County

*Actions that did not fit neatly into an action type are marked miscellaneous. Miscellaneous actions include outreach, planning, data collection, and other flood resilience steps not captured in the typology.

** Cost estimates are as follows: \$ < \$100,000; \$\$ \$100,000 - \$500,000; \$\$\$ \$500,000 - \$1M; \$\$\$\$ \$1M - \$5M; \$\$\$\$\$ > \$5M. Some actions have a variable cost estimate based on yet-to-be-determined details such as potential participation level for buyouts or elevations, opportunities related to siting an action, or the action is a combination of planning and implementation. For these actions, the relative cost shown in the Action List may vary, potentially dramatically, given the final scale and scope of the action when implemented.

PRIORITIZED BASIN ACTIONS



Action Name	Type*	Relative Cost Estimate**	Community Location
Coastal Counties - Water/Wastewater Infrastructure Retrofits	Critical Infrastructure	\$-\$-\$-\$	New Hanover County, Wrightsville Beach, Wilmington
Pender County - Sewer Lift Station Elevations and Retrofits	Critical Infrastructure	\$-\$-\$-\$-\$	Pender County
New Hanover County - Wastewater Pump Generators	Miscellaneous	\$-\$-\$-\$	New Hanover County
New Hanover County - Floodplain Pump Station Elevation	Utility Elevation	\$-\$-\$-\$	New Hanover County
2.5 Reduce residudal risk related to dams and stormwater facilities			
Broadway - Watson Lake Dam Rehabilitation (Phase 2)	New and Existing Dam Structures	\$-\$-\$-\$	Broadway
Fayetteville - College Lakes Dam Retrofit	New and Existing Dam Structures	\$-\$-\$-\$-\$	Fayetteville
Fayetteville - Arran Lakes West Dam Upgrades	New and Existing Dam Structures	\$-\$-\$-\$-\$	Fayetteville
Vass - Crystal Lake Dam Repair/Retrofit	New and Existing Dam Structures	\$-\$-\$-\$-\$	Vass
Graham - GML Spillway Replacement	Storm Water Management Activities	\$-\$-\$-\$-\$	Graham

*Actions that did not fit neatly into an action type are marked miscellaneous. Miscellaneous actions include outreach, planning, data collection, and other flood resilience steps not captured in the typology.

** Cost estimates are as follows: \$ < \$100,000; \$\$ \$100,000 - \$500,000; \$\$\$ \$500,000 - \$1M; \$\$\$\$ \$1M - \$5M; \$\$\$\$\$ > \$5M. Some actions have a variable cost estimate based on yet-to-be-determined details such as potential participation level for buyouts or elevations, opportunities related to siting an action, or the action is a combination of planning and implementation. For these actions, the relative cost shown in the Action List may vary, potentially dramatically, given the final scale and scope of the action when implemented.

PRIORITIZED BASIN ACTIONS





Salt marsh Zeke’s Island Reserve NC Coastal Reserve

Broadway - Watson Lake Dam Rehabilitation (Phase 2)

Community:
Broadway

Cost:
\$3,500,000 (total cost depends on the extent of rehabilitation)

Goal:
Strengthen critical systems

Strategies:
2.5 Manage dams and stormwater facilities as shared risk assets

Guiding Principles:
Plan regionally, implement locally; Prioritize vulnerable places and people; Protect critical infrastructure and services

Source:
Locally prioritized

Category:
Infrastructure & Control Structures

Type:
New and Existing Dam Structures

Priority:
High

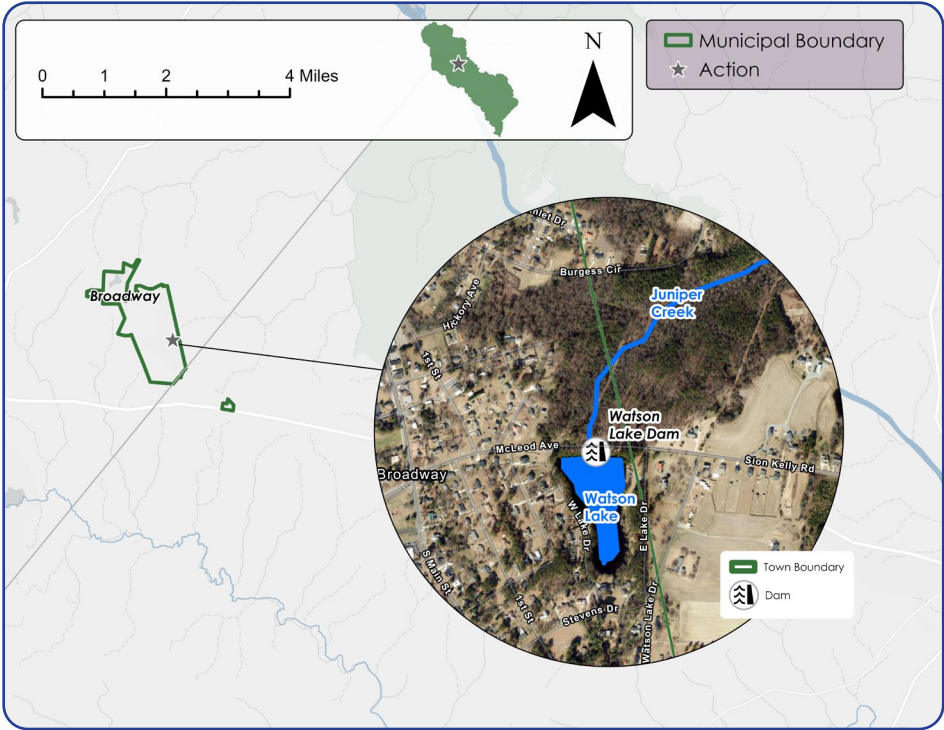


Figure 24: Broadway Watson Lake Dam Rehabilitation (Phase 2) Action Map.

The Broadway - Watson Lake Dam Rehabilitation Phase 2 action will advance the rehabilitation of the Watson Lake Dam to reduce downstream flood risk and improve the safety of waterways that drain through the county. The Town has already secured a FEMA High Hazard Potential Dams (HHPD) Grant through NCDEQ Dam Safety for design, planning, and permitting work, which will provide the foundation for a future construction phase. Phase 2 would seek grant funding for the actual dam rehabilitation and installation of a new spillway, both of which are needed to address the hazard posed by the existing structure.

This action is important because the dam has the potential to affect downstream county roads and other infrastructure if it were to fail or have uncontrolled releases during a storm event. By completing the rehabilitation work, the Town can reduce the risk of dam-related flooding and strengthen long-term resilience for the surrounding area. The action represents a critical next step in moving from planning and permitting toward implementation of a more secure and reliable flood protection system.



Burgaw - West Wilmington Street Drainage Improvement

Community:
Burgaw

Cost:
\$500,000-\$1,000,000 (total cost depends on the amount of road replacement needed)

Goal:
Strengthen critical systems

Strategies:
2.2 Upgrade drainage, stormwater, and conveyance systems; 2.3 Retrofit roads and streets

Guiding Principles:
Prioritize vulnerable places and people; Protect critical infrastructure and services

Source:
Locally prioritized

Category:
Infrastructure & Control Structures

Type:
Storm Water Management Activities

Priority:
High

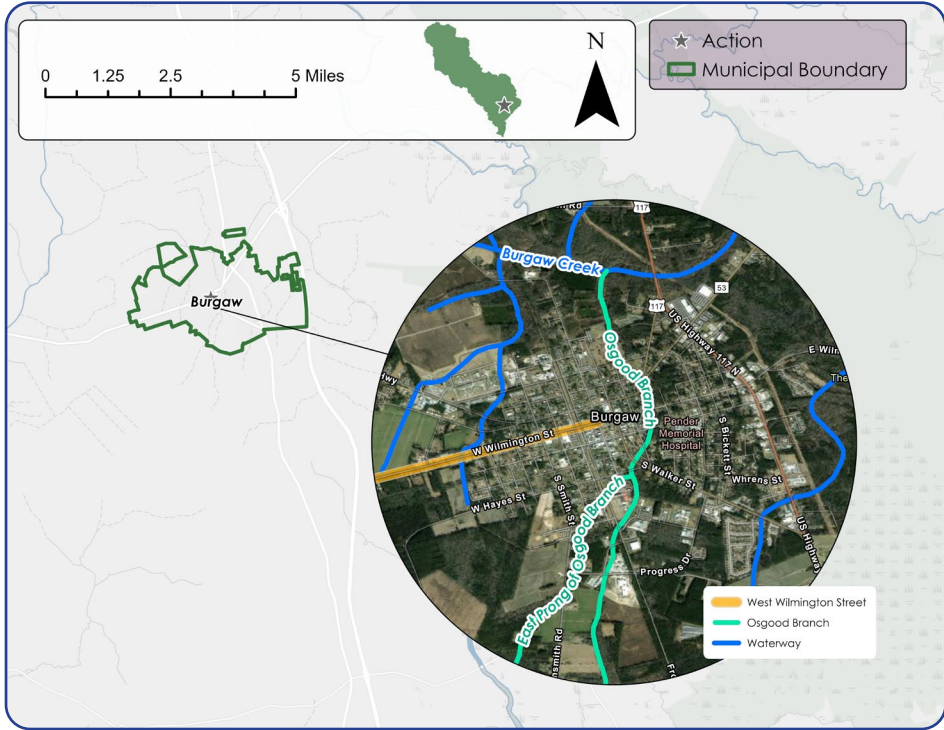


Figure 25: Burgaw West Wilmington Street Drainage Improvement Action Map.

The West Wilmington Street Drainage Improvement action will reduce flooding in a high-priority area of Burgaw through a coordinated set of stormwater upgrades. Identified through the Town’s stormwater master plan and assigned as a high priority for the Flood Risk Management action planning process, the action includes ditch widening, culvert replacement, pipe upsizing, and related drainage improvements. Because the affected area supports commerce and serves as an important access corridor, reducing flood impacts here will also help protect local businesses and maintain reliable emergency response.

The action scope includes multiple improvements across the Satchwell Street Median System priority area, such as pipe upsizing, ditch widening, and pipe clearing along Dudley Street, Dickerson Street, Satchwell Street, and Wright Street. Additional work includes upsizing culverts along East Fremont Street, South Cowan Street, South Walker Street, and South Wright Street, installing a bypass culvert from the South Wright Street culvert to just downstream of East Hayes Street, and raising the low point of East Hayes Street. Together, these improvements will strengthen drainage performance and improve flood resilience across the Osgood Canal system and surrounding streets.





Three Sisters Swamp

Fayetteville - Arran Lakes West Dam Project

Community:

Fayetteville

Cost:

\$32,200,000 (total cost depends on extent of rehabilitation)

Goal:

Strengthen critical systems

Strategies:

2.5 Reduce shared risk related to dams and stormwater facilities

Guiding Principles:

Prioritize vulnerable places and people, Protect critical infrastructure and services; Flood-wise development

Source:

Locally prioritized

Category:

Infrastructure & Control Structures

Type:

New and Existing Dam Structures

Priority:

High

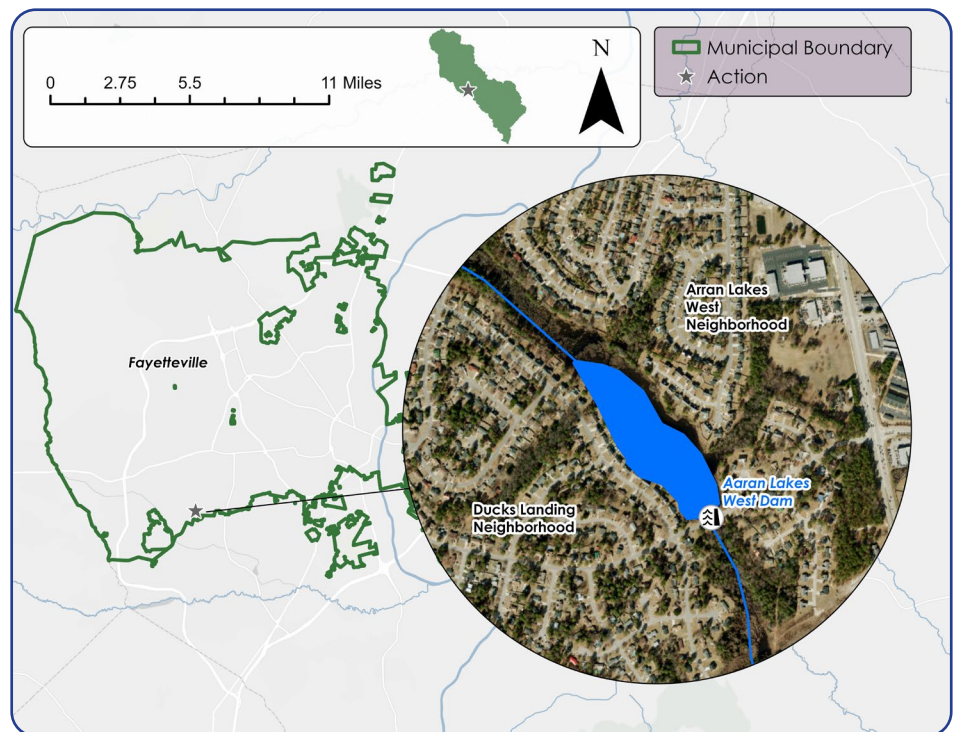


Figure 26: Fayetteville Arran Lakes West Dam Action Map.

The Arran Lakes West Dam Project will rehabilitate a critical stormwater impoundment in Fayetteville that supports flood control for the surrounding drainage system. A completed feasibility study identified the need for embankment upgrades, spillway replacement, and overtopping protection at the dam, along with related work such as utility relocation, paving, erosion control, and site restoration. These improvements are necessary to address the dam's existing condition and to prepare the structure for future stormwater management needs in the upstream drainage area.

Submitted in both the Cumberland County Hurricane Matthew Resilient Redevelopment Plan and the Fayetteville CIP, it requires design, permitting, approvals, funding, and then construction. The project is especially important because the dam must be strengthened before upstream stormwater mitigation projects, including the Rockford Drive and Rhemish Drive drainage improvements, can be fully effective. Once completed, the dam will help capture and temporarily store excess runoff during heavy rainfall, reducing downstream flooding and limiting stress on the receiving drainage network. It will also slow stormwater flows, reduce erosion, and support more controlled releases after storm events, improving conditions for nearby waterways, riverbanks, and infrastructure.



GOAL 3. PROTECT AND USE NATURAL SYSTEMS

Natural systems are a core resilience asset in the Cape Fear River Basin. Streams, floodplains, wetlands, forests, and riparian corridors store water, slow runoff, and reduce erosion. This goal recognizes that the Basin’s landscape is part of the solution to flooding. Restoration and conservation can increase storage capacity, improve baseflow, and reduce peak runoff into downstream communities. In a region with agricultural conversion, urbanization, and stream channel alteration, natural systems offer durable flood mitigation benefits when protected and restored at scale. This goal also supports nature-based stormwater practices that can work alongside gray infrastructure.

Strategy 3.1: Restore streams, floodplains, and riparian corridors

Restoring streams, floodplains, and riparian corridors in the Cape Fear River Basin helps reconnect rivers and creeks to the land that naturally stores and slows floodwaters. Many areas have been straightened, ditched, armored, or disconnected from their floodplains, which increases runoff speed and downstream flood peaks. Restoration can improve channel stability, reduce erosion, enhance water quality, and create room for water during storm events. It can also help communities downstream by reducing the volume and velocity of flood flows reaching developed areas.

Strategy 3.2: Conserve open space, forests, wetlands, and conservation corridors

This strategy protects land that naturally supports flood storage, habitat, and water quality. In the Cape Fear River Basin, open space conservation may include floodplain acquisition, land conservation, conservation easements, and preservation of wetlands, maritime forests, and other sensitive lands. These areas can absorb floodwaters, provide room for natural processes, and reduce future development exposure. Conserving open space is especially valuable where the cost of structural mitigation would be high or where land is already ecologically important. It also creates opportunities for public access, recreation, and habitat continuity while keeping vulnerable lands in a lower-risk, lower-maintenance condition over time.

Strategy 3.3: Use green infrastructure and nature-based stormwater practices

Nature-based stormwater practices and green infrastructure offer the Cape Fear River Basin a flexible way to reduce flooding while improving water quality and ecosystem function. Examples include bioretention cells, swales, wetland restoration, rain gardens, green roofs, floodplain reconnection, and reforestation of strategic lands. These practices slow runoff, increase infiltration, and reduce peak flows that overwhelm drainage systems and downstream channels. They are especially useful in developed areas where traditional gray infrastructure alone may be insufficient or too costly to expand. This strategy also supports watershed-scale approaches that address upstream conditions rather than only local symptoms.

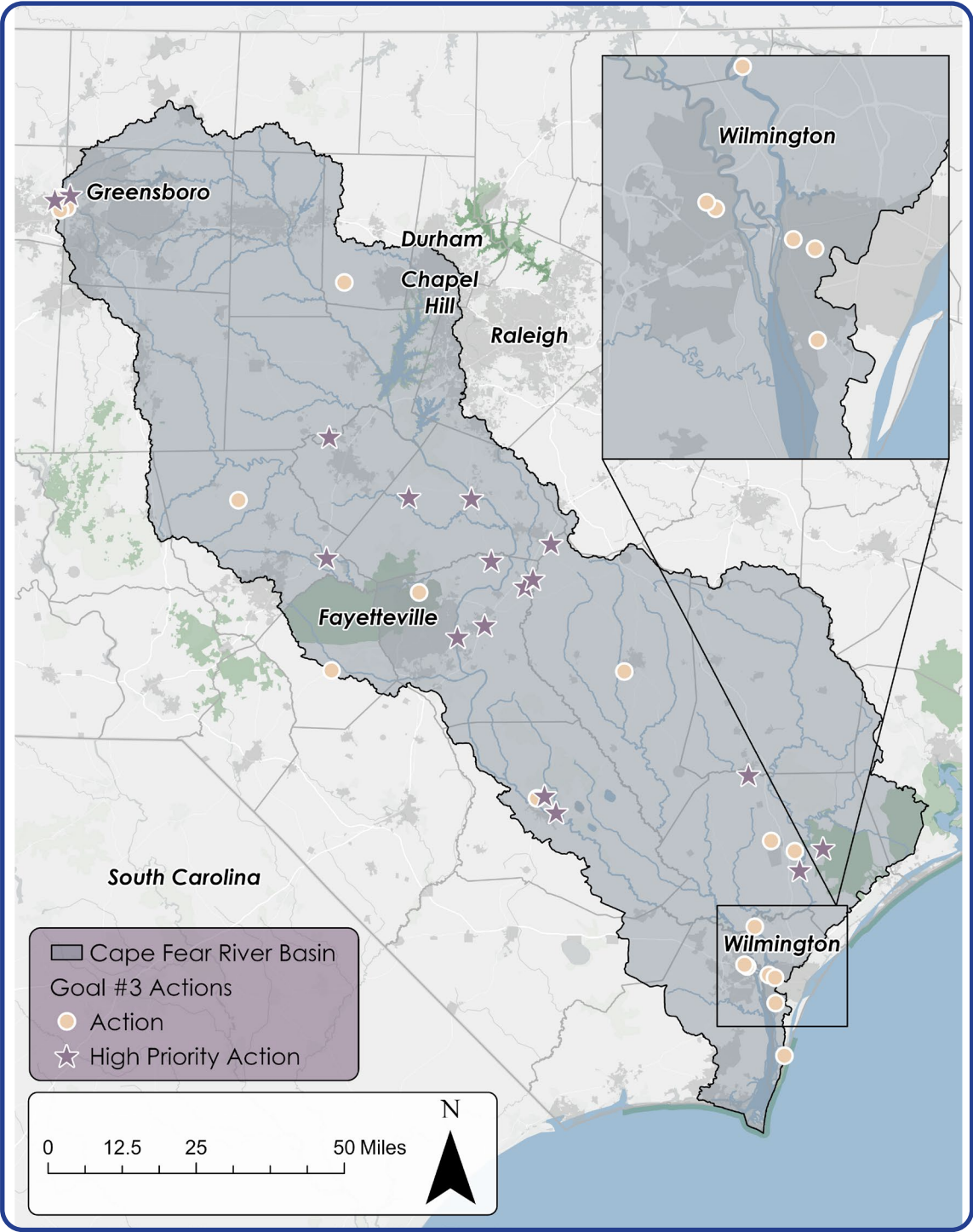


Figure 27: Basin-Wide Map with Goal 3 High Priority and Actions identified.

Strategy 3.4: Restore hydrology on strategic upstream lands

Restoring hydrology on strategic upstream lands in the Cape Fear River Basin helps address flooding at its source by reestablishing the natural movement, storage, and release of water across the landscape. This strategy is especially important in areas where drainage ditches, agricultural modifications, or altered wetlands have accelerated runoff and reduced the land’s ability to retain water. Through this work, upstream lands can function more like natural sponges and slow flood water before they reach downstream communities. This approach is particularly valuable in headwaters and broad wetland systems that influence major river corridors and tributaries across the Basin. It can also improve habitat, drought resilience, and water quality.

Goal 3. Protect and Restore Coastal Natural Systems/ Actions Descriptions

Goal 3: Protect and Restore Coastal Natural Systems includes 36 actions focused on the essential role that natural systems play in attenuating flood risk. Of these, 17 were identified as high-priority actions. Many of the actions under this goal benefitted from nonprofit participation in the Blueprint. Action submissions were more prolific in lower reaches of the Basin, although the potential for nature-based solutions higher in the Basin continues to interest Blueprint stakeholders.

Recommended Critical Needs

- Study and identify most suitable locations for green infrastructure, stream restoration, and other nature-based solutions in individual communities
- Identify and prioritize open space parcels or other areas most critical for flood water retention and ecosystem protection from communities.
- Reuse FEMA buyout properties for open space, habitat, and low-impact community uses
- Restore hydrology on strategic upstream lands to retain water in the Basin
- Install living shorelines and other coastal nature-based solutions
- Restore and stabilize streams to slow runoff and reduce erosion

Action List

**High priority actions are highlighted in blue.*

Action Name	Type*Relative	Relative Cost Estimate**	Community Location
Strategy 3.1 Restore streams, floodplains, and riparian corridors			
Bladen County - Carolina Bay Wetland Restoration at Egg Bay	Flood Storage Wetlands	\$ \$	Bladen County
Bakers Swamp Floodplain Restoration	Floodplain Restoration	\$ \$-\$ \$ \$ \$	Eastover
Falcon - Upper South River Tributary Stream and Floodplain Restoration	Floodplain Restoration	\$ \$-\$ \$ \$ \$	Falcon
Vass - Upper Little River Floodplain Restoration	Floodplain Restoration	\$ \$-\$ \$ \$ \$	Moore County near Vass

*Actions that did not fit neatly into an action type are marked miscellaneous. Miscellaneous actions include outreach, planning, data collection, and other flood resilience steps not captured in the typology.

** Cost estimates are as follows: \$ < \$100,000; \$ \$ \$100,000 - \$500,000; \$ \$ \$ \$500,000 - \$1M; \$ \$ \$ \$ \$1M - \$5M; \$ \$ \$ \$ \$ \$ > \$5M. Some actions have a variable cost estimate based on yet-to-be-determined details such as potential participation level for buyouts or elevations, opportunities related to siting an action, or the action is a combination of planning and implementation. For these actions, the relative cost shown in the Action List may vary, potentially dramatically, given the final scale and scope of the action when implemented.

PRIORITIZED BASIN ACTIONS



Action Name	Type*Relative	Relative Cost Estimate**	Community Location
Bladen County - Black River Floodplain Restoration	Floodplain Restoration	\$ \$-\$ \$ \$ \$	Black River, exact location not captured in our information
Lillington - Collins Creek/Cape Fear Floodplain Restoration	Floodplain Restoration	\$ \$ \$ \$-\$ \$ \$ \$	Lillington
Black River/Mingo Swamp Floodplain Restoration	Floodplain Restoration	\$ \$ \$ \$	Falcon
Deep River Basin Floodplain Restoration	Floodplain Restoration	\$ \$ \$ \$ \$	Cumnock
Fayetteville - Upper Cape Fear Floodplain Restoration	Floodplain Restoration	\$ \$ \$ \$ \$	Fayetteville
Linden - Little River Basin Floodplain Restoration	Floodplain Restoration	\$ \$ \$ \$ \$	Linden
Dunn - Stoney Run Dam Removal and Wetland Restoration	New and Existing Dam Structures	\$ \$-\$ \$ \$ \$	Dunn
Cumberland County - Little River and Gate Line Stream Debris Removal	Debris Removal	\$ -\$ \$	Cumberland County
Moore County - Stream Restoration and Debris Removal	Debris Removal	\$ -\$ \$ \$	Moore County
Bladen County - Carolina Bay Wetland Restoration (Bushy Bay)	Flood Storage Wetlands	\$ \$	Bladen County
Kernersville - Ciener Botanical Gardens Stream Restoration	Floodplain Preservation	\$ -\$ \$	Kernersville
New Hanover County - Lehigh Road Stream Bank Restoration and Outfall Design	Floodplain Restoration	\$ -\$ \$	New Hanover County
Navassa - Miles Branch Stream Restoration and Debris Removal	Floodplain Restoration	\$ -\$ \$	Navassa
Navassa - Robin Court Branch Restoration and Debris Removal	Floodplain Restoration	\$ -\$ \$	Navassa

*Actions that did not fit neatly into an action type are marked miscellaneous. Miscellaneous actions include outreach, planning, data collection, and other flood resilience steps not captured in the typology.

** Cost estimates are as follows: \$ < \$100,000; \$ \$ \$100,000 - \$500,000; \$ \$ \$ \$500,000 - \$1M; \$ \$ \$ \$ \$1M - \$5M; \$ \$ \$ \$ \$ \$ > \$5M. Some actions have a variable cost estimate based on yet-to-be-determined details such as potential participation level for buyouts or elevations, opportunities related to siting an action, or the action is a combination of planning and implementation. For these actions, the relative cost shown in the Action List may vary, potentially dramatically, given the final scale and scope of the action when implemented.

PRIORITIZED BASIN ACTIONS



Action Name	Type*Relative	Relative Cost Estimate**	Community Location
Coastal Counties - Floodplain Restoration Upstream of CFPUA Raw Water Intake	Floodplain Preservation	\$-\$ \$\$	New Hanover County, Wrightsville Beach, Wilmington
Burgaw - Osgood Canal Stream Restoration/Flood Mitigation Program	Storm Water Management Activities	\$-\$ \$	Burgaw
Strategy 3.2 Conserve open space, forests, wetlands, and conservation corridors			
Highway 421 Corridor Floodplain Protection	Floodplain Preservation	\$ \$ \$ \$ \$	Pender County
Pender County - Cape Fear River Bottomlands Floodplain Protection	Floodplain Preservation	\$ \$ \$ \$ \$	Pender County
Harnett County - Floodplain and Open Space Protection	Advanced Regulations (Land Use and Impervious Surface Restrictions)	\$ \$	Harnett County
Kernersville - Wetland and Open Space Preservation	Floodplain Preservation	\$-\$ \$ \$ \$	Kernersville
Kernersville Parks and Greenway Development and Stormwater Management	Multi-use Floodplains	\$-\$ \$	Kernersville
New Hanover County - Open Space Corridor Connectivity and Conservation Prioritization Study	Floodplain Preservation	\$-\$ \$	New Hanover County
Cape Fear River Floodplain Forest Protection Near Lock and Dam 1	Floodplain Preservation	\$ \$-\$ \$ \$ \$	Bladen County
Strategy 3.3 Use green infrastructure and nature-based stormwater practices			
Carolina Beach - Carolina Beach Lake Nature-Based Stormwater Improvements	Bioretention	\$-\$ \$	Carolina Beach
Raeford - Floodplain Preservation and Stormwater Management	Floodplain Preservation	\$-\$ \$	Raeford

*Actions that did not fit neatly into an action type are marked miscellaneous. Miscellaneous actions include outreach, planning, data collection, and other flood resilience steps not captured in the typology.

** Cost estimates are as follows: \$ < \$100,000; \$\$ \$100,000 - \$500,000; \$\$\$ \$500,000 - \$1M; \$\$\$\$ \$1M - \$5M; \$\$\$\$\$ > \$5M. Some actions have a variable cost estimate based on yet-to-be-determined details such as potential participation level for buyouts or elevations, opportunities related to siting an action, or the action is a combination of planning and implementation. For these actions, the relative cost shown in the Action List may vary, potentially dramatically, given the final scale and scope of the action when implemented.

PRIORITIZED BASIN ACTIONS



Action Name	Type*Relative	Relative Cost Estimate**	Community Location
Orange County - Rainwater Rewards Program Implementation	Raingardens/Sand Filters/Bio-Swales	\$-\$ \$	Orange County
Kernersville - Green Infrastructure Implementation for Water Quality and Stormwater Management	Stormwater, Water Quality, Floodplain Regulations	\$	Kernersville
Kernersville - Low Impact Design Flood Mitigation Alternatives	Stormwater, Water Quality, Floodplain Regulations	\$-\$ \$	Kernersville
Kernersville - Green Infrastructure Planning and Implementation	Stormwater, Water Quality, Floodplain Regulations	\$-\$ \$	Kernersville
Strategy 3.4 Restore hydrology on strategic upstream lands			
Pender County - Angola Bay Game Land Wetland Restoration	Flood Storage Wetlands	\$ \$ \$ \$ \$	Pender County
Holly Shelter Game Land Wetland Restoration and Drainage Improvements	Flood Storage Wetlands	\$ \$-\$ \$ \$ \$	Pender County
Coharie - Nature-Based Agricultural Flood Control Measures	Floodplain Restoration	\$-\$ \$	Clinton

*Actions that did not fit neatly into an action type are marked miscellaneous. Miscellaneous actions include outreach, planning, data collection, and other flood resilience steps not captured in the typology.

** Cost estimates are as follows: \$ < \$100,000; \$\$ \$100,000 - \$500,000; \$\$\$ \$500,000 - \$1M; \$\$\$\$ \$1M - \$5M; \$\$\$\$\$ > \$5M. Some actions have a variable cost estimate based on yet-to-be-determined details such as potential participation level for buyouts or elevations, opportunities related to siting an action, or the action is a combination of planning and implementation. For these actions, the relative cost shown in the Action List may vary, potentially dramatically, given the final scale and scope of the action when implemented.

PRIORITIZED BASIN ACTIONS





Deep River Basin Floodplain Restoration

Community:
Lee County

Cost:
\$35,000,000 (total cost depends on total restored area)

Goal:
Protect and use natural systems

Strategies:
3.1 Restore streams, floodplains, and riparian corridors; 3.4 Restore hydrology on strategic upstream lands; 5.1 Ground actions in local data and watershed-scale analysis; 5.5 Strengthen regional coordination and technical support

Guiding Principles:
Natural systems as the first defense; Data-driven long range planning; Plan regionally, implement locally; Measurable outcomes; Pilot, evaluate, scale

Source:
Locally prioritized

Category:
Nature Based Solutions

Type:
Floodplain Restoration

Priority:
High

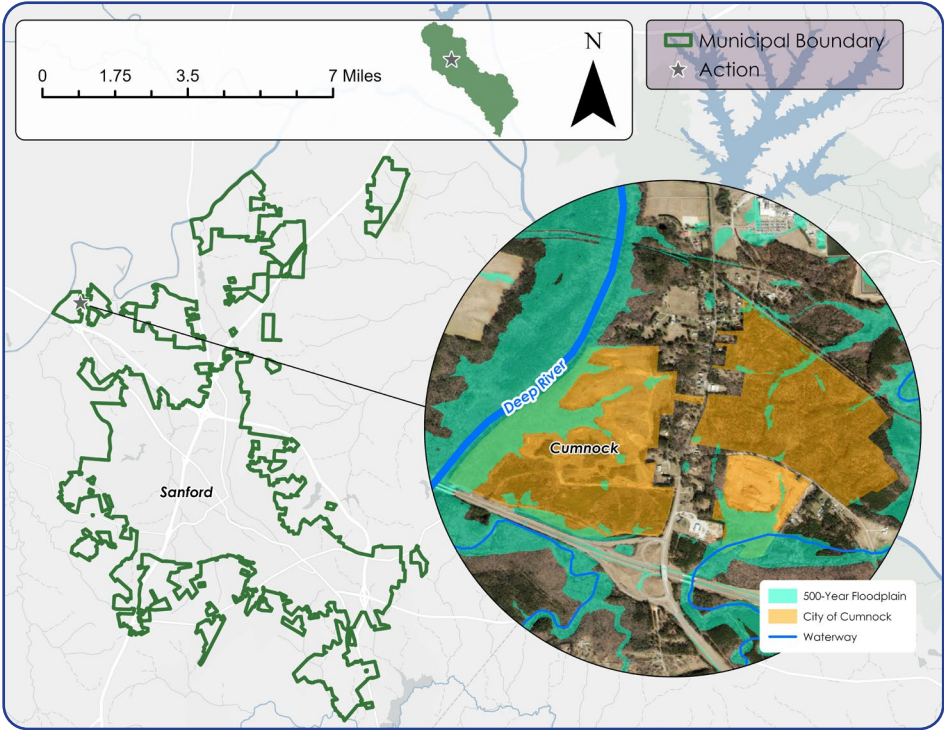


Figure 28: Deep River Basin Floodplain Restoration Individual Action Map.

The Deep River Basin Floodplain Restoration action is a regional nature-based solution focused on reducing riverine flooding near Cumnock and within the broader contributing watershed. The Nature Conservancy proposes restoring approximately 7,000 acres of flood-prone land back to natural floodplain conditions, particularly properties within the 500-year floodplain that have historically flooded during major storm events such as Hurricanes Matthew and Florence and do not contain structures within 1,000 feet. By returning these areas to their natural state, the project would recover lost flood storage capacity on the landscape and help reduce high-flow impacts to downstream communities.

This action is based on regional flood concern mapping and hydrologic analysis completed with the Central Pines and Mid-Carolina Regional Councils of Governments. Technical modeling identified roughly 15,000 acres of potentially restorable floodplain within the contributing watershed, and preliminary results suggest that restoring about half of that area could reduce peak flows at the point of concern by more than 50 percent during many storm events. The action could also improve baseflow conditions during dry periods, providing both flood resilience and ecological benefits.



Harnett County - Floodplain and Open Space Protection

Community:
Harnett County

Cost:
\$200,000\$ (total cost depends on the degree of ??? involved)

Goal:
Protect and use natural systems

Strategies:
3.2 Conserve open space, forests, wetlands, and conservation corridors; 4.3 Promote flood-wise and resilient development

Guiding Principles:
Natural systems as the first defense; Flood-wise development

Source:
Locally prioritized

Category:
Policy & Planning

Type:
Advanced Regulations (Land Use and Impervious Surface Restrictions)

Priority:
High

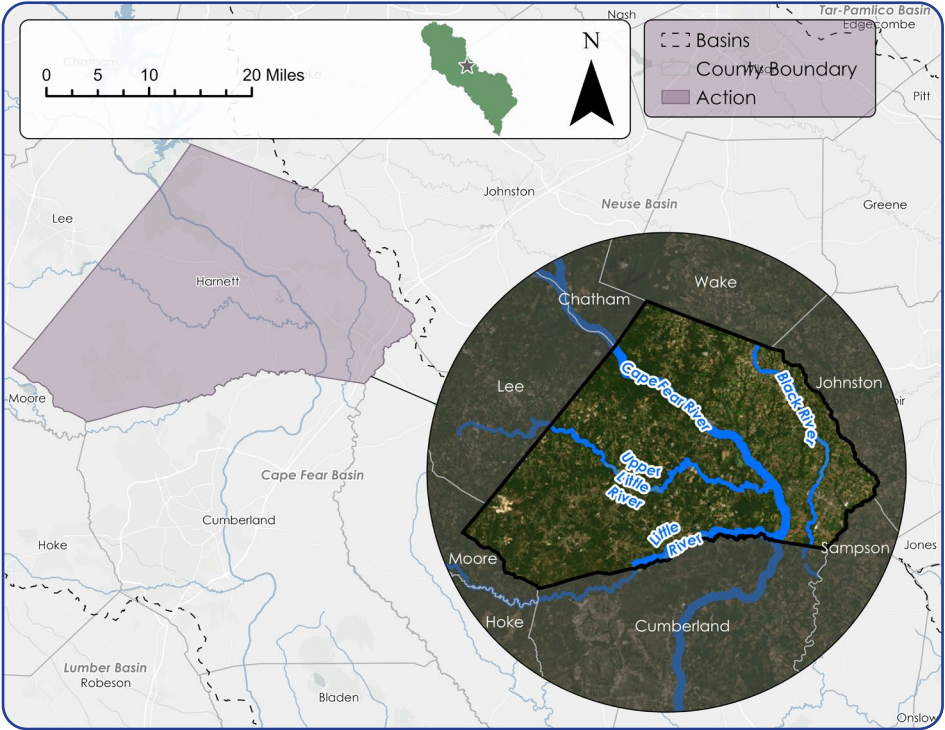


Figure 29: Harnett County Floodplain and Open Space Protection Individual Action Map.

This action will support Harnett County's goal of preserving floodplain areas and limiting problematic development in environmentally sensitive locations to promote a healthier and safer environment for County residents and downstream neighbors. The primary policy change would require all new major subdivisions in the County to set aside land for open space and restrict building in environmentally sensitive areas. Currently, the Harnett County Unified Development Ordinance allows this approach as an option, but not as a requirement for all major subdivisions.

This policy update is already supported in the Cape Fear Regional Hazard Mitigation Plan 2020 and the 2025 Regional Hazard Mitigation Plan update. Public engagement would occur through the ordinance amendment process. While the policy would be specific to Harnett County, it would also support broader regional flood resilience by helping preserve floodplains and environmentally sensitive areas that benefit downstream neighbors.





Dunn - Stoney Run Dam Mitigation and Wetland Restoration

Community:
Dunn

Cost:
\$856,463 (total cost depends on the size of the dam and areas to be restored)

Goal:
Protect and use natural systems

Strategies:
3.1 Restore streams, floodplains, and riparian corridors; 3.4 Restore hydrology on strategic upstream lands; 5.1 Ground actions in local data and watershed-scale analysis

Guiding Principles:
Natural systems as the first defense; Data-driven long-range planning, Plan regionally, implement locally; Protect critical infrastructure and services, Pilot, evaluate, scale; Preparedness, warnings, and public education

Source:
Locally prioritized

Category:
Infrastructure & Control Structures

Type:
New and Existing Dam Structures

Priority:
High

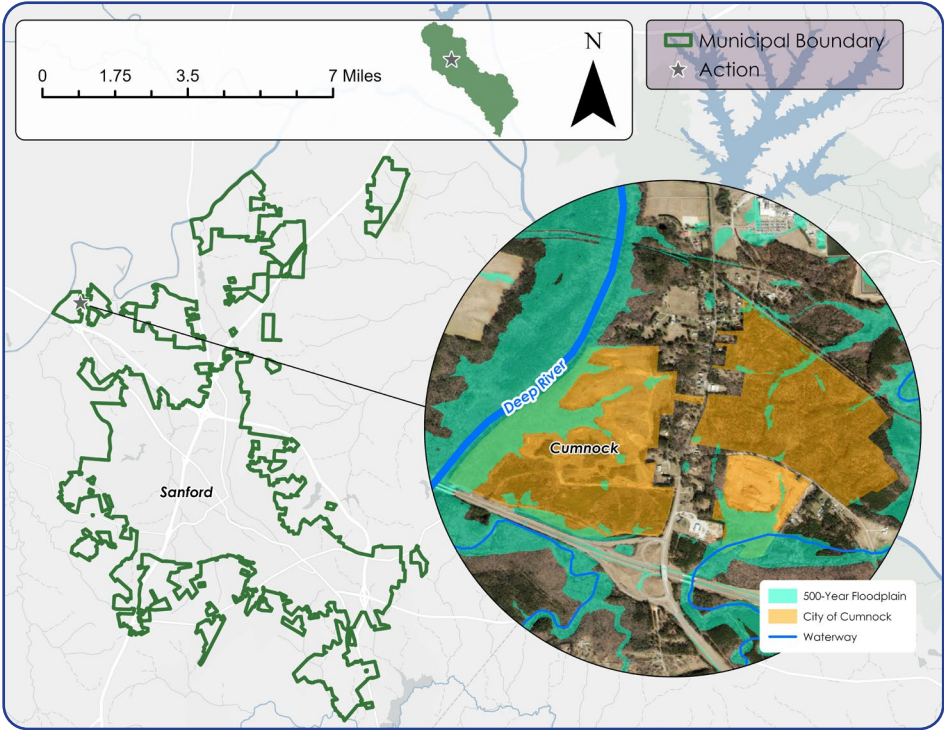


Figure 30: Dunn Stoney Run Dam Mitigation and Wetland Restoration Individual Action Map.

This action addresses a flood-prone area within the Town of Dunn that was identified through early 2026 workshops between The Nature Conservancy and local communities. During the mapping process, the Town identified a specific point of concern where flooding affects local roads and structures both inside and outside the FEMA-designated floodplain. Using technical mapping and modeling tools, The Nature Conservancy and the Mid-Carolina Regional Council determined the contributing watershed area and identified impediments to natural water flow within the system. A private dam at the site has emerged as a major contributor to flood concerns in the area.

The project builds on significant planning already completed by Carolina Wetlands, which has studied the feasibility of dam removal and the restoration of wetlands and natural stream channels. This action would advance those efforts by evaluating how restoring more natural hydrology could reduce flooding, improve drainage, and support long-term resilience in and around Dunn. By focusing on removal or modification of the dam and restoration of the surrounding floodplain functions, the project offers a nature-based path to reduce flood risk for nearby roads, structures, and downstream areas.



Falcon - Upper South River Tributary Stream and Floodplain Restoration

Community:
Falcon

Cost:
\$462,000 (total cost depends on the total amount restoring and easements needed)

Goal:
Protect and use natural systems

Strategies:
3.1 Restore streams, floodplains, and riparian corridors

Guiding Principles:
Natural systems as the first defense; Plan regionally, implement locally

Source:
Locally prioritized

Category:
Nature Based Solutions

Type:
Floodplain Restoration

Priority:
High

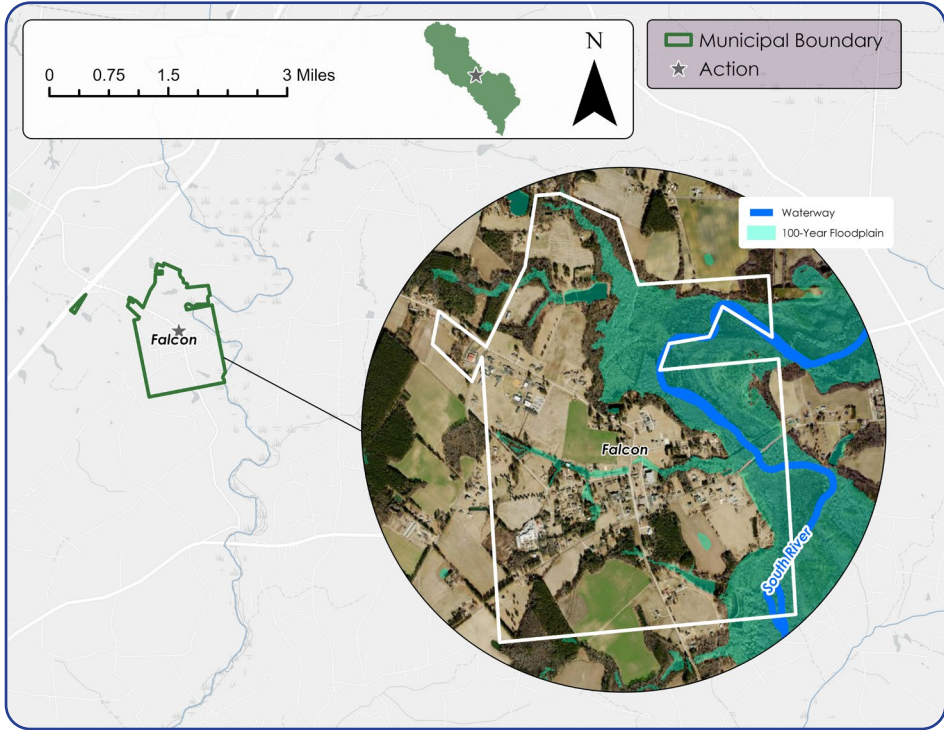


Figure 31: Falcon Upper South River Tributary Stream and Floodplain Restoration Individual Action Map.

The Nature Conservancy proposed this action to restore approximately 1,500 linear feet of a degraded tributary to the Black River that runs through the Town of Falcon and has been heavily armored with riprap and straightened over time. The project will replace the channel's hardened, linearized condition with a more natural stream form that slows water movement during storm events, improves channel function, and reduces the rapid conveyance of runoff into the Black River. The restoration would occur across both publicly and privately owned land, offering an opportunity to improve flood resilience while also enhancing the condition of a reach that has been significantly altered from its natural state.

In addition to its flood mitigation benefits, the action could support broader town revitalization efforts. Restored stream corridors can create opportunities for improved public park amenities, stronger community access to green space, and the development of a town bike and greenway system. By combining stream restoration with recreational and placemaking goals, this action would help strengthen Falcon's resilience while also contributing to a more attractive and connected community landscape.



GOAL 4. REDUCE FLOOD RISK THROUGH LAND USE AND DEVELOPMENT

Goal 4: Reduce Flood Risk Through Land Use and Development focuses on preventing future risk while reducing exposure in places that are already vulnerable. This goal focuses on reducing future losses by mitigating risks of existing land use, steering development away from high-risk areas, and strengthening current and future development. This goal also supports mitigation of repeatedly affected structures through buyouts, elevations, and other actions where infrastructure improvements alone may not solve the problem. In a basin with both urban and rural floodplain pressures, thoughtful land use planning is one of the most durable ways to avoid creating new risk. It helps communities balance development needs with safety, environmental protection, and long-term resilience.

Strategy 4.1: Mitigate existing at-risk properties

Existing at-risk properties across the Cape Fear River Basin often face repeated flooding that damages homes, disrupts access, and creates ongoing public cost. This strategy includes buyouts, elevations, and retrofits, especially where repeated losses are likely to continue. It is particularly relevant for buildings in low-lying floodplains, single-access neighborhoods, and areas where infrastructure improvements cannot fully eliminate risk. Buyouts also create opportunities for restoring flood storage, open space, or natural habitat on land no longer suited for intensive development.

Strategy 4.2: Direct development away from high-risk areas

Directing development away from high-risk areas is a fundamental risk-reduction strategy in the Cape Fear River Basin, where floodplains, wetlands, and low-lying drainage corridors can be highly vulnerable to storm impacts. This strategy includes zoning, subdivision standards, conservation tools, and planning policies that guide new buildings toward safer locations and reduce pressure on flood-prone land. It is especially important in fast-changing areas where updated flood studies may lag actual development trends. By avoiding construction in the most hazardous places, communities can reduce future rescue, recovery, and infrastructure costs while preserving natural flood storage.

Strategy 4.3: Promote flood-wise and resilient development

Promoting flood-wise and resilient development in the Cape Fear River Basin means designing and building in ways that respect flood risk rather than ignoring it. This strategy includes higher elevation standards, better drainage design, floodproofing, open-space integration, and site planning that reduces vulnerability to intense rainfall and river flooding. It also encourages performance-based zoning and development standards that can adapt to local conditions. In a Basin with varied hydrology and growing development pressure, resilient design helps reduce future losses and accommodate development pressure. Flood-wise development can improve access, protect structures, and reduce the burden on stormwater infrastructure when done well. It also creates opportunities to incorporate green space, natural systems, and water-sensitive design into neighborhoods and public facilities.

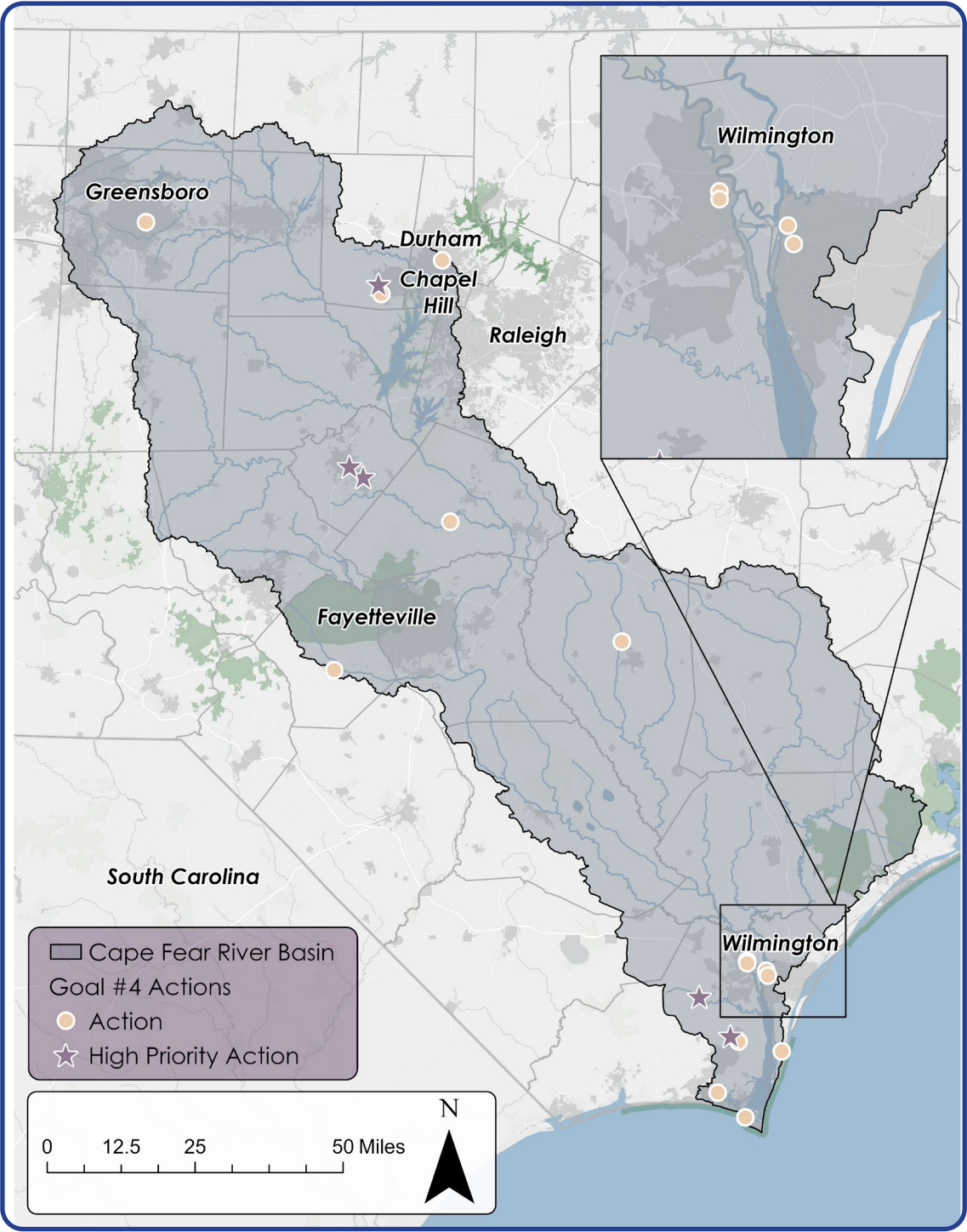


Figure 32: Basin-Wide Map with Goal 4 High Priority and Actions identified.

Strategy 4.4: Reuse acquired lands for lower-risk purposes

Reusing acquired lands for lower-risk purposes allows the Cape Fear River Basin to turn flood-prone properties into assets that support resilience, recreation, habitat, and stormwater management. When parcels are purchased or otherwise acquired because they flood repeatedly, they are not limited to just becoming a vacant lot or a maintenance burden. This strategy supports converting those lands into open space, parks, greenways, wetlands, flood storage areas, or conservation land where appropriate. Such reuse can maintain community value while preventing future damages and keeping people out of harm's way. In many basin settings, these properties are well suited to natural or low-intensity uses because of their location in floodplains or drainage corridors.

Goal 4. Reduce Flood Risk Through Land Use and Development Actions Descriptions

Goal 4: Reduce Flood Risk Through Land Use and Development includes 19 actions focused on preventing future risk while reducing exposure in places that are already vulnerable. Of these, 5 were identified as high-priority actions. These actions include locally prioritized actions submitted by New Hanover County, Brunswick County, Harnett County, Guilford County, Carrboro and Carolina Beach. This goal featured buyout, elevation, and other retrofit projects that reflect an existing pattern of land use that creates flood risk. Many communities in the Cape Fear list these actions in their hazard mitigation plans, but may not have identified specific next steps to implement.

This goal also includes exploration and development of innovative local development tools to reduce the flood risk generated by new development for new residents as well as existing structures located nearby. Because Cape Fear stakeholders are sensitive to the needs and interests of private property owners and developers, several actions are focused on working with private landowners or other private parties to collaborate on reducing flood risk.

Recommended Critical Needs

- Pursue voluntary buyouts in at-risk areas
- Mitigate individual properties, including elevations, floodproofing, and other retrofits
- Develop datasets needed to understand where frequent flooding occurs, even if outside the floodplain, to help guide new development
- Explore and develop local regulatory tools that minimize the growth of flood risk within a community for new and existing residents
- Provide private development stakeholders such as developers, homeowner associations, and homeowners information that empowers them to reduce the flood risk generated by land use change or mitigate the risk on individual properties

Action List

*High priority actions are highlighted in blue.

Action Name	Type*	Relative Cost Estimate*	Community Location
Strategy 4.1 Mitigate existing at-risk properties			
Brunswick County - Voluntary Hazardous Land Transfer	Floodplain Preservation	\$	Brunswick County
New Hanover County - High-Risk Mitigation Properties	Acquisition/Demolition/ Buyouts	\$\$-\$\$\$	New Hanover County
Carolina Beach - Buyout or Property Transition Exploration	Acquisition/Demolition/ Buyouts	\$\$-\$\$\$	Carolina Beach

*Actions that did not fit neatly into an action type are marked miscellaneous. Miscellaneous actions include outreach, planning, data collection, and other flood resilience steps not captured in the typology.

** Cost estimates are as follows: \$ < \$100,000; \$\$ \$100,000 - \$500,000; \$\$\$ \$500,000 - \$1M; \$\$\$\$ \$1M - \$5M; \$\$\$\$\$ > \$5M. Some actions have a variable cost estimate based on yet-to-be-determined details such as potential participation level for buyouts or elevations, opportunities related to siting an action, or the action is a combination of planning and implementation. For these actions, the relative cost shown in the Action List may vary, potentially dramatically, given the final scale and scope of the action when implemented.

PRIORITIZED BASIN ACTIONS



Action Name	Type*	Relative Cost Estimate*	Community Location
Carrboro - Weatherhill Point Repetitive Loss Acquisition/ Demolition Projects	Acquisition/Demolition/ Buyouts	\$\$\$\$	Carrboro
Guilford - Acquisition/ Demolition of Repetitive Loss Properties	Acquisition/Demolition/ Buyouts	\$\$\$\$	Guilford County
Harnett County - Country Walk Residential Property Mitigation (Elevation, Acquisition/ Demolition)	Acquisition/Demolition/ Buyouts	\$\$\$\$-\$\$\$\$\$	Harnett County

Strategy 4.2 Direct development away from high-risk areas

Brunswick Public Facilities Location	Advanced Regulations (Land Use and Impervious Surface Restrictions)	\$	Brunswick County
Raeford - Forest Conservation and Farmland Preservation	Floodplain Preservation	\$	City of Raeford
Durham County - Higher Standards Enforcement and Flood Retrofits	Stormwater, Water Quality, Floodplain Regulations	\$	Durham County

Strategy 4.3 Promote floodwise and resilient development

Brunswick Floodprone Areas Protections	Stormwater, Water Quality, Floodplain Regulations	\$\$	Brunswick County
Lee County - Digital Flood Risk Data Management	Stormwater, Water Quality, Floodplain Regulations	\$\$-\$\$\$	Lee County
Navassa - Future Land Use Feasibility Study for Critical Community Assets	Advanced Regulations (Land Use and Impervious Surface Restrictions)	\$\$-\$	Navassa
Navassa - Cultural Resources Preservation Ordinance Development	Advanced Regulations (Land Use and Impervious Surface Restrictions)	\$	Navassa

*Actions that did not fit neatly into an action type are marked miscellaneous. Miscellaneous actions include outreach, planning, data collection, and other flood resilience steps not captured in the typology.

** Cost estimates are as follows: \$ < \$100,000; \$\$ \$100,000 - \$500,000; \$\$\$ \$500,000 - \$1M; \$\$\$\$ \$1M - \$5M; \$\$\$\$\$ > \$5M. Some actions have a variable cost estimate based on yet-to-be-determined details such as potential participation level for buyouts or elevations, opportunities related to siting an action, or the action is a combination of planning and implementation. For these actions, the relative cost shown in the Action List may vary, potentially dramatically, given the final scale and scope of the action when implemented.

PRIORITIZED BASIN ACTIONS



Action Name	Type*	Relative Cost Estimate*	Community Location
New Hanover County - Floodplain Management Best Practices Implementation	Multi-use Floodplains	\$	New Hanover County
Brunswick County - Baseline Parcel Data for Flood	Stormwater, Water Quality, Floodplain Regulations	\$	Brunswick County
Strategy 4.4 Reuse acquired lands for lower-risk purposes			
Carrboro - Acquisition and Prioritization of Green Development in Flood-Prone Properties	Acquisition/Demolition	\$\$	Carrboro
Lee County - Comprehensive Open Space/Reuse Planning	Advanced Regulations (Land Use and Impervious Surface Restrictions)	\$-\$\$	Lee County
Bald Head Island - Open Space Preservation	Acquisition/Demolition	\$	Bald Head Island
Coharie - Flood-prone Property Acquisition/Demolition and River Access Enhancement	Acquisition/Demolition	\$-\$\$	Clinton

*Actions that did not fit neatly into an action type are marked miscellaneous. Miscellaneous actions include outreach, planning, data collection, and other flood resilience steps not captured in the typology.

** Cost estimates are as follows: \$ < \$100,000; \$\$ \$100,000 - \$500,000; \$\$\$ \$500,000 - \$1M; \$\$\$\$ \$1M - \$5M; \$\$\$\$\$ > \$5M. Some actions have a variable cost estimate based on yet-to-be-determined details such as potential participation level for buyouts or elevations, opportunities related to siting an action, or the action is a combination of planning and implementation. For these actions, the relative cost shown in the Action List may vary, potentially dramatically, given the final scale and scope of the action when implemented.



Boat Traveling on I-40 Following Hurricane Florence

PRIORITIZED BASIN ACTIONS



Greenfield Lake

PRIORITIZED BASIN ACTIONS





Lee County - Digital Flood Risk Data Management

Community:
Lee County

Cost:
\$100,000-\$500,000\$
(total cost depends on the scope of data inclusion and GIS customization)

Goal:
Reduce flood risk through land use and development

Strategies:
4.3 Promote flood-wise and resilient development; 4.2 Direct development away from high-risk areas; 5.1 Ground actions in local data and watershed-scale analysis

Guiding Principles:
Data-driven long range planning; Preparedness, warnings, and public education

Source:
Locally prioritized

Category:
Policy & Planning

Type:
Stormwater, Water Quality, Floodplain Regulations

Priority:
High

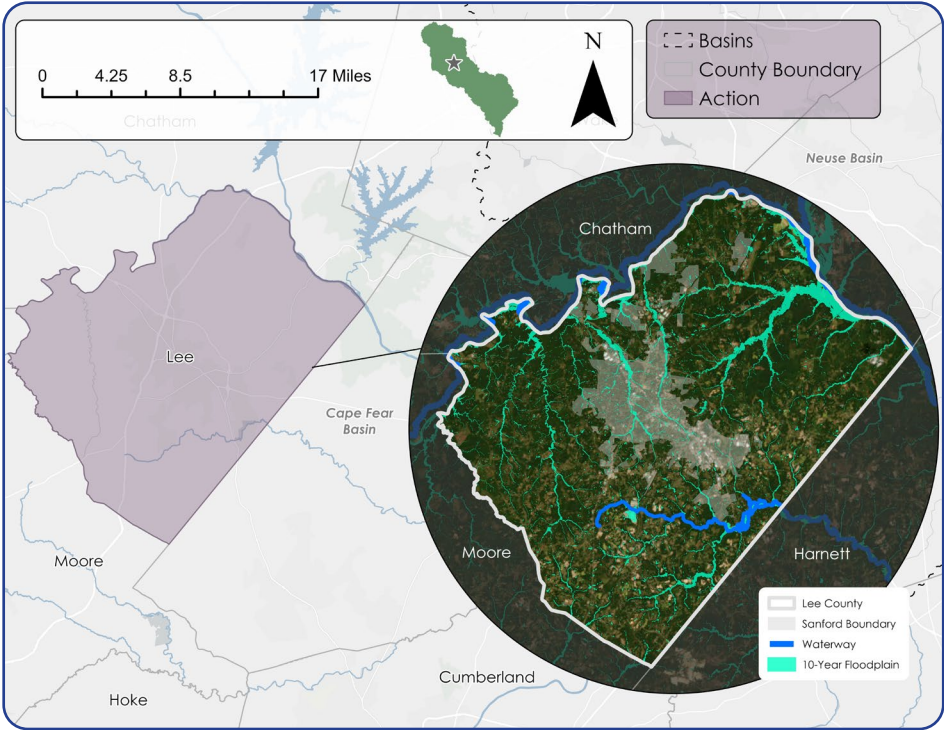


Figure 33: Lee County Digital Flood Risk Data Management Individual Action Map.

This action will incorporate digital floodplain and topographic data into Lee County’s automated permit database and Geographic Information System (GIS) inventory to improve land use and floodplain management decisions. By integrating these datasets into a single system, the County can better evaluate development proposals, identify flood-prone areas, and support more informed permit review processes. This approach will help staff more quickly assess site constraints and flood exposure when reviewing applications and planning future land use decisions.

This action is included in the Lee County/Sanford/Broadway Land Use Plan 2018, and provides a practical tool for strengthening flood resilience through better data coordination. The updated GIS layer inventory will improve access to accurate spatial information, support more consistent decision-making, and help the County track floodplain-related conditions over time. By combining floodplain and topographic information within the permitting system, the County can better protect sensitive areas, reduce development risk, and support more resilient growth management.



Carrboro - Acquisition and Prioritization of Green Development in Flood Prone Properties

Community:
Carrboro

Cost:
\$410,656 (total cost depends on total staff time)

Goal:
Reduce flood risk through land use and development

Strategies:
4.1 Mitigate existing at-risk properties; 4.4 Reuse acquired lands for lower-risk purposes

Guiding Principles:
Natural systems as the first defense; Flood-wise development; Pilot, evaluate, scale

Source:
Locally prioritized

Category:
Building Level Mitigation

Type:
Acquisition/Demolition

Priority:
High

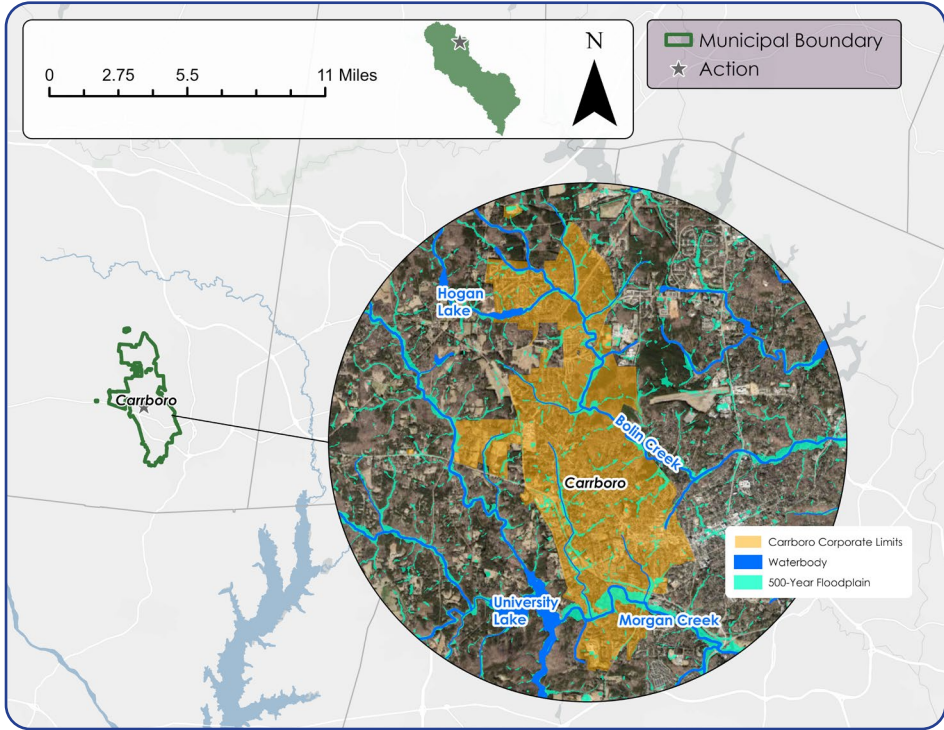
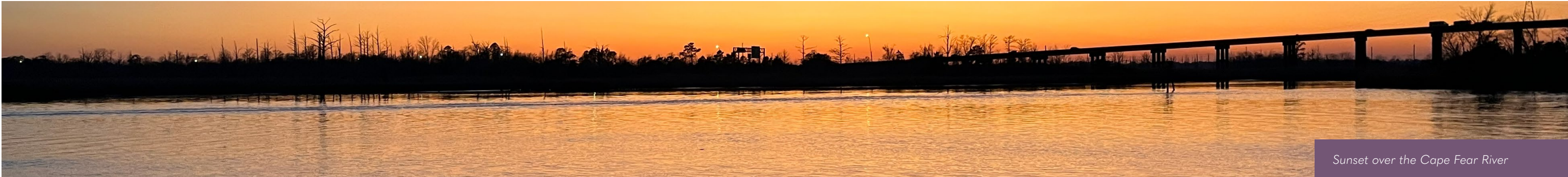


Figure 34: Carrboro Acquisition and Prioritization of Green Deveopment in Flood Prone Properties Individual Action Map.

The Town of Carrboro is proposing to prioritize the beneficial reuse of acquired flood-prone properties by focusing on “green” development that supports natural watershed functioning. This action would guide the future use of parcels acquired through flood mitigation efforts so that they continue to provide resilience benefits rather than being redeveloped in ways that increase risk.

By keeping these lands in low-intensity, nature-based uses, the Town can help preserve flood storage, improve drainage, and maintain the ecological functions of the watershed. This approach also creates an opportunity to turn formerly vulnerable properties into community assets.





Sunset over the Cape Fear River

Lee County - Comprehensive Open Space/ Reuse Planning

Community:
Lee County

Cost:
\$100,000-\$500,000\$ (total cost depends on the scope of the framework development)

Goal:
Reduce flood risk through land use and development

Strategies:
3.2 Conserve open space, forests, wetlands, and conservation corridors; 4.1 Mitigate existing at-risk properties; 4.2 Direct development away from high-risk areas; 4.4 Reuse acquired lands for lower-risk purposes

Guiding Principles:
Natural systems as the first defense; Flood-wise development

Source:
Locally prioritized

Category:
Policy & Planning

Type:
Advanced Regulations (Land Use and Impervious Surface Restrictions)

Priority:
High

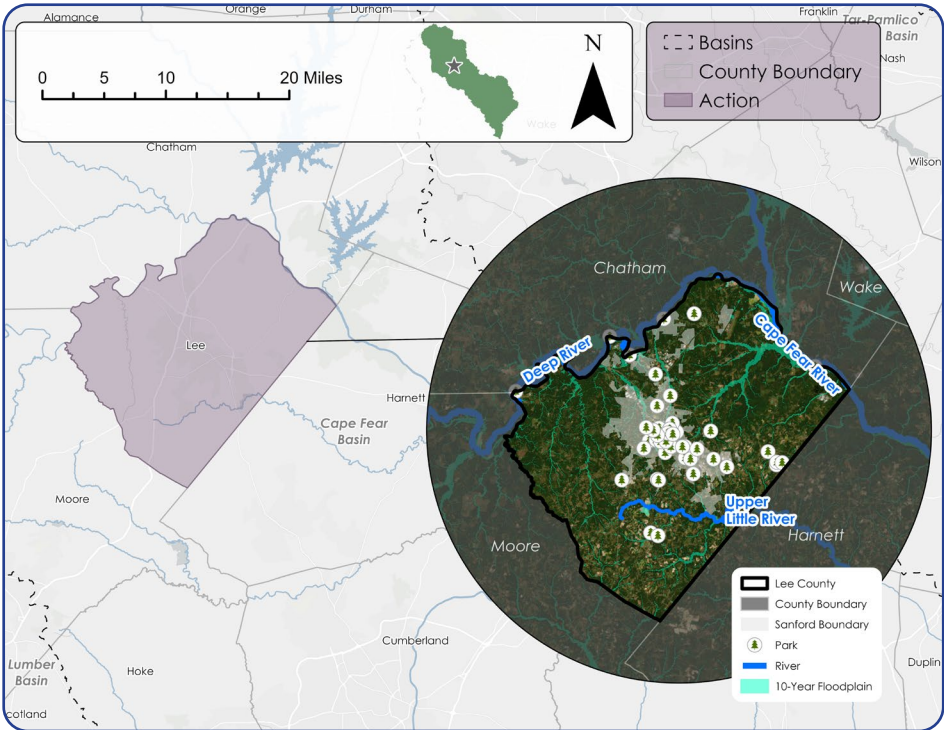


Figure 35: Lee County Comprehensive Open Space/Reuse Planning Individual Action Map.

Lee County is proposing to develop a comprehensive open space and reuse plan that can guide floodplain acquisition initiatives while also identifying opportunities for recreational use and community benefit. This action, originally included in the 2018 *Lee County/Sanford/Broadway Land Use Plan*, provides a policy framework for managing growth in ways that support both hazard reduction and land conservation. The open space and reuse plan could help the County prioritize parcels for acquisition, protect floodplain functions, and create additional public value through compatible recreational opportunities. Together, these strategies would strengthen floodplain management, reduce long-term risk, and support more resilient land use decisions across the County.

PRIORITIZED BASIN ACTIONS



New Hanover County – Floodplain Management Best Practices Implementation

Community:
New Hanover County

Cost:
(total cost depends on the use of staff time or consultant support)

Goal:
Reduce flood risk through land use and development

Strategies:
3.2 Conserve open space, forests, wetlands, and conservation corridors; 4.2 Direct development away from high-risk areas; 4.3 Promote flood-wise and resilient development

Guiding Principles:
Flood-wise development

Source:
Locally prioritized

Category:
Policy & Planning

Type:
Multi-use Floodplains

Priority:
High

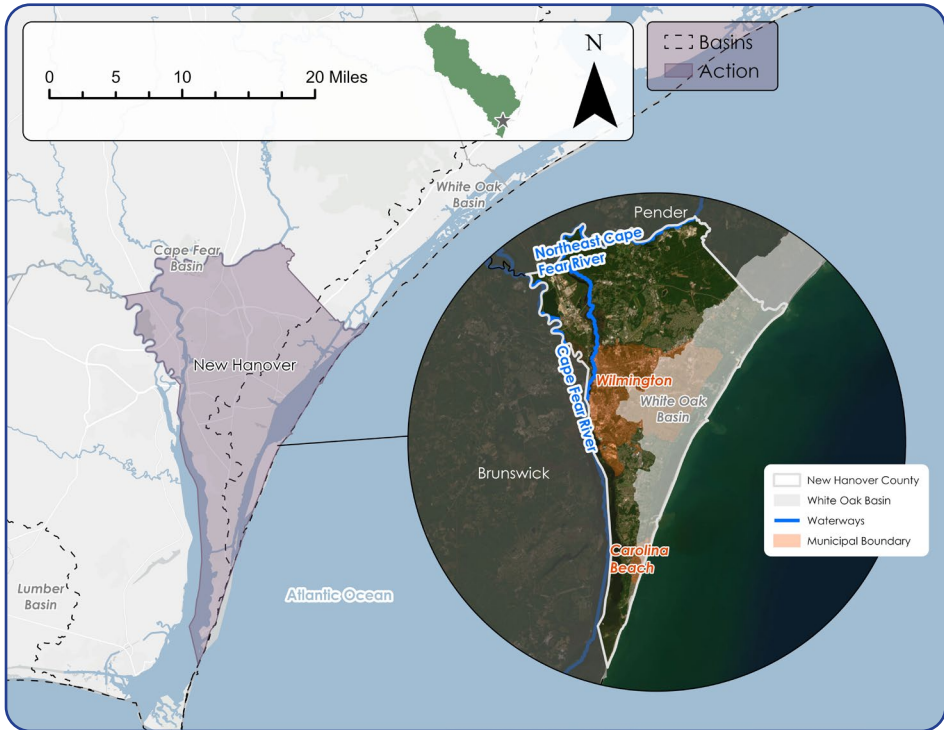


Figure 36: New Hanover County Floodplain Management Best Practices Implementation Individual Action Map.

New Hanover County submitted this action proposing to research and implement best-practice floodplain management strategies through updates to its Unified Development Ordinance (UDO). This action would evaluate tools such as density tradeoffs, cluster development, and land donation or dedication to better manage growth in flood-prone and environmentally sensitive areas. By using performance zoning, which regulates land use by ensuring measurable outcomes instead of dictating land use categories, and conservation standards, the County can guide development toward safer locations while preserving land that supports natural flood storage, drainage, and watershed function.

This policy approach is intended to reduce future flood risk while still allowing for responsible development. Concentrating development away from sensitive areas and encouraging conservation-based site design can help limit runoff, protect open space, and reduce the long-term exposure of people and property to flooding. Through these standards, New Hanover County can strengthen floodplain management, support more resilient land use patterns, and ensure new development contributes to broader watershed protection goals.

PRIORITIZED BASIN ACTIONS



GOAL 5. BUILD A PATHWAY TO IMPLEMENTATION

Goal 5. Build a pathway to implementation aims to ensure that the Basin’s priorities can move from one-off ideas into funded, coordinated, and measurable action. In the Cape Fear River Basin, many flood resilience ideas are strong but need more analysis, clearer scope, or a delivery strategy before they can advance. This goal brings together the data, prioritization, funding, monitoring, and coordination needed to make implementation realistic, especially in smaller jurisdictions. It also recognizes that flood resilience is an ongoing process, not a one-time plan.

Strategy 5.1: Ground actions in local data and watershed-scale analysis

This strategy is focused on developing and using the best available data to guide decisions. In the Cape Fear River Basin, that may include the Blueprint’s watershed-scale modeling as well as local assessments and engineering studies. Importantly, it also includes the creation and regular updating of local datasets to keep information current and useful for decision-making.

Strategy 5.2: Create a project identification and prioritization pipeline

This strategy provides a sustainable way to turn broad ideas into a more organized list of candidate projects. In the Cape Fear River Basin, that means using assessment and planning to align needs, prioritize projects, and maximize synergies across projects. The NCDEQ RCCP is an excellent example of this strategy. A systematic approach for identifying needs and priorities is especially important in a Basin where communities may not have performed in-depth flood planning apart from participating in a regional hazard mitigation plan. This strategy was identified as a need during the development of the RBAS, but no actions were submitted that address this need.

Strategy 5.3: Create a funding and delivery pipeline

This strategy connects priority projects to grants, capital planning, and phased implementation. This strategy is supported by actions from stakeholders outside local government. Smaller jurisdictions especially benefit from a framework of technical assistance and reliable, regular funding opportunities. In the Cape Fear River Basin, many high-value projects will depend on outside funding and/or multiple funders. This strategy was identified as a need during the development of the RBAS, but no actions were submitted that address this need. This strategy was identified as a need during the development of the RBAS, but no actions were submitted that address this need.

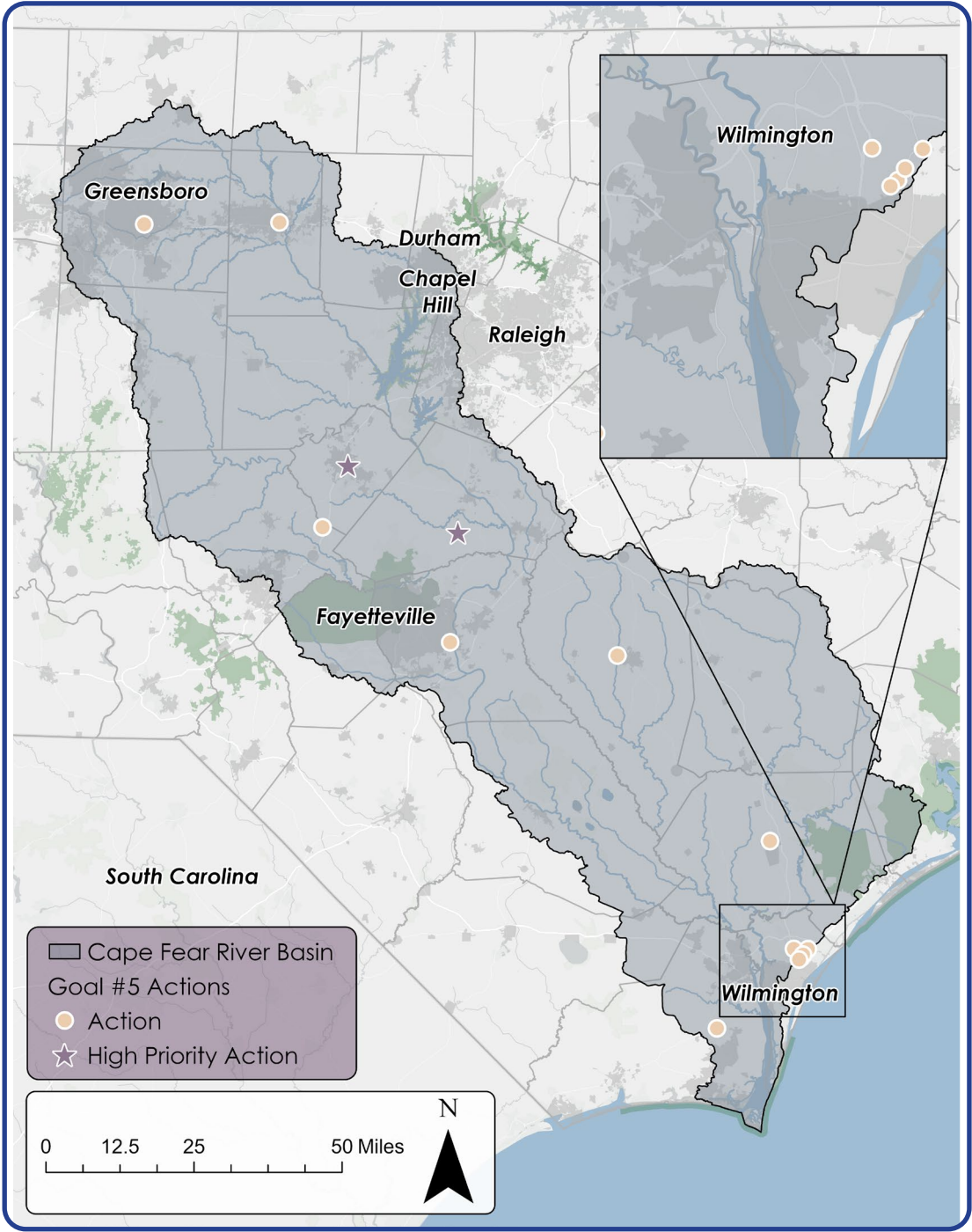


Figure 37: Basin-Wide Map with Goal 5 High Priority and Actions identified.

Strategy 5.4: Track outcomes, monitor conditions, and adapt over time

This strategy supports continuous learning and adaptive management. Flood resilience work must be monitored to understand whether projects are performing as intended and whether conditions are changing. In the Cape Fear River Basin, this means using gauges, project performance measures, updated models, and post-event observations to track results. Monitoring helps communities learn from completed projects, identify new vulnerabilities, and adjust priorities over time. This adaptive approach improves accountability and strengthens future decision-making. This strategy was identified as a need during the development of the RBAS, but no actions were submitted that directly address it in the project descriptions. However, it is possible that many of the projects will track outcomes, monitor conditions, and adapt over time.

Strategy 5.5: Strengthen regional coordination and technical support

This strategy recognizes that many flood resilience challenges in the Cape Fear River Basin cross jurisdictional boundaries, require shared effort, or above the capacity of smaller jurisdictions to implement in-house. Coordination among local, regional, and state partners can improve consistency, reduce duplication, and provide helpful knowledge transfer. It helps ensure that actions are consistent and complementary across administrative boundaries. This strategy also helps ensure that all communities, including those with fewer administrative and technical resources, can participate in and benefit from Basin-wide resilience efforts.

Goal 5. Build a Durable Pathway from Evidence to Implementation Actions Descriptions

Goal 5. Build a durable pathway from evidence to implementation includes 15 actions, including 2 high priority actions, that demonstrate how the Basin’s priorities can move from one-off ideas into data-backed, funded, coordinated, and measurable action. The actions in this goal include a variety of action types, with a common thread of identifying a clear pathway from studying the need to designing the project to construction. Of these, one was identified as a high-priority action, a locally prioritized action submitted by the Central Pines COG (Chatham, Johnston, Lee, and Moore Counties).

The smaller number of local actions for this goal reflects three trends. First, some strategies in this goal describe processes applicable to actions under other goals. Many actions under other goals do use techniques like grounding action in local data. Second, local governments are the primary Blueprint Tool users, but some strategies in this goal are better matched to organizations outside of local government, for example, councils of government or state agencies. Finally, some of these strategies are considered best practices but are not yet commonly implemented, such as systematic post-project monitoring or adaptive management.

Recommended Critical Needs

- Create local and regional environmental datasets needed for monitoring flood risk and developing projects
- Use best available data, such as the future conditions modeling provided by the Blueprint, to support project design and engineering
- Identify projects with a systematic approach that includes an assessment
- Use consistent frameworks to guide resilience planning from vulnerability assessment to strategy development to implementation
- For resilience plans, reconvene key contributors on a yearly basis to revisit priorities and reflect on progress

Profiled Actions

- Central Pines Council of Government Privately Owned Dam and Stormwater Inventory

Action List

*High priority actions are highlighted in blue.

Action Name	Type*	Relative Cost Estimate**	Community Location
Strategy 5.1 Ground actions in local data and watershed-scale analysis			
Harnett County - Hazard Data Collection	Miscellaneous	\$ \$	Harnett County
Brunswick County - Flood-Prone Area Mapping	Advanced Regulations (GIS Capacity Building)	\$-\$ \$	Brunswick County
Moore County - Southeast Area Hydrologic and Hydraulic (H&H) Study	Advanced Regulations (GIS Capacity Building)	\$ \$	Moore County

*Actions that did not fit neatly into an action type are marked miscellaneous. Miscellaneous actions include outreach, planning, data collection, and other flood resilience steps not captured in the typology.

** Cost estimates are as follows: \$ < \$100,000; \$ \$ \$100,000 - \$500,000; \$ \$ \$ \$500,000 - \$1M; \$ \$ \$ \$ \$1M - \$5M; \$ \$ \$ \$ \$ \$ > \$5M. Some actions have a variable cost estimate based on yet-to-be-determined details such as potential participation level for buyouts or elevations, opportunities related to siting an action, or the action is a combination of planning and implementation. For these actions, the relative cost shown in the Action List may vary, potentially dramatically, given the final scale and scope of the action when implemented.

PRIORITIZED BASIN ACTIONS



Action Name	Type*	Relative Cost Estimate**	Community Location
New Hanover County - Pumpkin Creek Ditch and/or Culvert Upgrade	Storm Water Management Activities	\$-\$ \$	New Hanover County
New Hanover County - Acorn Branch Ditch and/or Culvert Upgrade	Storm Water Management Activities	\$-\$ \$	New Hanover County
New Hanover County - Upper Motts Creek Ditch and/or Culvert Upgrade	Storm Water Management Activities	\$-\$ \$	New Hanover County
New Hanover County - Heritage Park Ditch and/or Culvert Upgrade	Storm Water Management Activities	\$-\$ \$	New Hanover County
Coharie - 2D Hydraulic Model/ Study for Great Coharie Watershed	Storm Water Management Activities	\$-\$ \$	Clinton
Central Municipalities - Local Flood Studies	Stormwater, Water Quality, Floodplain Regulations	\$-\$ \$	Graham, Mebane, Elon, & Gibsonville

Strategy 5.2 Create a project identification and prioritization pipeline

Cumberland County - Resilience Plan Integration	Advanced Regulations (GIS Capacity Building)	\$	Cumberland County
New Hanover County - Resilient Coastal Communities Program (RCCP) Phases 1 & 2 Completion: Upper Smith Creek Watershed	Miscellaneous	\$-\$-\$ \$ \$	New Hanover County
Wilmington - Resilient Coastal Communities Program (RCCP) Phases 1 & 2 Completion	Miscellaneous	\$-\$ \$	Wilmington

Strategy 5.3 Create a funding and delivery pipeline

None

Strategy 5.4 Track outcomes, monitor conditions, and adapt over time

None

PRIORITIZED BASIN ACTIONS



Action Name	Type*	Relative Cost Estimate**	Community Location
Strategy 5.5 Strengthen regional coordination and technical support			
Central Pines Region - Privately Owned Dam and Stormwater Inventory	Miscellaneous	\$\$-\$\$\$\$\$	Chatham, Johnston, Lee, and Moore
Guilford County - Flood Response Plan Development	Stormwater, Water Quality, Floodplain Regulations	\$	Guilford County

*Actions that did not fit neatly into an action type are marked miscellaneous. Miscellaneous actions include outreach, planning, data collection, and other flood resilience steps not captured in the typology.

** Cost estimates are as follows: \$ < \$100,000; \$\$ \$100,000 - \$500,000; \$\$\$ \$500,000 - \$1M; \$\$\$\$ \$1M - \$5M; \$\$\$\$\$ > \$5M. Some actions have a variable cost estimate based on yet-to-be-determined details such as potential participation level for buyouts or elevations, opportunities related to siting an action, or the action is a combination of planning and implementation. For these actions, the relative cost shown in the Action List may vary, potentially dramatically, given the final scale and scope of the action when implemented.



Boating on the Cape Fear River

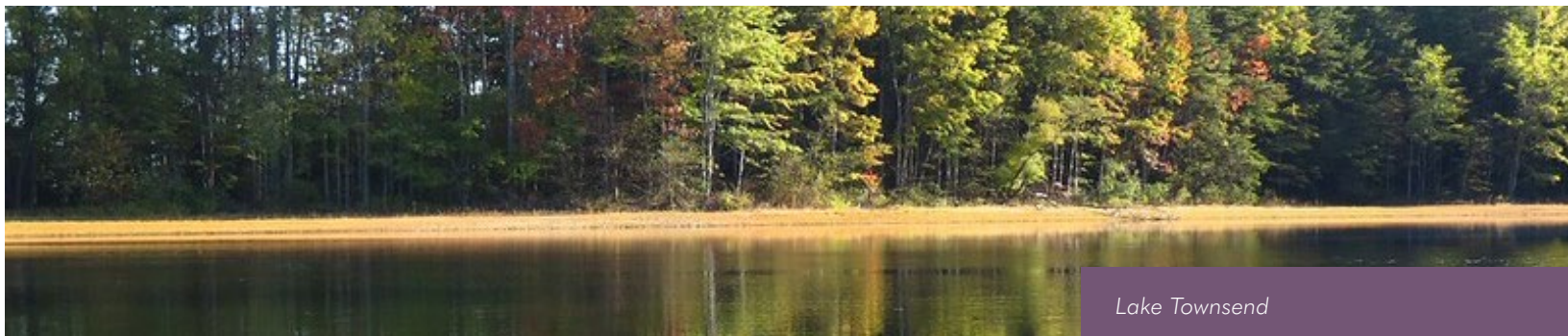
PRIORITIZED BASIN ACTIONS



Great Egret at Greenfield Lake

PRIORITIZED BASIN ACTIONS





Central Pines Council of Government - Privately Owned Dam and Stormwater Inventory

Community:

Chatham, Johnston, Lee, and Moore Counties

Cost:

\$100,000-\$6,000,000 (total cost depends on the accuracy and detail of the inventory and scope and breadth of the guidebook)

Goal:

Strengthen critical systems

Strategies:

2.1 Map infrastructure and assess system vulnerability; 2.5 Reduce shared risk related to dams and stormwater facilities; 5.2 Create a project identification and prioritization pipeline; 5.5 Strengthen regional coordination and technical support

Guiding Principles:

Data-driven long range planning; Plan regionally, implement locally; Flood-wise development; Pilot, evaluate, scale; Preparedness, warnings, and public education

Source:

Locally prioritized

Category:

Other

Type:

Miscellaneous

Priority:

High

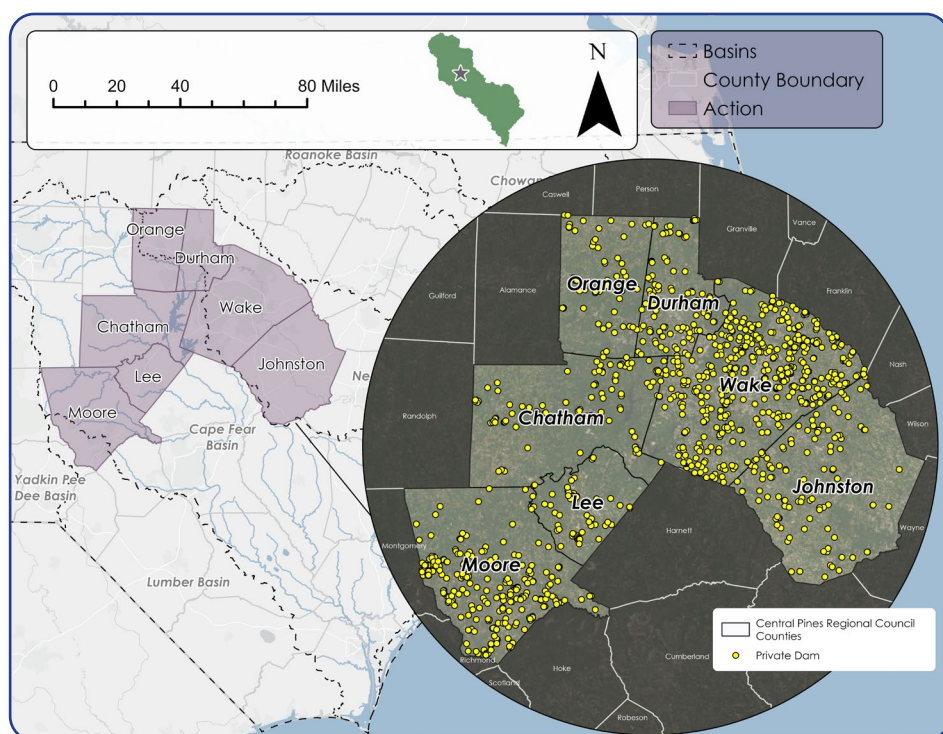


Figure 38: Central Pines Council of Government Privately Owned Dam and Stormwater Inventory Individual Action Map.

The Central Pines Private Dam Resources action is a regional resilience initiative proposed for the Central Pines (formerly Triangle J) COG region. This action will develop a comprehensive inventory of privately-owned dams and stormwater facilities across the region to improve awareness of potential dam safety hazards and better identify facilities that may require outreach, maintenance, or repair. By cataloging these assets, participating jurisdictions will be better positioned to understand where private infrastructure may pose downstream risks or require targeted attention.

The action also includes prioritizing needed maintenance and repairs at high-impact dam and stormwater facilities, which will help focus limited resources on the most vulnerable and consequential sites. In addition, the effort will produce a dam ownership guidebook for property owners responsible for these facilities. The guidebook will compile best practices for construction, operation, and maintenance, with the goal of preventing failures in private stormwater facilities, dams, and storm drainage ponds. Submitted as part of the 2022 RISE Climate Resilience Projects Portfolio for the Central Pines (formerly Triangle J) region, this action supports regional coordination, public safety, and improved private infrastructure stewardship.

PRIORITIZED BASIN ACTIONS



REVIEW OF FUNDING SOURCES

North Carolina communities face growing challenges from flooding, aging infrastructure, rapid development, and extreme weather. A wide ecosystem of federal, state, regional, and private funding sources exists to address these risks, but navigating this landscape is complex. The Funding Sources Writeup provides a comprehensive catalog of the programs available to support resilient infrastructure, watershed restoration, nature-based solutions, disaster recovery, stormwater improvements, and long-range community planning.

This summary synthesizes key funding takeaways, highlighting major categories of funding, core features of key programs, and strategic considerations for project selection, eligibility, and implementation. It is intended to support staff, local governments, and partners in identifying viable funding pathways and leveraging a variety of potential funding sources – including opportunities that are not directly focused on flood resilience – to align resilience needs with the strongest opportunities.

Federal Funding Landscape

Federal agencies administer a wide range of programs that support flood mitigation, disaster recovery, transportation resilience, water/wastewater infrastructure, land conservation, and ecosystem restoration. Many of these

programs are competitive, require detailed benefit cost analysis, and operate on recurring annual cycles or disaster specific funding streams.

FEMA Programs

FEMA funds are among the most significant sources for hazard mitigation and flood resilience:

25%

Across all FEMA programs, eligible applicants in North Carolina include local governments, tribes, and state agencies. Projects generally require a 25% local match unless the community qualifies for disadvantaged or severe repetitive loss adjustments.

- Building Resilient Infrastructure and Communities (BRIC)**
provides competitive funding for mitigation projects, with strong emphasis on shovel-ready infrastructure protection solutions, improved codes and code enforcement and long-term resilience in the face of changing conditions.
- Flood Mitigation Assistance (FMA)**
supports repetitive loss and severe repetitive loss properties through elevation, acquisition, and floodproofing, floodplain restoration, and flood mitigation planning.
- Hazard Mitigation Grant Program (HMGP)**
is available after major disasters and supports a wide range of projects such as buyouts, structural mitigation, and infrastructure retrofits.
- Disaster Relief Fund (DRF)**
is available post disaster for emergency projection, repair and restoration of public infrastructure, hazard mitigation, survivor assistance and fire management.

It is important to note that while the Blueprint Program uses advisory flood maps for risk and vulnerability assessment, FEMA programs reference regulatory floodplains.



HUD Community Development Block Grants (CDBG)

The U.S. Department of Housing and Urban Development (HUD) administers CDBG Disaster Recovery (CDBG DR) and CDBG Mitigation (CDBG MIT) programs following major disasters. These funds support:



Housing Reconstruction



Long-term Recovery



Mitigation



Infrastructure Upgrades



Planning

States manage allocation plans that define eligible activities and target low and moderate income communities.

U.S. Department of Agriculture (USDA) Programs

The USDA supports agriculture focused and rural community water infrastructure:

- Natural Resources Conservation Service Watershed and Flood Prevention Operations (NRCS WFPO)
- Emergency Watershed Protection (EWP)
- Rural Development Water & Waste Disposal Loans and Grants

These programs fund watershed improvements, streambank restoration, emergency stabilization, and water/sewer infrastructure in rural communities.

Department of Transportation (DOT) Programs

DOT’s programs—including PROTECT, RAISE, Emergency Relief (ER), and other discretionary grants—support projects that improve resilience of transportation systems, culverts, roadways, and multimodal networks.

National Oceanic and Atmospheric Administration (NOAA) and Interior Programs

Environmental agencies support conservation, floodplain restoration, and nature-based solutions. NOAA’s funding for habitat restoration and coastal resilience and the U.S. Fish & Wildlife Service’s programs for wetlands, rivers, and wildlife corridors offer opportunities for ecosystem based flood mitigation.

EPA and Water Infrastructure Programs

EPA’s major programs include:

- Clean Water State Revolving Fund (CWSRF)
- Drinking Water State Revolving Fund (DWSRF)
- WIFIA Loans for large scale water infrastructure

These sources offer low interest loans and forgivable principal for eligible communities.

USACE Section 205

The 205 program provides funding for small flood control projects with a focus on structural projects such as levees, dams and flood walls. The program requires a 35% local cost share.

Department of Agriculture Natural Resources Conservation Service (NRCS)

Funding for wetland restoration and protection with focus areas on floodplain easements and hydrology.



Department of Commerce Economic Development Administration (EDA)

EDAs Public Works and Economic Adjustment Assistance Programs and Disaster Supplemental support economic development, workforce development, economic diversification, small business, industry recovery, public infrastructure, planning, capacity building, strategic planning, implementation planning, and industry transformation.

Congressional Spending

Legislative Pre-Disaster Mitigation (L-PDM) and Community Project Funding (CPF) are Congressionally directed spending programs that can be used to mitigate against flooding. These funds are accessed directly through the local Congressional representative.

Evaluating Cost Effectiveness for Flood Resilience Actions

When creating a flood resilience action in the Blueprint Tool, the tool generates an estimated cost for the proposed action, as well as an estimated cost effectiveness ratio. The ratio is calculated based on dividing the estimated cost benefit if the action were implemented by the estimated cost of the action. Local governments and partners can use this information as a starting point for resilience planning but should consult the applicable technical experts for exact development costs for each flood resilience action.



Riparian vegetation at Holly Shelter Gameland



Grebes

PRIORITIZED BASIN ACTIONS



State of North Carolina Funding Programs

North Carolina has one of the most diverse state-level funding environments for water, land, flood, and resilience-related projects. Many state sources provide match flexibility, technical assistance, or planning support not available from federal programs.

North Carolina Land & Water Fund (NCLWF)

NCLWF supports land acquisition, stream and floodplain restoration, innovative stormwater management, and planning for water quality and flood resilience. Programs include:

- Acquisition Grants for riparian buffers, wetlands, and floodplain conservation
- Restoration Grants for streams, wetlands, and natural infrastructure
- Innovative Stormwater Projects
- Planning Grants for long-range watershed and restoration strategies

NC Division of Water Resources (DWR)

DWR administers several programs including:

- Water Resources Development Grant Program (WRDG)
- State cost share support for flood mitigation and water-based recreation
- Planning assistance for hydrologic and watershed studies

These programs support construction and planning for flood reduction projects, stormwater controls, and water supply solutions.

State Revolving Funds (SRF)

North Carolina administers CWSRF and DWSRF with added benefits for disadvantaged communities. Funds include loan forgiveness, match assistance, and priority scoring for resilience and green infrastructure.

NC Department of Commerce Rural Economic Development Division (REDD)

REDD's Small Business Infrastructure Grant Program assists small businesses by providing grants to local governments to expedite infrastructure repairs.

Environmental Quality Incentives Program (EQIP)

DEQ and NRCS program to help farmers, ranchers, and forest landowners integrate conservation into working lands with goals of Improved water and air quality; conserved ground and surface water; increased soil health; reduced soil erosion and sedimentation; improved or created wildlife habitat; and mitigation against drought and increasing weather volatility.



Millpond State Park Carvers Creek

PRIORITIZED BASIN ACTIONS



Disaster Relief and Mitigation Fund (DRMF)

Funding can be used for flood mitigation, transportation infrastructure resilience against natural disasters, and engineering assistance grants to local governments to identify and design shovel-ready projects

Dam Safety Grant Fund

Provides financial assistance for the repair, modification, or removal of eligible dams with focus areas on stormwater and flood control.

Parks and Recreation Trust Fund (PARTF)

Provides matching grants to local governments to assist with public park and recreation projects through acquisition and/or development of park and recreational projects.

Golden Leaf Flood Mitigation

Provides funding to local government and 501(c)(3) organizations for localized infrastructure repair, flood mitigation, drainage and retention.

Community Foundation Disaster Relief Fund

Supports long-term recovery, addresses unmet needs, and builds community resilience and preparedness for future disasters.

Streamflow Rehabilitation Assistance Program (StRAP)

The Streamflow Rehabilitation Assistance Program (StRAP) also provides funds to organizations working on projects that help reduce flooding, restore streams, and protect the integrity of drainage infrastructure across North Carolina’s waterways.

Agricultural Stream Cleanup (ASCP)

The Division of Soil and Water Conservation’s program to provide stream cleaning and debris removal on agricultural streams.

Coastal and Environmental Programs

For coastal communities, the state offers:

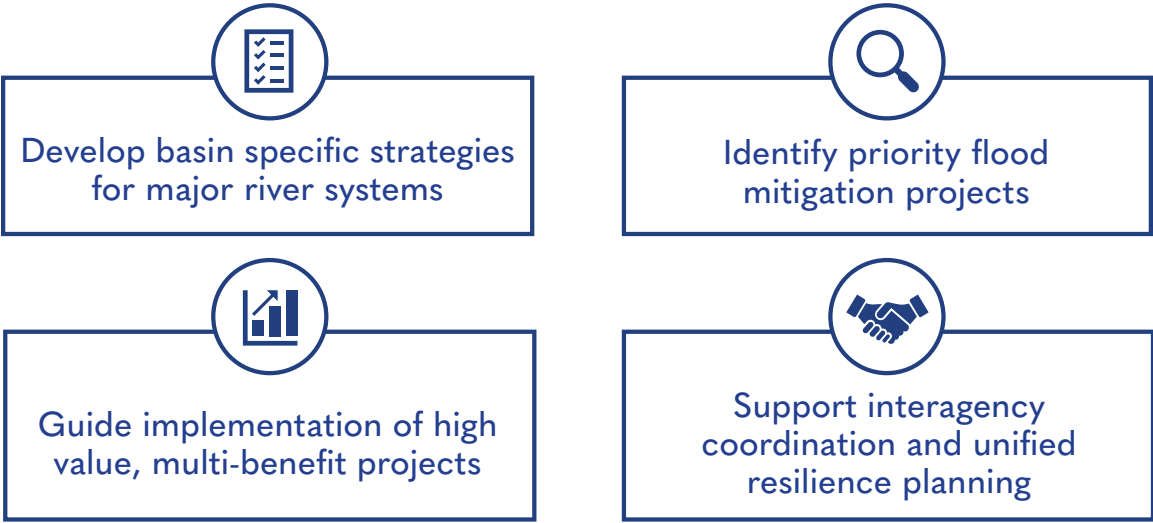
- Coastal Storm Damage Mitigation Fund
- RCCP
- CAMA grants for shoreline, planning, and hazard mitigation

Other programs, such as the Environmental Enhancement Grant (EEG) and agricultural conservation programs, support habitat restoration, water quality enhancements, and preservation of natural lands. The Blueprint also encourages leveraging programs such as the North Carolina Department of Agriculture’s Agricultural Development and Farmland Preservation fund to undertake actions focused on working lands that can have flood resilience co-benefits.



Blueprint Project Implementation Funding

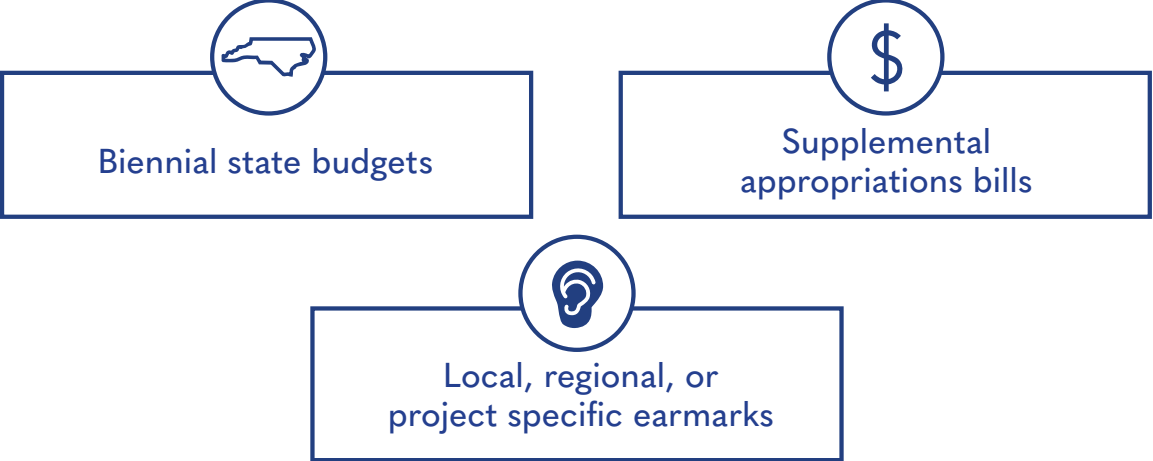
The North Carolina Flood Resiliency Blueprint represents one of the largest state investments in long term flood mitigation planning. Funded initially with \$96 million and now operating with \$76 million, the Blueprint aims to:



Blueprint implementation funds are designed to move high priority projects from concept to construction, particularly where solutions reduce community flood risks, restore natural systems, and provide durable watershed benefits. As strategies are finalized for each basin, these funds will act as a state-level catalyst for projects that align with Blueprint priorities.

Legislative Appropriations from the NC General Assembly

The North Carolina General Assembly can allocate funding for resilience and infrastructure through:



Recent budgets have included substantial statewide investments in water, sewer, and stormwater infrastructure, as well as direct allocations to counties, municipalities, and utilities. Legislative appropriations are often strategic tools for addressing urgent needs or advancing major projects that do not fit traditional grant programs. One unique example is the Private Roads and Bridges program that provides funding for repairs to private roads / bridges that are the sole access for emergency services to residential properties occupied by the property owner for over six months of the calendar year; and repairs to private roads / bridges providing access to multiple residential homes, recreation or commercial facilities

Local governments can work with legislators to elevate priority projects for potential inclusion in budget cycles, especially when projects align with statewide resilience, infrastructure, and economic development objectives.



Local, Regional, and Nonprofit Funding Sources

Local governments, regional planning organizations, and nonprofit partners provide essential complementary resources that can fill match requirements, support early-stage planning, or implement smaller scale resilience solutions.

Local and Utility Funding

Local sources include:

- **General funds**
- **Stormwater utility fees**
- **Water & sewer enterprise funds**
- **Local CIPs**



These funds can be used as match for federal or state programs or to advance preliminary engineering.

Regional Transportation Planning Funds

Metropolitan Planning Organizations (MPOs) and Rural Planning Organizations (RPOs), in coordination with the North Carolina Department of Transportation (NCDOT), can incorporate resilience components into transportation improvement programs, often unlocking federal dollars for culverts, bridges, greenways, and road related stormwater improvements.

Nongovernmental Organizations and Philanthropy

Nongovernmental organizations can serve as applicants, co applicants, match partners, land stewards, or technical supporters. Key partners include:

- North Carolina Community Foundation
- National Fish & Wildlife Foundation (NFWF)
- The Nature Conservancy
- Conservation Trust for NC
- Local land trusts and conservation groups

These partners often bring additional capacity, volunteer support, specialized expertise, and access to philanthropic funding streams.

Climate Smart Communities Initiative

Provides funding and technical assistance to advance community-based climate resilience in communities or regions that are highly vulnerable to the impacts of climate change and in need of additional technical and administrative capacity from a 3rd party adaptation practitioner



Strategic Considerations for Project Success

The document highlights several cross cutting considerations:

Eligibility and Governance

Eligibility differs across programs:

- Some require the applicant to be a unit of local government
- Others accept nonprofit organizations or special districts
- Utility authorities may be eligible for water infrastructure funds
- FEMA programs require state sponsorship and hazard mitigation planning compliance

Understanding institutional eligibility early in project development is critical.

Matching, Cost Share, and Funding Stacking

Most major programs require local match contributions, typically ranging from 0% to 25%, though disadvantaged community provisions may reduce this requirement. Many projects are financed through braided funding, combining:

- Federal grants
- State grants or loans
- Local funds
- Philanthropic contributions

Conclusion

North Carolina has access to one of the most diverse and strategically aligned funding environments for flood mitigation, watershed restoration, and resilience in the United States. The programs cataloged in the Funding Sources Writeup provide a broad spectrum of opportunities for planning, engineering, land conservation, stormwater improvements, resilient infrastructure, and long-term community capacity building.

Aligning local project needs with the right funding source—while leveraging multi-agency partnerships and taking full advantage of the Flood Resiliency Blueprint—positions communities to make transformative progress in reducing flood risks and improving watershed health.

Planning and Readiness

Competitive programs prioritize:

- Strong benefit cost analysis
- Permitting readiness
- Engineering feasibility
- Multi benefit outcomes (e.g., water quality + flood reduction + recreation)
- Community engagement and social impact outcomes

Nature-Based Solutions

Many programs strongly encourage or explicitly prioritize nature-based approaches such as:

- Floodplain reconnection
- Wetland restoration
- Stream restoration and buffer enhancement
- Green stormwater infrastructure

These solutions typically score well in competitive evaluations and provide durable long term benefits.



ACTION STRATEGY TAKE-AWAYS

The Cape Fear RBAS is intended to support local governments, regional partners, state agencies, and other organizations in identifying and advancing flood resilience actions that are appropriate to different conditions across the basin. The vulnerability assessment shows that flood risk is increasing under future conditions, with more people, homes, critical facilities, and essential systems exposed to flooding over time. These and other findings support the need for an Action Strategy that can guide both near-term risk reduction and longer-term flood resilience planning across the basin.

This Action Strategy includes a mix of Priority Actions that reflect differences in flood risk, vulnerability, and implementation context across the Cape Fear River

Basin. The actions were identified through the Blueprint planning process and include action prioritized by local communities.

The actions identified in this RBAS reflect the diversity of the river basin and flooding sources. Some actions are intended to reduce concentrated flood losses in more developed areas, some are intended to protect infrastructure and maintain access to essential services, and others are intended to support adaptation in places where flooding is widespread or persistent. Taken together, the Action Strategy provides a basin-wide framework for understanding flood resilience needs and for advancing actions through continued coordination, funding, technical assistance, and project development.



Zeke's Island

PRIORITIZED BASIN ACTIONS



NEXT STEPS AND IMPLEMENTATION

DEQ Program and Project Accountability

Through the development of the River Basin Action Strategies, local governments, Councils of Government, and other partners have used the Blueprint Tool and staff support to develop local resilience plans. RBAGs and Blueprint Teams have further evaluated and prioritized actions for inclusion in the RBAS. These planning efforts are a critical part of building a more resilient state, but they must be matched with funding and implementation.

The completion of the River Basin Action Strategies is not an endpoint. The Blueprint team will continue working with local governments and other partners to support flood resilience planning and will collaborate with basin partners to help identify funding for prioritized mitigation actions. As of April 2026, DEQ has received funding for RBAS development in six basins, as well as an additional \$96 million for project implementation in those basins. To implement projects, DEQ has used a range of funding mechanisms, including direct partnerships with local governments, funding private firms for full-delivery flood mitigation projects, and collaboration with fellow state agencies and programs, including North Carolina Emergency Management (NCEM), NCLWF, the North Carolina Department of Agriculture and Consumer Services (NCDA&CS), DWR, and NCDOT. These partnerships support the efficient implementation of priority projects and help address gaps in current mitigation efforts. The RBAS process has also identified a need for funding to support engineering and design, in addition to construction. For many actions, implementation may begin with project development

rather than construction. Natural infrastructure, hybrid infrastructure, stormwater, roadway, and floodplain projects often require additional screening, field verification, community and landowner coordination, technical analysis, alternatives evaluation, permitting review, cost refinement, conceptual design, and benefit documentation before they are ready for final design or construction. Recognizing these early-phase activities as important implementation steps can help communities move from planning-level concepts to fundable, permittable, constructible, and maintainable projects, particularly where local capacity is limited. Moving forward, this is an area where the Blueprint can be especially impactful.

Additional funding is needed to complete RBAS development, identify projects, and support project implementation in the remaining eleven river basins. In addition, the RBAS process will identify areas where data improvements are needed, allowing those needs to be prioritized to ensure that the most accurate data is used to inform these critical decisions.

Overall, DEQ is committed to making the state more flood resilient by providing local governments, state agencies, and other partners with the data, tools, and support needed to guide investments that reduce the cost and disruption of future flooding.

Blueprint Tool

The Blueprint Tool is available statewide, but as of the publication of this report, the tool functionality is limited outside the initial six basins. With additional funding, improved flood mapping and expanded data development will be completed for the rest of the state, allowing the Blueprint Tool to effectively support all communities across North Carolina. Continued investments to improve and refine the Blueprint Tool will better serve North Carolina's residents and ensure the state remains a leader in data-driven flood resilience planning.

In the basins currently engaged, Blueprint staff will continue providing support and resources to build local capacity to use the Tool from project conception through completion. This approach will enable local entities and basins to continue applying the Blueprint Process beyond the initial RBAS effort.

PRIORITIZED BASIN ACTIONS



ACKNOWLEDGEMENTS

River Basin Advisory Group Members

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Chip Bartlett, Cape Fear Council of Governments

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Blueprint Partners & Other Collaborators

AECOM

Village of Alamance

Alamance County

American Rivers

Town of Angier

Town of Apex

City of Archdale

City of Asheboro

Town of Atkinson

AtkinsRealis

Town of Autryville

Bald Head Island

Town of Belville

Town of Benson

Town of Beulaville

Town of Biscoe

Bladen County

City of Boiling Springs Lake

Town of Broadway

Brunswick County

Brunswick County Conservation Partnership

Burlington-Graham Metropolitan Planning Organization



Town of Burgaw

City of Burlington

Town of Calypso

Town of Cameron

Town of Candor

Cape Fear Arch

Cape Fear Council of Governments

Cape Fear Public Utility Authority

Cape Fear Resource Conservation & Development

Cape Fear River Partnership

Cape Fear River Watch

Cape Fear Rural Transportation Planning Organization

Capital Area Metropolitan Planning Organization

Carolina Beach

Carolina Wetlands Association

Town of Carrboro

City of Carthage

Town of Cary

Town of Caswell Beach

Caswell County

Central Pines Regional Council

Central Pines Rural Planning Organization

Chapel Hill

City of Charlotte

Chatham County

City of Clinton

Coastal Carolina Riverwatch

Town of Coats

Columbus County

Coharie Intra-Tribal Council

Conservation Trust for North Carolina

Cumberland County

Town of Dublin

Duke Energy

Duke University

City of Dunn

Duplin County

City of Durham

Durham-Chapel Hill-Carrboro Metropolitan Planning Organization

Durham County

Town of East Arcadia

Eastern Carolina COG

Eastern Carolina Rural Transportation Planning Organization

Town of Eastover

Elizabethtown

Town of Elon

Town of Erwin

Town of Faison

Town of Falcon

City of Fayetteville

Fayetteville Area Metropolitan Planning Organization

Forsyth County

Fort Bragg

Town of Franklinville

Town of Fuquay-Varina



Town of Garland	Town of Lillington
Town of Gibsonville	Town of Linden
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Town of Goldston	Lower Cape Fear River Program
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Town of Green Level	Town of Magnolia
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City of Greensboro	City of Mebane
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Harnett County	Moore County
Harnett County Soil & Water Conservation District	Town of Morrisville
Town of Harrells	Town of Mount Olive
Town of Haw River	Town of Navassa
City of High Point	New Hanover County
High Point Metropolitan Planning Organization	New Hanover County Soil & Water Conservation District
Hoke County	Town of Newton Grove
Town of Holly Springs	North Carolina Foundation for Soil and Water Conservation
Town of Hope Mills	North Carolina Association of Floodplain Managers
Jamestown	North Carolina Department of Agriculture & Consumer Services
Jacksonville Urban Area Metropolitan Planning Organization	North Carolina Coastal Federation
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Town of Liberty	

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North Carolina Central University	Town of Roseboro
North Carolina Sea Grant	Town of Salemburg
City of Northwest	Sandhills Metropolitan Planning Organization
Northwest Piedmont Rural Planning Organization	Sampson County
Piedmont Conservation Council	Town of Sandy Creek
Piedmont Triad Regional Council	City of Sanford
Piedmont Triad Water Authority	Town of Seagrove
Town of Oak Island	Town of Sedalia
Town of Oak Ridge	Town of Siler City
Onslow County	Town of Southern Pines
Orange County	Southeast North Carolina Community Resource System Users Group
Town of Ossipee	Town of Spring Lake
Pender County	Summit Design & Engineering Services
Pender County Long Term Recovery Group	City of Southport
Village of Pinehurst	Town of Spring Lake
Town of Pittsboro	Town of Summerfield
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Town of Ramseur	Town of Star
City of Randleman	Town of Stedman
Randolph County	Town of Stokesdale
City of Reidsville	Town of Summerfield
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United Way of the Cape Fear Area

Town of Vass

Town of Wade

Wake County

Town of Wallace

Town of Warsaw

Town of Watha

Village of Whispering Pines

Town of White Lake

Town of Whitsett

City of Wilmington

Wilmington Urban Area Metropolitan Planning
Organization

Wilmington-Cape Fear Home Builders Association



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American alligator — Cape Fear River / adjacent tidal wetlands, Wilmington, North Carolina